

ENVISIONING NATURE, SCIENCE,
AND RELIGION



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AND RELIGION



EDITED BY *James D. Proctor*

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CONTENTS

Acknowledgments vii

Introduction. Envisioning Nature, Science, and Religion 3
James D. Proctor

1. The Nature of Visions of Nature: Packages to
Be Unpacked 36
Willem B. Drees

2. Visions of Nature through Mathematical Lenses 59
Douglas E. Norton

3. Between Apes and Angels: At the Borders of
Human Nature 83
Johannes M.M.H. Thijssen

4. Locating New Visions 103
David N. Livingstone

5. Enduring Metaphysical Impatience? 131
Robert E. Ulanowicz

6. God from Nature: Evolution or Emergence? 149
Barbara J. King

7. Who Needs Emergence? 166
Gregory Peterson
 8. Creativity through Emergence: A Vision
of Nature and God 180
Antje Jackelén
 9. Rereading a Landscape of Atonement on an
Aegean Island 205
Martha L. Henderson
 10. The Vision of Malleable Nature: A Complex
Conversation 227
Andrew Lustig
 11. Visions of a Source of Wonder 245
Fred D. Ledley
 12. Nature as Culture: The Example of Animal
Behavior and Human Morality 271
Nicolaas A. Rupke
 13. Environment After Nature: Time for a
New Vision 293
James D. Proctor
 14. Should the Word *Nature* be Eliminated? 312
John Hedley Brooke
- Afterword. Visualizing Visions and Visioners 337
James D. Proctor
- Contributors 353
Index 357

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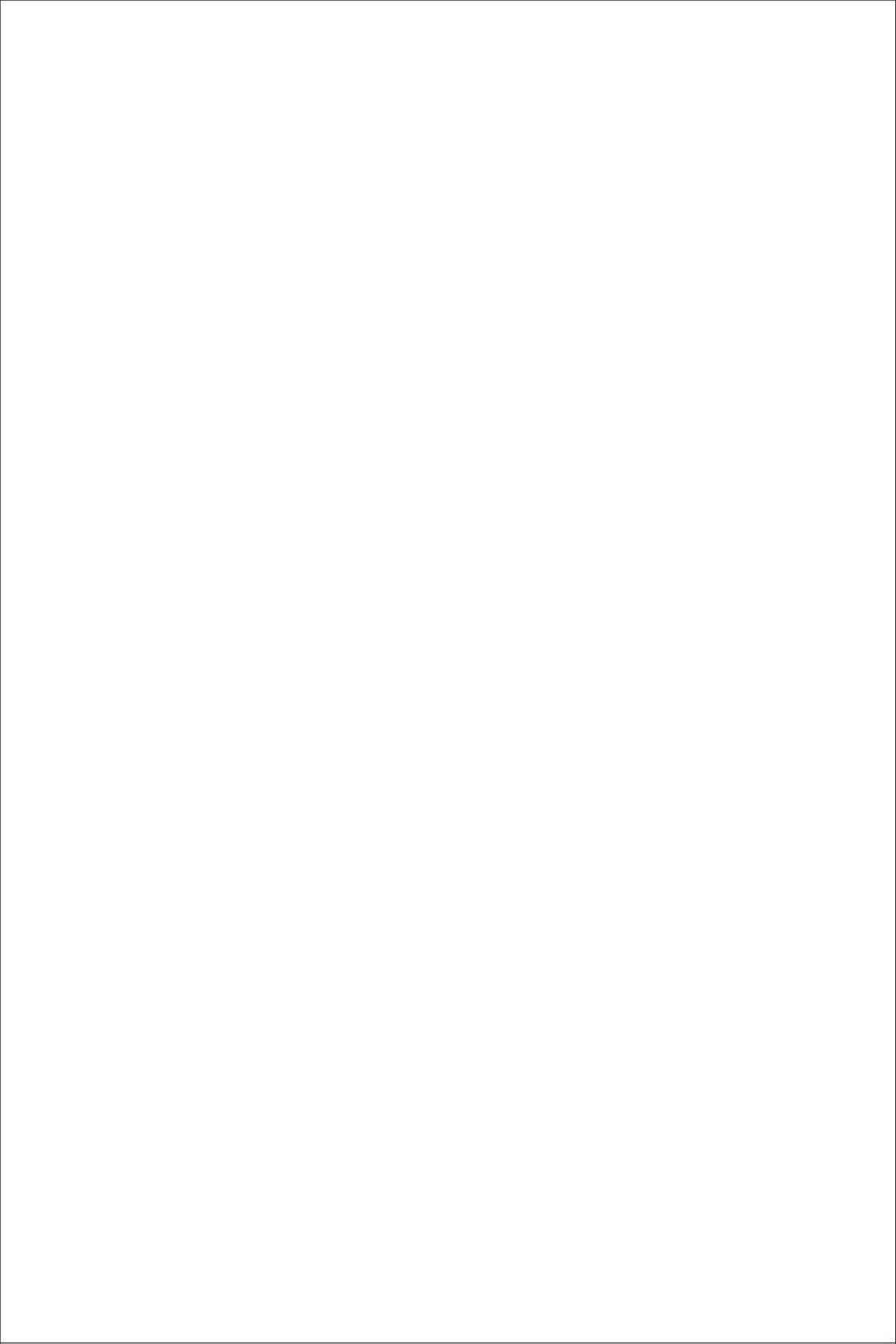
From the first gathering of contributors to this volume in fall 2004 in Santa Barbara, California to the last of four North American and European regional workshops held in Wageningen, The Netherlands in summer 2007, a vast support network made possible the project known as *New Visions of Nature, Science, and Religion*. I primarily acknowledge the generosity of the John Templeton Foundation and the University of California, Santa Barbara, which jointly provided necessary funding and in-kind support. Paul Wason of the John Templeton Foundation and the staff of the Institute for Social, Behavioral, and Economic Research at UC Santa Barbara deserve a special note of thanks for their able assistance and encouragement. Other key support entities at UC Santa Barbara included the College of Letters and Science, Office of Institutional Advancement, and Office of Instructional Resources. Thanks go to the *New Visions* faculty steering committee at UC Santa Barbara, an admixture of expertise in fields such as the geological sciences, psychology, biological sciences, religious studies, anthropology, and history, and to external steering committee members Philip Clayton, Nancey Murphy, and Jeffrey Schloss. Steering committee member Michael Osborne ably took over administration of the UC Santa Barbara portion of the program when I left in summer 2005 to serve at Lewis & Clark College in Portland, Oregon. In addition to sponsoring UC Santa Barbara graduate students doing research in nature, science, and religion, the program received key support from a number of

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I also wish to offer a special word of thanks for the thirteen scholars who dedicated nearly three years of their academic careers to work with each other toward the result that is this volume. It goes without saying that the journey I asked them to take with me was unorthodox: Interdisciplinarity is a gamble, and its fruits taste sweeter to some than others. Yet we fondly remember our times together in Santa Barbara, Boston, Chicago, Oxford, and Wageningen, and sincerely wish that this volume inspires young scholars to stretch beyond their fields of expertise in search of surprising intellectual connections.

As with my previous edited volume, *Science, Religion, and the Human Experience*, I save final thanks for my daughters, Elise and Joy, who have given me support and encouragement in ways far beyond their years. I can see that their heads, too, are filled with crazy visions. If this volume carries a lesson for them, it is that visions can—must—be both lived and questioned, that one needn't nullify the other, that the paradox of blending critical and constructive passion is their delightful challenge as much as it has been mine.

ENVISIONING NATURE, SCIENCE,
AND RELIGION



Introduction

VISIONS OF NATURE, SCIENCE, AND RELIGION

James D. Proctor

Nature, Science, and Religion: A Tangled Trilogy

In the popular Japanese hand game, known in the English-speaking world as rock, paper, scissors, a trilogy is defined by the relations between these common items. The relations are generally fixed, as we all know; for instance, if you are a rock, it's best to come up against scissors (which you can crush) versus paper (which can, we have been persuaded, "cover" and thus defeat rock).¹

In many ways, the rock-paper-scissors trilogy could not be further from the trilogy of nature, science, and religion. Everyone knows the one set of rules governing rock-paper-scissors relations; yet there are innumerable ways in which the relations between nature, science, and religion have been, and could be, envisioned. Even this comparison does not suggest a more

fundamental difference: Most of us don't even imagine nature, science, and religion as being related at all! How often do we hear assertions that science has nothing whatsoever to do with religious faith, or that religion has no connection with how nature operates?

Yet nature, science, and religion are not entirely unlike the objects of that simple game: They can indeed be viewed as separate (like your favorite pair of scissors and a big rock in your garden), but when viewed relationally, new insights emerge. Indeed, this volume's contributors find their understandings of nature, science, and religion to be inextricably tangled. Every time we hear someone talking about religion, we hear glimmers of nature and science; every time an assertion is made about nature, science and religion are implicated. It stands to reason, then, that if either nature, science, or religion matters to you, then all three matter to you as well.

We are scholars representing a diverse array of specialties that span the physical and life sciences, the social and behavioral sciences, the humanities, and theology. What we share is a passionate intellectual and personal concern over concepts as politically, culturally, and psychologically significant as these. We want everyone to think a bit more deeply about nature, science, and religion, because each has been invoked to justify some of the most profound as well as pernicious claims advanced by humanity.

The trilogy of nature, science, and religion is a vast and tangled terrain, too much for one book to cover. What focuses our volume is the insight that many of these claims—both profound and pernicious—have primarily been about nature: claims that certain people are naturally of inferior intellect; that science and religion have aligned in decrying the wanton destruction of the natural world; that certain human sexual proclivities are unnatural and thus should be prohibited; that the wonders of nature, long relegated to the realm of religion, are now best understood via the empirical logic of science. In each of these cases, a claim on nature is simultaneously a claim on religion and science, whether made explicitly or (more commonly) not.

Our point of departure, therefore, in working together to shed light on the tangled trilogy of nature, science, and religion was to consider how particular contemporary understandings or "visions" of nature implicate science and religion in important ways. We proceeded with five, expanded below: evolutionary nature, emergent nature, malleable nature, nature as

sacred, and nature as culture. These were selected to represent a spectrum of contemporary academic inquiry spanning the physical and life sciences, the social and behavioral sciences, and the humanities. Many classic visions or metaphors for nature, such as nature as machine versus organism,² find contemporary expression in the visions we selected for our collaboration, but these classic visions were not themselves included due to the extensive literature already covering them.

Our group of scholars held a series of workshops in Santa Barbara, starting in fall 2004 and culminating in late spring 2006, under the sponsorship of the University of California, Santa Barbara, and with the university's generous support as well as that of the John Templeton Foundation. Our outlook was as diverse as the terrain we explored together; no ready consensus emerged. But we developed a respect for each other's ideas, which led to an extremely productive collaboration. This volume represents the culmination of our joint efforts.

Visions of Nature, Science, and Religion

The term *nature* comes from the Latin *natura*, which is derived from the verb that means "to be born" (*natal* comes from the same root). According to one classic account, there have been three progressive senses of the English use of the word *nature* through time.³ From the thirteenth century on, *nature* meant the essential quality or character of something, such as the nature of a person or of mortality. Beginning in the fourteenth century, the word was also used to represent the inherent force directing the world and human beings, as in "the way of nature." Not until the seventeenth century—relatively recently in English language usage—did the word *nature* also come to mean the physical world as a whole. Thus it spans a wide variety of meanings in reference to both humans and biophysical reality.

Visions of external (biophysical) and internal (human) nature have been at the heart of theories of science and religion, running from Thomas Aquinas to Isaac Newton, and continuing in the work of notable contemporaries, such as Ian Barbour.⁴ In addition to strong scientific interest in external and internal nature, questions of human nature are found in all major religious traditions,⁵ and concerns regarding biophysical nature have emerged in many religions as well.⁶

Yet visions of nature have both united and divided science and religion. In its reference to the biophysical world, nature has been invoked by scientists to reject religious or “supernaturalistic” explanation, but it also serves as a common sacred ground for theologians and scientists oriented toward ecospirituality. In its reference to human nature, the concept has been used to explain everything from the theological doctrine of sin to the biological basis of religion. Nature plays a central role in policy concerns of our time, yet still unites and divides science and religion: Consider, for instance, the 1991 joint statement signed by leading scientists and religious leaders declaring their common concern for environmental protection,⁷ versus the ongoing dispute—with significant scientific and religious dimensions—over human cloning.

As noted above, the five visions to be considered in this volume include evolutionary nature, emergent nature, malleable nature, nature as sacred, and nature as culture. The first two of these visions have arisen in the physical, life, and behavioral sciences; the final two have arisen in the social sciences, the humanities, and theology, with malleable nature straddling the sciences and the humanities. Taken together, these visions represent a variety of scholarly approaches toward understanding nature, with important assumptions and implications regarding science and religion.

Evolutionary Nature

The evolutionary vision of nature is the predominant contemporary scientific means of addressing questions of the origin and diversity of life, with important parallels to scientific theories of the origin and development of the universe. It links biophysical and human nature in a common naturalistic explanatory framework. Though its supposed challenges to traditional religious belief are well-known, it may offer new theological insights for spirituality. It may also help us reflect on, and reevaluate, some of science’s basic metaphysical assumptions.

Evolution is an ancient idea; but the evolutionary vision of nature derives primarily from one of the most far-reaching and influential works in the history of science: Charles Darwin’s *On the Origin of Species*.⁸ Beginning with the publication of Darwin’s work in the mid-nineteenth century, continuing through the twentieth-century modern synthesis with population genetics, and running all the way up to contemporary research, the

evolutionary vision of nature has played a powerful, integrative role among life scientists.

Evolutionary theory is far from settled, which is understandable given its considerable power and breadth of explanation. One of its most celebrated recent interpreters, Stephen Jay Gould, released soon before his death a magnum opus on evolutionary theory, reconsidering the basic questions of whether (a) natural selection is the primary mechanism of adaptation, (b) natural selection operates at the genetic, organism, and/or group level, and (c) changes induced by evolutionary mechanisms are incremental or sudden.⁹ Yet Gould's take on evolution stands in sharp contrast to that of Richard Dawkins, for whom genetic selection is paramount and the lessons of evolution apply equally to humans and nonhumans.¹⁰ Dawkins' strident position on genetic selection is opposed by more scientists than just Gould, however; the long-celebrated biologist Ernst Mayr has also rejected the implications of genetic reductionism.¹¹

The discussion is equally vigorous when evolution is applied to human nature. An example is the field of evolutionary psychology, an approach in which knowledge and principles from evolutionary biology are put to use in research on the structure of the human mind.¹² Researchers in this area have derived results for behaviors as wide-ranging as cooperation, love, incest, and racism. Yet biologist Paul Ehrlich (a staunch defender of evolutionary theory) has argued that it is primarily cultural evolution, rather than biological evolution, environment rather than genes, that is responsible for human behavior.¹³ When evolution is applied to morality, questions such as the reality and possibility of empathy emerge.¹⁴

There are strong philosophical parallels in accounts of the evolution of life and the evolution of the universe. Both are answers to fundamental "origins" questions. Both have traditionally involved recourse to a deity, whether as a Prime Mover or an involved God; yet scientific theories have been advanced by some to suggest that the notion of a deity is unnecessary, perhaps even impossible. It is this thoroughgoing naturalism (or, rather, antisupernaturalism) that has united certain proponents. Thus, for instance, Steven Weinberg has linked evolutionary and cosmological theory as part of a historical process of scientific "demystification," which ultimately suggests "a chilling impersonality in the laws of nature."¹⁵

It is a popular assumption that the evolutionary vision of nature poses

a direct threat to religion; thus, debates over evolution versus creation (or intelligent design) have persisted.¹⁶ Yet evolutionary nature has been seen as a threat by some scholars in the social sciences and humanities as well. As one example, E. O. Wilson's *Consilience* argues for a unity of knowledge based largely on the natural sciences, in particular a model of human nature based on biological evolution;¹⁷ this model predictably finds mixed support in the scholarly community.¹⁸

In summary, evolutionary nature is a powerful, sweeping vision of biophysical and human nature with significant implications for the relationship between science and religion, and the sciences and the humanities. These implications are far from resolved.

Emergent Nature

A second major scientific understanding of biophysical and human nature hinges on emergence, which has been invoked to explain complex phenomena, ranging from biological diversity to human consciousness; its influence has spread far beyond the sciences as well.¹⁹ Emergent nature is becoming a unifying vision for a vast array of scientific disciplines, and sheds new light on traditional metaphysical questions of order and chaos, parts and wholes. Emergence has also been offered as a way to situate theology in a scientifically valid framework.

Emergent nature champions antireductionist explanation. It has been recognized throughout the ages that nature exists at multiple scales of complexity; yet what is the relationship between these levels? The perennial Great Chain of Being posited a vast hierarchy running from matter to spirit, joining levels of complexity (and, significantly, science and religion) with higher levels ultimately explaining lower levels.²⁰ But many of the sciences have, especially in the last century, moved in the opposite, reductionist direction, seeking explanation at smaller and smaller levels of reality.

A good example is physics, which arguably encompasses a broader range of scales of complexity than any other science. A well-known advocate of reductionist explanation is Steven Weinberg.²¹ Weinberg believes that complex phenomena, such as mind and life, do emerge out of simpler systems, yet "The rules they obey are not independent truths, but follow from scientific principles at a deeper level" (p. 115). Reductionist explanation has generally been the hallmark of physics, but has not gone without criticism.

A key early paper was written by condensed-matter theorist Philip Anderson in 1972, in an essay aptly titled "More is different."²² One of Anderson's main points is that "The ability to reduce everything to simple fundamental laws does not imply the ability to start from those laws and reconstruct the universe" (p. 393). The early work of Anderson and other physicists led to the cross-disciplinary field of complex systems analysis, which is explicitly devoted to establishing nonreductive modes of explanation of complex phenomena. This interest has spawned research centers, such as the Santa Fe Institute and the New England Complex Systems Institute, with significant participation by physicists such as Murray Gell-Mann.²³

Complex systems research has led to new ways of understanding the age-old question of the relationship between order and disorder in reality, leading to fundamental insights into nature, classically understood as part of an orderly cosmos. Pivotal to this work has been the concept of deterministic chaos, in which apparent disorder emerges from very orderly simple rules, yet this emergent disorder turns out to be quite orderly in other ways. The vision of emergent nature thus challenges the strict separation of cosmos and chaos, order and disorder in the universe. In emergent nature, randomness and pattern are linked; this very different metaphysical way of looking at nature has led to fundamental new insights in natural science fields, such as ecology.²⁴

Perhaps the most breathtaking recent publication on emergent nature is *The Emergence of Everything*.²⁵ In this work, biophysicist Harold Morowitz assembles a continuum of twenty-eight steps of higher levels of emergent complexity, rivaling in scope the classical Great Chain of Being and running from the universe to planets to cells to animals to humans to culture to spirit. Morowitz ascribes much of the recent flurry of scientific discovery around emergence to the advent of high-speed computing, which has presented new opportunities for modeling complexity in nature. Major implications exist for science, as it potentially moves from mathematical to algorithmic modes of explanation (e.g., understanding the emergence of complex behaviors based on simple computational models, such as cellular automata), as championed in Stephen Wolfram's *A New Kind of Science*.²⁶

Morowitz's work reaches beyond science to religion in tracing implications of this vision of emergent nature. He advances the radical theological

thesis that “Transcendence is an emergent property of God’s immanence. . . . We *Homo sapiens* are the mode of action of divine transcendence” (p. 195). Morowitz thus claims that, according to the vision of emergent nature, God is to be understood as the immanent laws of nature; people, who possess emergent consciousness, are the true transcendent agents in the cosmos. Others have also discussed theological implications of emergence with varying degrees of departure from traditional theism: for instance, John Polkinghorne has considered implications of chaos, complexity, and emergence, linking God with the possibility of top-down causation between levels of reality.²⁷ More recently, Philip Clayton argues that emergence theory in recent science offers an important opening for language about the spiritual dimension of human existence, including the concept of spirit and perhaps even the idea of God.²⁸ He traces emergentist arguments from the emergence of the classical world out of quantum mechanics, through contemporary debates in evolutionary biology and neurophysiology, and up to the emergence of spirituality and metaphysical concepts.

Emergent nature is thus in many respects an even more far-sweeping vision than evolutionary nature. It is quite recent, may signal major changes in science, and has afforded diverse theological interpretations. Its stronger scientific advocates have, however, not escaped criticism for their ambitious extension of this vision.²⁹ In its theological extensions, emergence can, if not carefully articulated, become an inspiring but fuzzy “god-of-the-gaps” argument; indeed, its popularity in certain new religious movements bears little resemblance to its scientific origins.³⁰ Yet these theological extensions suggest ways in which contemporary visions of nature can have significant spiritual dimensions, to be explored later under the cultural and philosophical vision of nature as sacred.

Malleable Nature

The vision of nature as malleable straddles the sciences and the humanities: It arises in the sciences and engineering from pathbreaking research in genetics and development of new genetic technologies over the last several decades,³¹ and has arisen in the same time period in conjunction with development in the humanities of poststructural and postmodernist perspectives on the nature of reality and human beings.³² The vision of malleable nature challenges the boundaries of nature and the natural, as what

lies beyond these boundaries—the unnatural, the artificial—is now less easily distinguishable from the realm of nature. As such, it also challenges the bedrock of biophysical and human nature upon which many societal and religious values are based,³³ and has thus engendered serious discussion and debate over its philosophical, theological, and political implications.

Malleable nature encompasses a wide swath of related topics: Examples include human reproduction and enhancement, genetic discrimination, human stem cell research, and food and agriculture in developing countries. But positions taken on these topics by scientists, religious leaders, industry, and the public have generally fallen into one of two camps, reminiscent of the polar “catastrophist” versus “cornucopian” stances Stephen Cotgrove detected in environmental politics some two decades ago.³⁴ On the catastrophist side, a number of religious denominations, environmental organizations, and sectors of society have denounced biotechnology as an imminent threat to humanity and the natural world; on the cornucopian side, advances in genetic research and biotechnology have been heralded by many scientists and industry as a panacea for problems ranging from birth defects to global food supply.

Much of this academic and popular discussion has focused on developments in science and technology, ranging from the Human Genome Project to current government-sponsored biodefense projects.³⁵ Proponents address public anxieties regarding risk in contemporary nature-society relations (e.g., pesticide-dependent industrial agriculture) and invoke larger values concerning the proper place of humans in the natural world, in casting biotechnology as a safe human improvement upon nature.³⁶ Similarly, opponents typically invoke potential environmental risks, coupled with the threat of societal disempowerment as human and biophysical nature becomes corporatized.³⁷ Others note the religious dimensions on all sides of biotechnology.³⁸

In a broader context, these developments have been examined in terms of implied features of science, and its connections with larger political and economic processes. Peter Dickens, for instance, argues that genetic research and technology treat biophysical and human nature as mechanisms comprising subsystems composed of parts that ultimately boil down to bits of information in the genetic code.³⁹ To Dickens, this fragmented idea of nature serves well its commodification in multiple market niches:

Nature is stuff that can be manipulated to presumably human, and certainly corporate, benefit. Others similarly link genetic research with the increasing emphasis on profitable information in science,⁴⁰ as witnessed by the rapid rise of molecular biology.

Yet malleable nature is not wholly restricted to the sciences. In the humanities and popular culture, a related discussion has considered malleable nature from a poststructural and postmodernist perspective. Jean Baudrillard, for instance, has argued that the malleable human genome erases the boundary between natural and the artificial, real and virtual; there is no reality beyond our “Disney World” representations of it.⁴¹ And though some have warned of the dangers of treating human biology as infinitely malleable,⁴² others have pointed out the historicity of supposedly biological concepts, such as *woman* in arguing for an embrace of postmodern difference in biotechnology.⁴³ The upshot of these critiques has been a rejection of appeals to “nature” or “natural” in justifying policy and morality. All of this has taken on new dimensions as the malleability of nature has been reduced to the molecular level in nanotechnology.⁴⁴

In sum, much discussion concerning biotechnology has taken science and religion as givens, rather than provoking a deeper examination of implications of malleable nature for the very science that studies it, and religious bodies that comment on it. Preliminarily, biotechnology paints a mixed picture of contemporary science, and one in which religion has not yet advanced far beyond a simplistic reading of both nature and science. Yet malleable nature is an unsettling notion, in the same way that poststructural and postmodernist notions of malleable reality are unsettling. Malleable nature is hence both sweeping and inconclusive in its implications for science and religion, and must be situated in the context of other visions of nature in order to derive robust indications for progress in religion and science in the future.

Nature as Sacred

In contrast to the notion of biophysical and human nature as thoroughly material entities, distinct from the sacred realm of God or spirit, a more theological vision of external and internal nature has recently arisen in both scholarly and popular circles. This vision of nature, with variants running from theistic ecospirituality to agnostic religious naturalism, may

serve as an important metaphysical basis governing ethical behavior, yet raises major challenges for reconciliation with both transcendent religion and scientific rationality.

Scholarly attention has been empirical (involving historical and contemporary studies of concepts of sacredness in nature and sacred space) and philosophical and theological (attempting to systematize this empirical information and understand it in light of religious teachings and sacred texts). As an example of the latter, Ian Barbour has included themes of stewardship, celebration, sacrament, and the Holy Spirit into a theology of nature.⁴⁵ An example of the former is the Forum on Religion and Ecology at Harvard University, a cross-cultural project involving a multiyear series of conferences and related publications.⁴⁶ Perhaps the fullest scholarly analysis concerns how religious notions of the sacred inform fully secularized transformations of biophysical and human nature in late modernity.⁴⁷

In the American context, Catherine Albanese has identified a perennial “nature religion” in the United States, stretching from early settlement to contemporary spirituality.⁴⁸ To Albanese, the Western religious tradition “has placed nature near the top of its short list of major categories by which to make sense of religion. God and humanity [as expressed in organized religion and civil religion] comprise the first two categories. Nature, however culturally diffuse and evanescent, forms the third.”⁴⁹ Albanese notes four expressions of nature religion in American history: (1) the Transcendentalist legacy inherited by contemporary environmentalism, (2) metaphysical forms of spiritualism (e.g., Theosophy) reaching to contemporary New Age practices, (3) a revitalized emphasis on bodily healing and well-being grounded in nature, and (4) Enlightenment-style natural religion and natural theology, expressed in peculiarly American forms, such as pragmatism.⁵⁰ Thus, both biophysical and human nature fall under this broad rubric. Albanese’s historical work is validated by contemporary social science research, demonstrating the ubiquity and significance of notions of nature as sacred in contemporary environmental concern.⁵¹

A much more voluminous literature has been devoted to philosophical and theological dimensions of the vision of nature as sacred.⁵² This literature is quite diverse, mixing immanent and transcendent sacredness and exploring related practices in multiple religious traditions. Much of it constitutes a continuing response to Lynn White’s famous thesis that the

roots of environmental crisis lie in Judeo-Christian attitudes of domination over nature,⁵³ but some of this literature traces implications for human as well as biophysical nature.

What are the implications of the vision of nature as sacred for science and scientific rationality? Scientific opinion is apparently mixed: Some have strongly supported this vision as a mode of reenchancement of the natural sciences,⁵⁴ whereas others have charged that it constitutes a “betrayal of science and reason,”⁵⁵ an “assault on reason,”⁵⁶ or “nature worship.”⁵⁷ This discussion suggests different positions on the boundary between science and religion, and many of these contradictions have yet to be resolved. The vision of nature as sacred is thus quite culturally diffuse and important among theologians, humanists, and social scientists; it will surely play an important role in science-religion dialogue in future. But more attention is needed to systematize and join its empirical and philosophical/theological dimensions, and to rectify potential contradictions with science.

Nature as Culture

A diffuse vision of nature arising in the social sciences and humanities concerns nature as culture. This vision emphasizes nature’s inextricable connection with human meaning, in contrast to the prevalent notion of nature as entirely separable from culture. As with the other visions, it poses important challenges and opportunities for rethinking science and religion, in this case as human endeavors as opposed to direct conduits to reality and God.

The separation of nature and culture is one of the most deeply entrenched divides in Western thought.⁵⁸ It can be traced back at least to Aristotle, for whom nature (*physis*) is that which is not made by humans, in contrast to *techné*, that which is of human origin. It underscores ideas of objectivity, which arose in the seventeenth-century valorization of scientific rationality, often grounded in nature as an objective referent, as a means of technical ordering of society based on a new, naturalist “religion.”⁵⁹ The idea of objectivity forced culture into the diminutive category of subjectivity, and forced God into two polar alternatives as either equivalent in status to the objectively verifiable reality explored by science, or merely the subjective projection of a wishful or oppressed people.

The vision of nature as culture has roots in Kantian philosophy and

earlier expressions of idealism, but it is best known for its recent flourishing in opposition to naïve notions of objectivism, underscoring the practice and interpretation of natural and behavioral science. It is often called *social constructivism* or the “social construction of nature” thesis,⁶⁰ and should be understood primarily as an epistemological assertion concerning our knowledge of nature, rather than an ontological assertion concerning the reality of nature itself. Nonetheless, one of the primary tenets of social constructivism is that biophysical and human nature are incomprehensible outside of culturally based knowledge schemes, so the vision of nature as culture cannot be readily dismissed as merely a vision of ideas of nature versus nature itself.

The vision of nature as culture has been primarily championed among the social science and humanities disciplines—those for which culture is a primary category of analysis. Its most vocal opponents have been scholars working in the natural sciences. This debate, known popularly as the “science wars,” has tended to promote philosophical caricatures of naïve realism, asserting the reality and ready knowability of nature, against naïve relativism, questioning the truth-value of all scientific knowledge.⁶¹ Fortunately, an excellent and growing body of scholarly work has refused to accept these polarized terms of the epistemological debate over nature and culture.⁶²

The vision of nature as culture, then, resonates with a diffuse epistemological position, characterizing many of the social sciences and humanities. It has been understood by some as standing in fundamental opposition to science, but it need not be, as long as dualistic caricatures are rejected. On the contrary, this vision poses a powerful means of potentially reconciling the “two cultures” problem of the sciences and humanities,⁶³ and bears important potential for bringing science and religion together.

Comparison

There are some important similarities in these visions. All are strong arguments concerning nature in its entirety, not simply weak arguments concerning certain properties of nature. For example, the evolutionary vision attempts to explain all life through the prism of evolution, not just certain forms or aspects of life; similarly, the vision of nature as culture maintains that all knowledge of nature is filtered through cultural lenses, including scientific as well as popular understandings. This common feature will pose

challenges for synthesizing these visions, as none necessarily includes room for the others. Yet what may arise could thus be something entirely new for nature, science, and religion.

As strong arguments, each of the five visions challenges a prevalent metaphysical dichotomy. The evolutionary vision stresses the continuity of all nature, and hence opposes the notion that humans are entirely separate from nature. The emergent vision not only challenges the reductionist notion that nature at all scales of complexity can ultimately be analyzed in terms of its constituent pieces, but more fundamentally revisits the larger opposition between chaos (disorder) and cosmos (the order of nature). The malleable nature vision challenges the dichotomy between natural and artificial, in that genetic manipulations of nature are arguably both. The vision of nature as sacred challenges the distinction between matter (the stuff of which nature is ostensibly composed) and spirit, secular and sacred. The vision of nature as culture challenges the same notion questioned by the evolutionary vision, but takes the opposite tack by means of “culturizing” nature as opposed to “naturalizing” culture.

These five visions of nature are by no means entirely distinct. There has been a good deal of interest, in particular, in bringing together the two scientifically based visions of evolutionary and emergent nature,⁶⁴ with important implications for human morality and religion.⁶⁵ Similarly, the vision of nature as sacred could be understood as a specific claim made by certain cultural groups, thus falling under the vision of nature as culture. In many ways, the vision of malleable nature is the ontological equivalent of the epistemological argument of nature as culture: In one, nature is literally constructed, whereas in the other it is conceptually constructed. Other linkages are indeed possible: Consider the notion of an embodied mind,⁶⁶ which links the seemingly opposing visions of evolutionary nature and nature as culture, or theological work from an emergentist perspective,⁶⁷ potentially linking emergent nature and nature as sacred. Yet there are differences. For instance, the vision of nature as culture can have a corrosive effect on the realist epistemological assumptions underlying evolutionary nature and emergent nature.⁶⁸ Similarly, evolutionary nature may explain, and hence explain away, the vision of nature as sacred.⁶⁹ These differences may suggest important points of departure for a comparative and synthetic effort.

The Essays

The volume proceeds with a broad examination of the very notion of visions of nature, in an essay by Willem Drees titled “The Nature of Visions of Nature: Packages to Be Unpacked.” Drees notes that visions of nature involve both facts and values, descriptive and prescriptive elements. Though there are many elements to religion, visions of nature relate most closely to what he calls *theologies*, or the cognitive dimension of religion. According to Drees, theologies are creative combinations of cosmologies—how the world is—and axiologies—how the world should be. The natural sciences deal centrally with cosmologies, yet their most significant cosmological insights do not fully determine the nature of reality, so cosmology cannot be reduced to the findings of science. When this schema is applied to the five visions of nature we considered as a point of departure, some (e.g., evolutionary nature) appear to favor cosmological elements, whereas others (e.g., nature as sacred) favor axiological elements. Yet all include important cosmological and axiological assumptions, being both visions “of” and “for” nature. Drees then reviews each of the five visions using this schema, noting their very different implications for science and values. Drees concludes by observing that, though reflection on the nature of visions sounds far removed from the business of living one’s life, this practice affords the opportunity to reflect on, integrate, and apply these cosmological and axiological concerns.

In “Visions of Nature through Mathematical Lenses,” Douglas Norton takes another broad look at the nature of visions, this time from the perspective of a mathematician. To Norton, mathematics is far deeper and more aesthetically driven than most people would assume, given its typical quantitative caricatures. This impulse to seek elegant explanations of the nature of reality links mathematics centrally with visions of nature, starting in the earliest years of mathematics with a vision not unlike that of nature as sacred. Norton invokes nature as culture to acknowledge the historicity of mathematics, moving from its early times to medieval, Renaissance, and modern instances. What is significant in Norton’s review is the extent to which nature, science, and religion are intertwined in the personal lives and professional outlooks of leading mathematicians. Norton then focuses on dynamical systems and chaos theory to suggest their significant and novel perspective on nature, with broader implications for science and religion.

In this contemporary body of mathematics, the relation between order and disorder is central. Norton closes by acknowledging his sense of delight when mathematics provides an elegant vision of nature.

As emphasized above, nature is human as well as nonhuman. In “Between Apes and Angels: At the Borders of Human Nature,” Johannes Thijssen considers the Aristotelian heritage of our views of what is special about the human being. These views share many of the qualities of our views of biophysical nature, in that we commonly assume that nature has some special property that sets it apart from nonnature. In the case of biophysical nature, this is generally understood to be its lack of human origin; in the case of human nature, this is generally understood, following Aristotle, to be some peculiar property of reason that sets the human apart from the nonhuman. But Thijssen disputes this notion of nature on two levels: First, this capacity for reason was understood differently at different times in history, and, more broadly, the influence of history on ideas of human nature validates the nature-as-culture vision that nature, whether biophysical or human, is more construction than essence. Thijssen examines the understandings of human nature, and the Aristotelian capacity for reason in particular, as evidenced in the anatomical ruminations of Edward Tyson (1650–1708), the earlier theological speculations of Saint Augustine and Albert the Great (c. 1200–1280), and debates among Spanish conquerors over native Americans. Thijssen closes by invoking the Aristotelian notion that living according to reason was not only a defining feature of human nature but an ethical norm, which at the time meant becoming godlike but since then has taken many different forms, of which we could readily note the practice of science as one envisioned ethical fulfillment of the capacity for reason. Nature, science, and religion thus closely intertwine in discussions over what it means to be human.

In the next essay, “Locating New Visions,” the geographer David Livingstone builds on the nature-as-culture notion adopted by the historically minded Thijssen in arguing that any given vision of nature must be located—that is, geographically situated—in order to be fully understood. He does so in the context of the first of the five visions of nature that launched our collaborative effort, that of evolutionary nature. Livingstone is intrigued by the particular ways in which different communities responded to the evolutionary notions of nature and humanity, following Darwin. He

builds on the argument of other contributors to this volume that ideas are inescapably open to multiple interpretations, noting the same to be true with respect to what people often mistakenly take as monolithic Darwinian theory. Livingstone provides a summary review of knowledge as what Edward Said called *traveling theory*, observing that ideas are not immutable abstractions but circulate in material form (e.g., as texts) much the same as other objects, and are thus influenced on each occasion where they are written and read. Turning to the place-based reception of Darwin, Livingstone contrasts first the sense of threat felt among Presbyterians in Belfast with the more dialogic reception among those in Londonderry. He then compares two sites in the U.S. South, where in both cases Darwin was understood as a threat to race relations, but the authority invoked to resist this threat was in one case polygenist science, and in the other (monogenist) biblical literalism. The third comparison examines Dunedin and Wellington, New Zealand, where in differing ways the cultural grip of religious institutions was less than in Ireland and the United States. But in the case of Wellington, Darwinism provided ready justification for the inevitable domination of native Maori by European settlers. Livingstone closes by clarifying his position as distinct from claiming that visions of nature, science, and religion are nothing but products of their location, yet maintaining that any call to fashion “new” visions must itself be aware of its locatedness.

Robert Ulanowicz bridges our first two visions of evolutionary and emergent nature in the essay “Enduring Metaphysical Impatience?” Ulanowicz makes the bold claim that fundamentalism of a sort exists among both scientists and religious advocates, to the extent that they manifest what John Haught has called metaphysical impatience in considering all ultimate questions on the nature of reality to be effectively solved. To Ulanowicz, the necessary entanglement of differing visions of nature suggests a necessity for scientists and theologians to be in patient dialogue with each other. He starts by reviewing some primary metaphysical principles of Newtonian naturalism, suggesting that even though many of these tenets have been updated in science they still hold sway among neo-Darwinists. This contemporary scientific form of metaphysical impatience has been challenged by proponents of intelligent design (ID), an equally impatient movement that talks science but is to Ulanowicz primarily theological. Ulanowicz then critically examines how ID uses information

theory-derived notions of complexity to attempt to prove the necessity of theological design in the evolution of life. He then proposes an alternate reading of complexity by posing metaphysical principles arising from the study of ecosystems that run counter to each of Newton's principles. One important implication is that disordered complexity is inevitable yet, given its ambiguity, amenable to explanation from both scientific and theological principles. Ulanowicz closes by briefly remarking on how his ecological metaphysics addresses some major conflicts between science and theology, such as free will and the efficacy of prayer, issues that could potentially result in rich dialogue instead of bitter conflict.

Similar to Ulanowicz's consideration of the first two visions of nature is Barbara King's essay, "God from Nature: Evolution or Emergence?" But King develops her argument from quite a different empirical basis: the African great apes. King defines religion by emphasizing practice and emotional connection with the supernatural, and argues that great apes may help us understand the evolution of religion among humans, given their likely similarities to early hominids. Her approach is decidedly dissimilar to that of scholars who use evolutionary theory to base the human religious impulse on particular genes or brain evolution. For King, these reductionist approaches neglect the social and relational dimensions of how primates, and presumably hominids, evolved. She offers important anecdotes that, corroborated by other empirical evidence, suggest the extent to which great apes display the capacity for empathy and compassion; these, King argues, are precursors for the meaningful ritual practice characterizing religion. King also provides a summary history of hominid evolution to modern human beings, noting how these primate traits were then extended into ritual and symbolic practice. But does this antireductionistic approach suggest the relevance of emergence theory—that very bastion of antireductionism—in explaining how religion came to be among humans? Working with a definition of emergence adopted from Philip Clayton, King seeks the "unpredictable, irreducible, and novel" dimensions of human religion vis-à-vis hominid precursors, closing with a nod toward the difficulty in resolving the possible role of emergence, yet noting that the largely evolution-based explanation she has provided is anything but reductionistic, given its vision of nature as "deeply social, emotional, and creative."

Gregory Peterson's essay "Who Needs Emergence?" summarizes over a

century of scholarly interest in emergence, then characterizes contemporary forms by invoking Clayton's taxonomy of *façon de parler*, weak, and strong types. *Façon de parler* emergence, essentially a nonemergentist account of complex realities, generally shares with weak emergence a physicalist view of existence, though the latter admits some reality and causal efficacy to these complex entities. By contrast, strong or radical emergence generally moves beyond strict physicalism in positing the existence of wholes that are in some ways of an entirely different sort than their pieces: Classic examples include the mind or consciousness and the Pauli exclusion principle, typically explained via the example of multiple electron energy states in an atom. Peterson then considers emergence as used in the physical and life sciences, arguing that their application is understandable, given the common need for scientists to account for causal connections between different scales of complexity; in this regard, however, the scientific use of emergence entails less a metaphysical commitment than an explanatory necessity. Indeed, scientists are wary of an "emergence of the gaps," in which emergence serves, miraclelike, to rescue causal explanations between scales of complexity. Peterson contrasts its uses in science with how philosophers and theologians consider emergence: In these latter fields, ontology as well as causality are key, leading, for instance, to the philosophical interest in strong versus weak emergence (given differing accounts of reality), and the theological interest in God as an emergent reality (or conversely, the world as emerging from God), and in the causal sufficiency of nature to account for novelty. Given its various forms and the differences of focus between the sciences and philosophy/theology, Peterson concludes with caution that much more work needs to be done in coming to terms with the role of emergence as a vision of nature.

In "Creativity through Emergence: A Vision of Nature and God," theologian Antje Jackelén further explores emergence, proceeding from the observation that several centuries ago it would be not complexity, novelty, and emergence, but conformity to law, which would have been celebrated, suggesting the culture in which emergent nature has arisen. Jackelén then reviews the long discussion over whether complexity has emerged from nature or God, ultimately suggesting that both may be intertwined; yet this discussion entails a level of vulnerability, given the vagueness of the concept. She notes that the emphasis on levels of reality in emergence

theory, with its attendant hierarchy of value, is problematic. Jackelén's emergence reminds us of indeterminacy and potentiality: Important related concepts are design and order, with implications for theological doctrines, such as the creation of order out of nothing versus chaos, suggesting a form of *tehomophilia* (appreciation of chaos), and linking closely with possible emergentist accounts in science. Jackelén does mention a number of limitations of emergence, most especially the value-ladenness implied among some of its proponents; for Jackelén, emergence does not provide a new proof of God or defeat of materialism. Yet Jackelén closes with the bold move of building a new vision of nature, human nature, God, evil, sacramentality, and ultimately theology in light of emergence.

Martha Henderson's essay, "Rereading a Landscape of Atonement on an Aegean Island," further extends the vision of emergent nature in the context of human-nature interactions on landscapes. To Henderson, the emergent notion of a self-organizing system offers a better understanding of these interactions in the Aegean island of Lesbos than the typical declensionist story, especially as told by George Perkins Marsh in the classic mid-nineteenth-century *Man and Nature*,⁷⁰ that human practices, such as overgrazing, have resulted in landscape destruction (e.g., erosion). Henderson views Greek Orthodox religion as playing a key cultural role in the coevolution of these landscapes by providing guidance and necessary correctives to landscape practices. She reviews the literature on self-organizing systems and the history of Aegean landscape, emphasizing scholarly interpretations of the latter that dispute a declensionist reading. Henderson suggests that the environmental damages noted in recent times in these landscapes are not so much the product of ancient practices as of modern pressures, including urbanization. Henderson discusses the religious landscape of Orthodox Christianity and features relevant to land use, such as the need for sacrificial lambs, then moves to a more detailed description of Lesbos, located just off the coast of Turkey. She argues that Marsh misread landscapes, such as Lesbos, because he applied a background combining North American farming and ideas of humans as a destructive force in nature. In between this declensionist reading and a more positive one that similarly privileges human agency, Henderson suggests the possibility of coevolution between humans and biophysical processes, as well as the significance of religious practices in supplying meaning. She closes by noting that landscapes provide tangible

evidence of ideas of nature, science, and religion, and ties the proclamations of the “green” Greek Patriarch Bartholomew I into this connection between religion and landscape.

Moving to another broad framework for understanding biophysical and human reality is Andrew Lustig’s “The Vision of Malleable Nature: A Complex Conversation.” Lustig notes that, more so than the other visions of nature, malleable nature problematizes the human role in altering nature, thus raising the deeper question of the relationship between descriptive and normative statements about nature. Yet, to Lustig, this makes malleable nature open to multiple perspectives and interpretations; he reviews the other four visions of nature to demonstrate a similar potential for plural interpretation. Lustig then considers the philosophical distinction between description and prescription, suggesting that strict readings make science and ethics mutually exclusive in spite of recent accounts that effectively base one on the other. In moving deeper on the question of whether nature or the natural can be used to ground morality, Lustig finds particular relevance in the critical perspective of feminism, noting related points feminists make that call for serious caution. He then turns to a summary of major religious traditions, considering how their doctrine and historical practices shed light on what position may be derived as to the propriety of altering biophysical and human nature. The variety of these perspectives calls in Lustig’s mind for care to be taken in making generalizations of any sort about religion per se and its relationship with science. Lustig concludes with a number of questions that nonetheless remain, such as possibilities for interfaith cooperation on guidelines for biotechnology, given these differences.

Fred Ledley’s “Visions of a Source of Wonder” suggests how one scholar specializing in the scientific and medical practices underlying malleable nature approaches the relations between nature, science, and religion. Ledley’s interest lies in the potential to escape the constraints of both science and religion in visions of nature by attending to the sense of wonder that is often understood to typify religious and scientific experience, yet precedes formal characterization via the languages of science and religion. Ledley notes broad evidence of this sense of wonder in experiencing the natural world—a sense sometimes translated as the sublime. Ledley then seeks further evidence and possible explanation of the experience of the sublime in religion, specifically rabbinic commentary on the first words

of Genesis, at the very beginning of the Hebrew Bible: A wide range of Jewish scholars have weighed in on their grammatical complexities, often with an interpretive eye toward aspects of nature lying in the wonder of creation and not toward any straightforward interpretation. Ledley then considers the domain of mysticism, one in which experience of wonder is key, alongside religion and science: Mysticism is often appreciated as a bridge between the realm of the sublime and the realm of religion, and even scientific intuition can be understood as a form of mysticism (certainly of wonder). He next suggests how neurological research indicates a common human capacity for mystical experience, via heritable brain pathways. Yet the presence of these neurobiological structures does not, as some argue, deny the reality of the source of these mystical experiences; indeed, these evolved capacities may have conferred benefits, including the motivation for advancement of religion and science! Ledley closes by noting that this sublime vision of nature need not be a backhanded proof of God, nor need it diminish claims based on scientific and religious understanding.

The final vision of nature is exemplified in Nicolaas Rupke's "Nature as Culture: The Example of Animal Behavior and Human Morality." Here the engagement with concepts of nature seems to concern science more than religion, but ultimately, in serving as an expression of political and other sentiments, both scientific and religious claims to authority are brought into context. Rupke begins by reviewing the nature-as-culture argument, which challenges the moral authority of nature as revealed by science. He prefers a view from somewhere, the notion shared with Livingstone and certain others in this volume, that situates scientific accounts of nature in their geographical-historical contexts. Rupke chooses the case of scientific research into animal behavior in the nineteenth century, first offering an overview of the field, then focusing on the German earth and life scientist Carl Vogt (1817–1895). Rupke provides details on both the scientific and philosophical-political inclinations of Vogt, emphasizing his strong materialist and antimonarchist impulse: For instance, he described bee colonies as little more than organized systems of class violence and oppression. Vogt was internationally recognized for his scientific achievements, but his extension of scientific research into political commentary was blatant, though not unrepresentative of other scientific accounts linking animal behavior and human morality. Rupke

closes by providing a brief overview of similar scientific studies of animal behavior that address themes of human sexuality, war, and aggression. His ironic conclusion is that, in attempting to explain culture in terms of the forms of nature, scholars such as Vogt draw unwittingly on culture in their explanatory reliance on nature.

My essay, "Environment after Nature: Time for a New Vision," partly affirms the notion of nature as culture, yet problematizes the binary distinction between nature and culture assumed in support or denial of this vision. I focus on the notion of environment accompanying contemporary environmental concern: I argue that the profound limits of our contemporary understanding of environment as nature call for a renewal of the earlier vision of environment as connectedness, noting that connection is emphasized in a wide variety of essays in this volume. I begin by reviewing the usage of *environment* over the last few centuries, as it moved from a sense of connection with surroundings to the surroundings themselves, and ultimately physical surroundings. I point out that this reduction of environment to physical reality has broader roots, revealed as well in our understandings of science and religion, where their relationship is often portrayed as one of either essential similarity or dissimilarity. In particular, recent statements suggest that science and religion come together in their support of environmental concerns. Yet there is a binary implied in these treatments of science and religion that ultimately boils down to an assumed binary of nature and culture, and prevents the harmonization of science and religion, or of humankind and environment, that is desired. What, then, is the solution? I draw on the work of Bruno Latour as one example of how to supplant the nature-culture binary by counting beyond two, rejecting the duality that subtly colors our understanding of environment, and the dual authorities of science and religion we commonly invoke to justify environmental concerns. Latour's emphasis on connection and hybridity results in a very different sense of science, religion, and environment than is commonly understood, one that resonates in recent "death of environmentalism" claims that similarly cite environmentalism's conceptual foundations as fundamentally flawed. I conclude by asking whether environmentalism will indeed move toward this new/renewed vision.

The last essay in this volume is John Hedley Brooke's "Should the Word *Nature* Be Eliminated?" Brooke's contribution brings the vision of nature as

culture to its logical conclusion, as there arguably is nothing at all natural to nature, in this view. What is particularly important and problematic in our cultured notions of nature, Brooke emphasizes, is the dualities on which they are inexorably founded: Nature versus human, natural versus supernatural, nature versus art, and so forth, all largely constitutive of how nature is understood and used in religious and scientific discourse—and Brooke ably points out connections with both. One early account that recognized the resultant lack of conceptual coherence to nature was that of Robert Boyle, who made the case to dispense with the word entirely, given this ambiguity. Brooke then turns to a review of the dichotomies on which our notion of nature is founded; for instance, that between the realm of the natural and the supernatural, which was complexified not only by the introduction of a third domain, that of the preternatural, in theological and early scientific speculation, but by critiques of the long-standing notion of the two books of nature and Scripture, one revealing the natural and the other the supernatural. Similarly, the distinction between nature and art, or the question of whether human artifice could ever resemble the majesty of the natural world itself, has been elided in countless examples of human contrivance. Similar cases are provided by Brooke for the distinction between nature and nurture, and ultimately between nature and culture. If, then, the word *nature* ought to be dispensed with, given its foundation on unsupportable binaries—that is, as defined by that which it is not—then what ought to replace this word *nature*? Brooke suggests that, instead of looking for new visions of nature, we simply look for new visions of reality, of which there are many from which to choose. One advantage Brooke notes is that there is no way we can claim reality to be any less expansive or broad than it really is! If, then, there is also no essential human nature, still an exploration of the reality of the human condition is worthwhile. Yet Brooke reminds us, in conclusion, that any new *vision* of nature is more properly understood as another *voice for* nature; hence we should ask who as well as what is implicated in visions of nature.

These fourteen essays reflect a wide range of scholarly views on envisioning nature, science, and religion. How may they be compared? The initial framework specified five visions of nature, and the resultant structure of the volume largely follows these visions of evolutionary nature, emergent nature, malleable nature, nature as sacred, and nature as culture. Yet,

clearly, a set of recurrent themes emerges through the volume. Additionally, a comparison of the essays as well as the essayists themselves may offer us some perspective on the possibility of harmonizing these visions and their underlying philosophical themes, given the wide variety of disciplinary backgrounds and predispositions of the scholars who participated in our collaborative research.

The Afterword presents visualizations of visions of nature, based on a set of empirically derived graphics focusing on the essayists' disciplinary specialties, their inclinations regarding the five visions of nature, and the emphasis on nature, science, and/or religion revealed by key terms in their essays. It also follows the inspiration of John Brooke's concluding essay in constructing a set of four key philosophical binaries, representing common ontological, epistemological, and aesthetic distinctions between nature and antinature, and summarizing essayist positions with respect to these binaries. A common visualization technique employed in this Afterword is correspondence analysis, which offers preliminary glimpses into interesting points of resonance and differences among the essayists and essays. The upshot of this comparative analysis is a set of important tensions underlying the relations between nature, science, and religion, which we believe must be engaged and embraced, rather than resolved, if new visions are indeed to emerge out of the creative soup constituting this book. The volume thus closes not so much with an ending as an invitation for a renewed exploration of the essays herein, as the reader considers the possibility and form of new visions of nature, science, and religion.

Acknowledgments

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Notes

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