Biology

THE WONDER OF BIRDS: What They Tell Us about Ourselves, the World, and a Better Future by Jim Robbins. New York: Spiegel & Grau, 2018. 352 pages. Paperback; $13.62. ISBN: 9780812983760.

The photo of an Anna's hummingbird in flight is what first caught my attention. As I further inspected the cover of Jim Robbins's book *The Wonder of Birds: What They Tell Us about Ourselves, the World, and a Better Future*, I have to admit that I expected the book to be a secular version of John Stott's classic *The Birds Our Teachers*. I anticipated that each chapter would be a vignette about a wondrous feat accomplished by some far-flung species of fine-feathered friend, with each feat being a metaphor for our lives, or the human condition, or our relationships with each other. Instead, Robbins's book takes the reader on a four-part journey that reveals his insights regarding what birds tell us about the natural world, ourselves, and our future (as promised in the title of the book), along with a discussion of the "gifts of birds" (what ecologists might call "avian ecosystem services").

The book certainly includes the obligatory wondrous feats of birds that can be handy knowledge during a trivia contest (e.g., a calliope hummingbird can hover nonstop for 90 minutes, and bar-headed geese can migrate over the Himalayas at 30,000+ feet). However, the focus of his eighteen chapters is not really to wow us with impressive statistics, but to draw us to a deeper appreciation for our avian neighbors, which are often ignored and/or taken for granted. Each chapter of Robbins's book is prefaced with a handsome illustration of one of the chapter's focal species. But the book is not really about how pretty birds are (in fact, one chapter focuses on the unseemly practices of vultures and another chapter discussed slaughtering practices in the chicken industry), and appropriately, the illustrator, D.D. Dowden, does not embellish the drawings with mountains, ponds, prairies, or fields of wildflowers.

Robbins begins Part I (What Birds Tell Us about the Natural World) by bringing the reader up to speed on the origin of birds (as a surviving lineage of dinosaurs) and the evolution of bird flight. Upon reading the first chapter, I was starting to wonder whether the author had pulled a bait-and-switch, but my puzzlement was short-lived, as the next three chapters examine avian versus human (mechanical) flight, what canaries, black-backed woodpeckers, and other birds tell us about their/our environment, and flock dynamics (information used in the battle scenes in the *The Lord of the Rings* and *The Hobbit* film trilogies).

In Part II (The Gifts of Birds), Robbins presents us with other origin stories, those of industrial chicken production ("Big Chicken") and of the $5 Costco fully-cooked rotisserie chicken. Robbins then discusses the myriad of ways that birds serve humankind just by doing what they do, and how the loss of birds can be catastrophic for human societies. For example, Robbins describes the recent loss of vultures in India due to poisoning by a livestock drug and the ripple-effects of this loss, including the loss of an estimated 48,000 human lives.

As a graduate student studying birdsongs of black-capped chickadees and house finches in the 1990s, I was often asked at social gatherings why anyone would care about birdsongs and whether there was something more important that I could be studying. I quickly learned that most people do not find birds to be particularly interesting, cool, or worthy of investigation. I soon began weaving what in my mind were embarrassingly simplistic fabrications to appease the masses—explanations about how studying birdsong development and song learning can help us understand more about human vocal development and perhaps provide us with treatments for speech pathologies such as delayed speech acquisition. Twenty years later, Robbins presents his readers, in Part III (Discovering Ourselves through Birds), with a similar but much less "fabricated" story about how spatial memory develops similarly in bird and human brains and how, if scientists can unlock the secrets of neurogenesis in the vocal centers and other areas of bird brains, we may be able to "usher in a new era of therapy for stroke, trauma, Alzheimer's, Parkinson's, and other brain ailments." Other topics in Part III include the soap-opera-like family dynamics of bee-eaters, the language of birdsongs in chickadees (ever wonder why there are sometimes so many "dees" in the "chick-a-dee-dee-dee" call?), the intellect of ravens and crows, and the athletic prowess of birds such as bar-headed geese.

In Part IV (Birds and the Hope for a Better Future), Robbins begins with a discussion of how we have put bluebirds and falcons to work controlling pests. Next time you are at a party and someone drinking a Spring Mountain (Napa Valley) chardonnay asks you why birds matter, you can tell them that they can thank western bluebirds for helping make their beverage pesticide-free. Robbins's next chapter focuses on the beloved yet maligned domestic pigeon, with the harrowing story of Cher Ami, the pigeon that saved a battalion of 194 US soldiers during World War I. While these stories seemed somewhat out of place as I read them (they seem like fodder for Part II), Robbins then shifts the focus toward the emotional connection some urban dwellers have with pigeons,

as the pigeons are the only nature some of them ever experience. Interestingly, Robbins posits that the love for pigeons may be vital to protecting the rest of the world's biodiversity. Robbins continues Part IV with chapters about the transformational power of owls and other raptors, including how at-risk inner-city youth were able to return the bald eagle to its historic nesting areas along the Anacostia River in Washington, DC. Robbins concludes with a discussion of ethno-ornithology, a relatively new field of study that looks at the holistic relationship between some tribal societies and their avian companions. As Robbins puts it, "Understanding the relationship between native cultures and birds may lead us back to a sustainable world in which their fate—and ours—is no longer in doubt" (p. 295).

This is a book that would appeal not only to fans of honeyguides, corvids, vultures, eagles, hawks, owls, linnets (house finches), penguins, chickens, hummingbirds, zebra finches, chickadees, egrets, flycatchers, waterfowl, starlings, bluebirds, ratites, pheasants, or any of the other myriad birds described in the book, but also to anyone who wants to learn more about birds and their roles in our lives. Robbins's use of swear words on two occasions might be distracting or offensive to some readers, but all in all, Robbins has produced a thoroughly researched and well-written book on the ecological, economic, and spiritual value of birds to humankind. The book reminds us of the value of biodiversity, and although Robbins is writing for a secular audience, his scientific approach to the subject matter and ability to weave the science into an entertaining narrative can help *PSCF*'s readers and other Christians to understand more fully and to appreciate more deeply the responsibility we bear in having dominion over creation.

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History of Science

DARWIN'S FIRST THEORY: Exploring Darwin's Quest to Find a Theory of Earth by Rob Wesson. New York: Pegasus, 2017. xxi + 383 pages, including endnotes, index, and 62 figures. Hardcover; $29.95. ISBN: 9781681773162.

DARWIN'S FOSSILS: The Collection That Shaped the Theory of Evolution by Adrian Lister. Washington, DC: Smithsonian Books, 2018. 215 pages, including sources, references, index, 16 figures, and 9 maps. Paperback; $19.95. ISBN: 9781588346179.

Charles Darwin, while en route to authoring *On the Origin of Species*, was widely appreciated as an explorer and as an observant field geologist. His geological and paleontological observations and inferences influenced his approach to nature as well as his appreciation for the significance of history for interpreting what we see today. The two volumes reviewed here narrate and interpret the effort, physical and mental, that Charles Darwin exerted as a young and vigorous naturalist while on board *H.M.S. Beagle* (1831–1836). *Darwin's First Theory* also covers Darwin's tutelage in field geology under Adam Sedgwick in the weeks prior to setting sail, and his field excursions in Scotland and Wales following his return. Together, the two books complement one another, revealing Darwin's growing understanding of Earth function, the implicated depth of geologic time, and the relationships of past biotas to those of today. These three subjects arguably provided the young scientist with a foundation for his later work on the mechanisms channeling the history of life.

The young Darwin was a keen geologist. His first book (1839) was his *Journal of Researches into the Geology and Natural History of the Various Countries Visited by H.M.S. Beagle*, only later retitled by a publisher as the *Voyage of the Beagle*. On the title page, the author's name is subtended by his credential as a scientist: "Secretary, Geological Society." This may have been meant in part as a claim to professional status, but it also declared the author's identity as a geologist. Wow! Darwin dedicated the second edition (1845) of the *Journal of Researches* to the geologist Charles Lyell, explicitly referencing Lyell's *Principles of Geology*. Darwin's debt to Lyell while a young scientist has been noted by many historians, but the intellectual link has often been developed merely to underscore Darwin's developing uniformitarian approach to natural history. This thinning of Darwin's early fascination with geology has been remedied by the biographies of Darwin by Desmond and Moore (1991) and by Janet Browne (1995; 2003). Further rehabilitation of Darwin the geologist and paleontologist has been provided by Richard Darwin Keynes, in *Fossils, Finches and Fuegians* (2003), a thorough account of the voyage of the *Beagle*; and by Sandra Herbert, in *Charles Darwin, Geologist* (2005), which examines many facets of Darwin's development as a scientific observer and communicator. The books by Lister and Wesson, here under review, continue this revelation of Charles Darwin, field geologist.

Darwin's Fossils, as the title suggests, is focused on the kinds of fossils that Darwin collected while on the *Beagle* expedition. A preliminary chapter introduces us to Darwin's associates on the *Beagle* and

the paleontologists and zoologists to whom Darwin forwarded his fossils while en route. Following this chapter are three long chapters treating fossil mammals, fossil plants, and fossil marine life. The penultimate chapter takes a look at Darwin's examination of coral reefs while on the return voyage across the Pacific. The last chapter is a brief exposition of Darwin's development as a scientist following his return, and the significant impact of his paleontological collecting on his development as an evolutionary biologist. The numerous illustrations include many photos of the very specimens collected by Darwin. There are also photos of Darwin's South American landscapes and collection sites, as well as modern South American organisms relevant for comparison to the fossils. The illustrations are in color and uniformly well executed, resulting in an attractive volume that grabs and sustains the reader's attention. In addition, the several maps are clear and make the narrative much more understandable.

Darwin's First Theory is a more complicated read. It is actually three interwoven narratives. The fundamental narrative is that of Darwin's field geological researches in South America and in the Pacific. In this respect, there is great overlap between this volume and *Darwin's Fossils*. But the book also looks at the effects of plate tectonics—earthquakes, tsunamis, and volcanism—on contemporary life (and death) along the Pacific margin of South America, a significant chunk of what is often termed the "Ring of Fire." The third interwoven component is that of author Rob Wesson's geophysical researches into tectonism in southern South America, plus his personal retracing of Darwin's inland excursions. The common theme to these three narratives is that of motions in Earth's crust, and the decipherment of the cause(s) of said motions. Wesson explicates the gamut of geologic and paleontologic phenomena (including the great Conceptión earthquake of February 1835) that Darwin encountered, which convinced him that Earth's crust had experienced a long but punctuated history of localized vertical motions. Darwin pondered over what he was seeing and continued to ponder after his return to England, where he wrote up his geological discoveries. Among his realizations was the necessary role of protracted crustal subsidence in the evolution of coral atolls.

Wesson demonstrates how Darwin grappled with geologic data. The eastern and western South American coastlines as well as the Argentinian coastal plain bore features indicating that in some places, land surfaces had bobbed down while in other places, they had been elevated. Confusingly, some localities provided evidence of complex motions in both directions. Lacking an understanding of plate tectonics and of underlying mantle dynamics, Darwin and his contemporaries attempted to resolve the whys of vertical crustal translations. In the process, Darwin developed a preliminary sketch of the geologic history of the Andes. Darwin also was drawn into the debates surrounding massive glacial advances and retreats in the past. In these efforts, Darwin relied on Lyell's work as a compendium of background information and as a foil.

The new volumes by Lister and by Wesson underscore Darwin's strenuous and sometimes risky journeys along shorelines or cross-country and often at high altitude, driven by his realization of the opportunity with which he had been presented. Darwin collected all manner of marine invertebrates, terrestrial plants, mammals, fishes, reptiles, birds, and fossils, which were periodically sent back to England to be referred to specialists. The fossil mammals went to Richard Owen. One of the helpful aspects of both of these books is to highlight the respectful friendship between Darwin and Owen during Darwin's early career, countering the common perception of Darwin and Owen as perennial intellectual adversaries. Darwin learned much from Owen's store of anatomical knowledge. Lister's book makes clear the personal impact upon Darwin that his up-close encounter with fossils provided: it was apparent that the fossils in more recent sedimentary layers resembled their modern counterparts more than the fossils in earlier strata. And the recent fossils of South America, including monster ground sloths and giant armadillo-like glyptodonts, were obviously more closely related to the modern biota of South America than to those of other continents. There were biogeographic patterns as well as historic patterns to be found, hidden in the rocks.

Darwin was poised at an interesting point in history. The preceding generation had elucidated the fact that fossils occurred in an order within the strata; Darwin's contemporaries were deploying that discovery to chronicle the major contours of the history of life. Meanwhile, the origins of major Earth features such as continents, ocean basins, and mountain chains remained highly problematic. Darwin was propelled into the study of natural history during this exciting period. His growth as a natural scientist while on the *Beagle* expedition has often been flattened to a two-dimensional perspective, focused on the revelatory power of biogeography linked to his evolutionary tool-kit. The volumes at hand help restore the third dimension and illuminate Darwin the historical scientist, pondering processes and time.

Readers of *PSCF* who wish to better understand the logical train of reasoning that led to the *On the Origin*

of Species, and to remediate the distortions of the history and role of biostratigraphy that have been and continue to be put forth by the proponents of flood geology, will profit from these volumes.

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THE GREAT RIFT: Literacy, Numeracy, and the Religion-Science Divide by Michael E. Hobart. Cambridge, MA: Harvard University Press, 2018. xiv + 506 pages, with appendices, endnotes, and index. Hardcover; $39.95. ISBN: 9780674983632.

Michael Hobart's book *The Great Rift* presents a novel and provocative perspective on the age-old conflict between religion and science. In his words:

> My central thesis may be baldly and succinctly stated: the shift between two distinct information technologies—literacy and numeracy—resides at the source of how science and religion went their separate ways, producing the Great Rift between them. (p. 4)

To be clear, Hobart does not specifically address the alleged discord between science and religion but delineates how a chasm (his word) opened up to drive them apart. Nevertheless, Hobart holds that as life became ever more secularized, religion became less relevant to science and was "not so much conquered as ignored" (p. 10), so that "from the late nineteenth century to our own times we have reached the point where observers and participants alike … have come to view the widening separation between science and religion as an impasse, or even a war zone" (p. 323).

To support his thesis, Hobart fleshes out and refines some research begun two decades earlier with a colleague on transitions between the three stages in the history of information technology: literacy, numeracy, and computerized information processing. The result here is a well-researched book, based on a lifetime of work, that extensively examines medieval and Renaissance developments in mathematics as well as Galileo's seminal role in the rise of modern science. The detailed scholarly treatment given these topics, which we cannot adequately recapitulate here, makes the book well worth its modest price, completely aside from its take on the science-religion divide.

Hobart begins his narrative with a brief look at the ancient world, which introduced and developed the information technology of recorded language. Greek writing is epitomized by its literature and philosophy, which make extensive use of definition and classification to capture the essence of things. Aristotle systematically codified forms of deductive reasoning based on this type of thinking in his logic. Medieval schoolmen later adopted this mode of knowledge acquisition in their educational practices and intellectual debates. Classification and fine distinctions permeated the writings of those who studied the quadrivium (arithmetic, music, geometry, and astronomy) as well as the writings of those dedicated to more advanced topics in theology and philosophy.

During this time period, there was a methodological unity overall to science and religion. Thinkers described the observed behavior of natural phenomena in terms of causes related to their essential natures, leaving room for divine purposes at the head of it all. They employed the same sort of reasoning that explained the structure of the natural world to incorporate religious ends and means. Science and religion in medieval Europe formed a fairly harmonious whole.

As people began to use mathematics more consistently in the late Middle Ages and Renaissance in order to relate things in everyday arenas such as commercial transactions, music, perspective painting, and astronomy, the explanatory focus for natural phenomena moved away from appealing to the intrinsic nature of things to demonstrating how they functioned quantitatively. Mathematically relating numerical features of events or activities via ratio and proportion (the rule of three was an omnipresent mainstay) became the new mode of accounting for natural phenomena. This approach was fruitfully employed by Galileo in his scientific analysis of terrestrial motion, yielding his times-squared law for falling bodies and parabolic paths for projectiles. Such an approach left both traditional philosophy and theology on the outside, creating a fault line between science and religion. Galileo's clash with the Roman Catholic Church over the factual status of Copernican astronomy, the nature of scientific demonstration, and the legitimacy of theological incursions into science only exacerbated this rift.

Hobart attributes the new analytic approach in natural philosophy to changes in information technology, indeed, to the rise of numeracy. He sees developments within mixed/applied mathematics during the Renaissance and early modern period as embodying a new understanding of the nature of mathematics and the role of symbols. Using terms proposed in 1959 by Jagjit Singh (but for distinguishing formalistic late nineteenth- and twentieth-century mathematics from its more concrete antecedents), Hobart brands classical and medieval mathematics as "thing mathematics" and Renaissance and early

modern mathematics as "relation mathematics." This characterization works to some extent, but it has shortcomings.

Classical mathematics was certainly about mathematical entities encountered in everyday life (numbers, spatial figures), but it also treated their basic properties (being prime, being isosceles) and relations (being divisible by, being congruent to). Hobart correctly notes that late medieval, Renaissance, and early modern mathematics made extensive and productive use of relations such as ratio and proportion (a significant part of what qualifies them as being relation mathematics) to formulate functional dependencies, but these relations were also prominent in earlier mathematics—in the works of Euclid, Archimedes, Apollonius, Heron, and Ptolemy, and even in the mathematical practice of earlier cultures.

Another aspect of the new relation mathematics, as Hobart conceptualizes it, is an emphasis on the use of abstract or empty symbols. In one sense, this was not new. As far back as the end of the third millennium BC, for instance, the Mesopotamian sexagesimal place-value system made abstract computations possible, so that the differing concrete metrological systems still in use could be bypassed. But, in another sense, applying this characterization to late medieval, Renaissance, and early modern mathematics is anachronistic. Hindu-Arabic numerals referred to quantities such as goods, weights, and monetary value in commercial arithmetics; musical notation denoted temporal duration, pitch relations, harmonies, and time signatures; and letters used in the analysis of motion stood for speeds, times, and distances. More-abstract symbols were introduced in algebra by Viète and others to stand for numerical operations as well as unknown and known quantities, and these were used to formulate and solve equations, but they were not vacuous—they had numerical meaning in some assumed domain of quantities. Furthermore, while Viète made some major notational advances in algebra for solving equations prior to 1600, Galileo remained rooted in an older geometric form of ratio arithmetic that he learned from the recently recovered Book V of *Euclid's Elements*. In his earlier work, Hobart highlighted Viète's role in the new numeracy, but here Galileo is his protagonist. Galileo does use mathematical symbolism to analyze relations among physical quantities, but these are neither empty of meaning nor related by equations.

However, there is some validity to Hobart's assertion that the symbols of modern relation mathematics were becoming empty. As mathematics was increasingly being used to quantify empirical realities such as cost, distance, harmony, time, speed, and so on, time-worn metaphysical and occult connotations of numbers and spatial configurations became superfluous, and, as a result, symbolic representations were emptied of enchanted meaning. This practice became more widespread as time went on, though as Hobart acknowledges, it was not uniformly followed even by the start of the 1600s. Mystical associations of mathematics were often deemed as important as practical applications; in fact, this development encouraged some to believe that mathematics would unravel the secrets of nature. Kepler's astronomical writing, for example, contains hard-nosed calculations about elliptic planetary orbits and also religious and mystical ruminations about Platonic solids and the ability to think God's thoughts after him.

More could be said about Hobart's defense of his thesis—particularly his idiosyncratic use of the notions of cardinality and ordinality in connection with mathematicians beginning to join the fields of number and space in their practice of mixed mathematics—but I will end with a question and follow that with a few concluding remarks.

What is gained, I wonder, by conceptualizing the transformation of natural philosophy (from using Aristotelian teleological argumentation to employing mathematical analyses of functional dependencies) as a sweeping shift in information technology, exchanging words for empty quantitative symbolism? Why is this not seen instead, for instance, as a renewed neo-Pythagorean/Archimedean emphasis on the primacy of quantifying (mathematization) combined with a more experimental and mechanistic bent in physical investigations? That is, why concentrate so exclusively on the how of information technology—"the humanly constructed screen between the knowing mind and the world outside" (p. x)—rather than on the what of the discovered numerical connections between meaningful content? Hobart would no doubt respond that the latter does not occur without the former and that his stated aim is to determine the extent to which a change in information technology is implicated in the new mode of doing science, but I think more could have been done with developments on the religion and philosophy side of the divide to contextualize the shift.

Hobart successfully documents the changing methodology of science in the early modern period, especially in his expert examination of Galileo's work, but his thesis does not account for other important issues concerning the relationship of science and religion, even in this time period. I remain convinced that much more than information technologies are involved in the rise of modern science and its con-

nection to religion. To be fair, some of these factors are acknowledged in passing by Hobart. He admits that changing attitudes toward the roles of religion and philosophy in the pursuit of natural knowledge were influenced by historical developments such as the rise of nominalism, the Reformation, Renaissance humanism, the revival of Platonism, gradual secularization, and so on, but these lie mostly outside the scope of his thesis. More importantly, Hobart does not probe the significant ways that Christian religion—in both its medieval and early modern versions—provided a hospitable intellectual environment in which modern science could develop and thrive, Galileo's conflict with the church notwithstanding. Readers who recognize God as the author of nature (and of creation more broadly) will not be persuaded by Hobart's allegation that "the deep incompatibility of religion and science" is now "simply too great to overcome" (p. 323). Distinct epistemic methodologies or information technologies do not automatically create territorial conflicts, and what discord there is, can often be attributed to other factors, such as the opposition between Christian faith and a strong commitment to naturalism.

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Origins

KNOWING CREATION: Perspectives from Theology, Philosophy, and Science by Andrew B. Torrance and Thomas H. McCall, eds. Grand Rapids, MI: Zondervan, 2018. 341 pages. Paperback; $39.99. ISBN: 9780310536130.

The late modern unfurling of interdisciplinary studies continues to produce innumerable volumes. The relationship between theology and science is no exception. Zondervan recently released two volumes exploring "perspectives from theology, philosophy, and science," edited by Andrew Torrance and Thomas McCall, each with over a dozen qualified contributors. The first is *Knowing Creation* and the second *Christ and the Created Order*. This review looks at the first.

As one skims the introduction, it seems the volume might be just another opinionated survey of the stale debates over "creation, science, and intelligent design." But in reading through each chapter, it quickly becomes apparent that the book is far broader. In fact, readers generally interested in and familiar with this intersection of disciplines might find it a simple pleasure to read (as I did), without worrying about locating arguments within a contemporary context and making judgments. At any rate, the book fulfills its purpose: to give a microphone to the multiplicity of dimensions in this arena, all without reducing or overemphasizing one aspect over another.

It is not possible to review each contribution, but I do want to highlight points from some of them to give readers a sample of the contents.

Christoph Schwoebel, in "We Are All God's Vocabulary," focuses on a topic vital for any discussion about interacting disciplines: language. Although many of us tend to think we understand basic concepts such as "metaphor" and "analogy," we often don't. "Metaphors do not simply add a coat of meaning to things which underneath remain what they are," he writes. "They change the way things are for us and how we are to relate to them" (p. 49). In a modern age that privileges the literal, propositional, and measurable/quantifiable and downplays the symbolic, metaphorical, and qualitative (that is, "it's *just* a metaphor"), getting a handle on the linguistic dimensions of the science-theology enterprise cannot be overstated.[1]

Andrew Torrance, in "Not Knowing Creation," attempts to clarify methodological naturalism. There's much to comment on here, but the essay is more thoughtful and persuasive than those in *Theistic Evolution* (2017) edited by J. P. Moreland et al. on the same topic. Inevitably, there remain loose ends—especially with regard to the main assumptions of this discussion, such as models of God and creation, "special divine action," and how science done by Christians is substantially different than that done by non-Christians. Torrance writes, for example, that "there should be a difference between the way in which the Christian scientist and the naturalistic scientist approach and interpret the structure, behavior, and history of the natural world" (p. 101); this view gets the ball rolling but does not take us too far.

John Walton, in "Origins in Genesis," condenses some of his published research. In contrast to modern thought, he presses the superficiality of the natural/supernatural distinction. This default way of thinking simply is not part of biblical consciousness. "We cannot claim the Bible says something that makes no sense in the original context; it cannot make a categorical distinction if it does not have the categories" (p. 109). Walton is by no means the first to make this observation, but his repeated focus is justified given that many of those speaking and publishing on this topic still talk in ignorance; for instance, "miracles" are said to be part of the "supernatural" realm (that is, where God does stuff) in the Bible whereas "natural events" are said to be distinct and in the "nature

world" (that is, where the "real world" happens). "Scientific claims, then, are typically premised on this metaphysical divide, with the idea that if a natural explanation can be offered, then any biblical claims about God's involvement can be disregarded" (p. 108). In contrast, "When the Old Testament describes God's extraordinary involvement in the world, it is not to specify a supernatural event that is in defiance of natural, scientifically describable cause and effect" (p. 110).

Francis Watson then answers the question, "How Did Genesis Become a Problem?" He challenges the stereotypes about "truth" types, as well as the false equivocation "literal = reality."

> It is true that Earth revolves on its own axis and around the sun, but it is also true that the sun rises and sets. To ascribe motion exclusively to Earth in one context does not make it false to ascribe motion exclusively to the sun in another. These are two distinct truths, not a single truth accompanied by a necessary fiction or a higher truth accompanied by a lower one … In no circumstances … is a literal interpretation obliged to demonstrate a direct and exclusive relationship between the text and the reality to which it refers. One can interpret the text literally without having to claim that, according to the Bible, the sun revolves around the earth. (pp. 129–30)

William Brown switches gears to a fascinating look at "Job and Astrobiology," and Susan Eastman to an interesting discussion of "neurological mirroring" and the formation of identity as witnessed in Paul's letters and ministry.

Marilyn Adams (who sadly passed away after submitting her contribution) writes on "Sanctifying Matter," addressing the bigger philosophical contexts of God, creation, and meaning. This contribution alone made the book worth buying. I have never seen anyone so eloquently and concisely address the purpose of creation, meaning of life, problem of evil, death and hope, scientific reductionism, divine action and presence, God's love, and wise living all within such a short space. But she pulls it off in beautiful prose and precision that will probably remain one of my all-time favorite essays in Christian theology.

Getting more technical, C. Stephen Evans answers the question "Are We Hardwired to Believe in God?" He challenges the late-modern/post-modern emphasis on epistemological construction and the arbitrariness of cognitive categories, asserting instead that "evolution actually shows that the order we experience on the surface of things, so to speak, depends on a still deeper, hidden order" (p. 207). Along the way, he tips over some common misunderstandings about evolution and Christianity. "Atheists often seem to think that evolution and God are rival, mutually exclusive hypotheses about the origins of the natural world," but this "fails to grasp the relationship between God and the natural world by conceiving of God as one additional cause within that natural world" (p. 208). Likewise, biological explanations for one human feature or another are not automatically reductionistic, hegemonic, or totalizing. "From an evolutionary perspective, all our cognitive faculties must have a biological explanation," he argues. "The mere fact that a cognitive mechanism has an evolutionary explanation gives no reason to doubt that this mechanism is conducive to truth" (p. 211).

Robert Koons and William Simpson survey pertinent issues in ontology and metaphysics (for example, categories, reductionism, quantum theory, and materialism), with the latter making a philosophical case for transformative hylomorphism in contrast to emergentism and physicalist reductionism. Simpson concludes,

> The transformative hylomorphists can agree with structured emergentists concerning the vanity of trying to reduce everything in biology, neuroscience, and psychology to fundamental physics but should reject both the reification of matter in terms of physical constituents and the identification of forms as structures with physical parts. (p. 258)

The variants of emergentism probably should have been given more attention.[2]

After two other excellent essays, Tom McLeish attempts to craft a summary of a theology of science: "Science is the participative, relational, cocreative work within the kingdom of God of healing the fallen relationship of humans with nature" (p. 320). Behind this is the assertion that "Science and theology are not complementary; they are not in combat, they are not just consistent—they are 'of each other'" (p. 320).

Given the wide range and quality of writing in these contributions, one looks forward to the second volume with much anticipation. *Knowing Creation* is an excellent book for anyone interested in getting their feet wet with this complex subject.

Notes

[1]Compare the recent publication, Paul Chilton and Monika Kopytowska, eds., *Religion, Language, and the Human Mind* (New York: Oxford University Press, 2018), with my review in *Reading Religion,* Nov. 12, 2018, http://readingreligion.org/books/religion-language-and-human-mind.

[2]Note, for example, the qualifications offered in Jamin Hübner, "A Concise Theory of Emergence," *Faith and Thought* 59 (October 2015): 2–17.

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Science and Religion

MERE SCIENCE AND CHRISTIAN FAITH: Bridging the Divide with Emerging Adults by Greg Cootsona. Downers Grove, IL: InterVarsity Press, 2018. 184 pages. Paperback; $17.00. ISBN: 9780830838141.

Mere Science and Christian Faith: Bridging the Divide with Emerging Adults is a call by author Greg Cootsona to the importance of basic science literacy if one hopes to do ministry with young adults (aged 18–30). Cootsona is Lecturer in Religious Studies and Humanities at California State University at Chico and directs Science and Theology for Emerging Adult Ministries, a three-year, $2 million grant project, funded by the John Templeton Foundation and housed at Fuller Theological Seminary. From 2002–2016, he served as associate pastor for adult discipleship at Bidwell Presbyterian Church in Chico, and from 1996–2002 at Fifth Avenue Presbyterian Church in New York City. His experience makes him highly qualified to speak to the issues addressed in this book. Cootsona's popular appeal is evidenced by his writings in major newspapers, as well as by his interviews by national television networks. He is also a member of the American Scientific Affiliation.

Mere Science and Christian Faith has eight chapters, as well as a list of books for further reading. The chapters are short, pithy, provocative, and sprinkled with a plethora of interesting quotes. The book is well referenced. Cootsona discusses both the positives and negatives of technology, and then considers several topics that seem more like hot topics of interest to young adults than science topics critical to Christian faith. Some of these topics include the New Atheism, cognitive science, cosmic fine tuning, intelligent design, sexuality, and global climate change. This review will begin by highlighting three strengths, and then describe three weaknesses of *Mere Science and Christian Faith*.

First, this book is written for people who are ministering to 18– to 30-year-olds. Cootsona's working hypothesis is spot on. He argues effectively that the younger generation takes science and technology for granted. The impact of technology is an essential element of the world in which they live, as seen in advanced medical care, the internet, space travel, and environmental protection. The church today needs to take science and technology into account in order for its message to gain a hearing. So while the ministry of the gospel need not pander to popular trends, neither can it ignore them.

Second, the author has a good sense of humor, and uses it effectively. However, in some cases his approach is a bit too relaxed and compromises the intellectual tone of the book. For example, "Google, the source of all information," may be humorous to young adults, but considering that Google is the primary source of information for many university students, it may not be a joke at all.

Third, the author has made a start on his stated goal of creating a theology of culture, with science as a key component of that culture. For the Christian message today to have more impact, it must engage science. The author has a good grasp of the problem of science avoidance in church, and effectively alerts the reader to this problem.

Areas where the book could be improved include the following. First, *Mere Science and Christian Faith* popularizes and simplifies science enough to leave practitioners of science wanting more. And while the book's call to incorporate concepts from science and technology in ministry to young adults is well defended, it is not successful at telling the reader how to do so. The author seems to assume that talking about hot topics in science will pique the interest of young people and keep them engaged with the gospel. This leads to a second weakness.

Cootsona argues that science and technology are what young people want to hear and discuss, so that is what they should be given. That this is universally the preferred spiritual appetite for young Christians is debatable. Furthermore, spiritual growth is not always best served by giving people what they perceive themselves to need. According to many young people, what they want is that the church allow people trained in science to have a voice, and neither muzzle the true scientists, nor give the pulpit to people who are not qualified to speak adequately about science. The goal should be to normalize science and technology within the church, so that the topic is discussed responsibly and with faithfulness to scripture. Young people want science that makes a difference. The author acknowledges that young people want to see technology used in service to the poor and underprivileged, but seems to also consider titillating topics such as transhumanism to be important in engaging young people. But while generating fun conversations, such topics are probably less important to young adults than being able to observe spiritually mature, scientifically literate mentors living lives of integrity. These characteristics are probably more important to young people's spiritual formation than whether one is able to discuss the prospect of every human possessing a digital

version of their brain on file in case they develop Alzheimer's disease.

Third, the author plays around with technology like playing around with an apple in one's hands, not sure whether to eat it or not. It would have been helpful if the author had done more to explain the circumstances in which science and technology serve good purposes and those in which they do not. Although Jacques Ellul died in 1994, his *Technological Bluff* remains a prophetic word with implications more profound with every passing year. Interaction with some of the classic works on the ethics of technology would have strengthened the book's argument.

This book is an enjoyable read, and could be used as a springboard for conversations about the ways science and technology interact with Christian faith. People who minister to the age group which is the focus of this book will find it enlightening. However, a classic ASA member might find this book lacking in scientific rigor, and with an inadequate delineation of science and technology. But, to find out, buy the book, share it with your young adult friends, and have a conversation about it. Cootsona's experience in increasing the confidence of young people, by showing that the gospel is not made irrelevant by science, is impressive. This book is another contribution to that end.

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CITIZEN SCIENTIST: Searching for Heroes and Hope in an Age of Extinction by Mary Ellen Hannibal. New York: The Experiment, 2016. 423 pages including notes, references and index. Hardcover; $25.95. ISBN: 9781615192434.

> [G]eology, biology, and human history may be investigated by us as separate chapters but, in fact, they make up one book. And the time has come for us to learn to "read" that book. (p. 6)

Mary Ellen Hannibal is a prolific environmental journalist. Her previous works include *Evidence of Evolution*, commemorating the 150th anniversary of *On The Origin of Species*; and *The Spine of the Continent*, describing the most ambitious conservation effort yet attempted. She is an appropriate author for this rich and lengthy volume about the legitimacy of citizen science research. She takes it much further than mere legitimacy, however. This book amplifies her claim that data produced and reported on a variety of subjects (migratory birds, bees, redwoods, and tide pool creatures are a few specifically described) by interested members of the general public is crucial for the preservation of endangered species and ecosystems. Essentially, scientists simply cannot do it all. They need to enlist all the help they can get, and passionate volunteers make worthy contributors.

Hannibal has a particular gift for connecting the scientific community to the public. This is evident in this book, and indeed, it could almost be considered the theme of it, because this connection is the core of citizen science. Perhaps a clarification of the term "citizen science" is needed here. Citizen science is simply scientific work that is done by interested citizens rather than by professional scientists. *Citizen Science* describes a number of projects that are underway and functioning because of the efforts of countless nonscientists who document the honey bees they observe, or count the migrating hawks that pass over a particular point each fall, or note the dates that local plants first bloom in the spring. They typically record their data electronically and submit it to scientists who use it in various ways, such as establishing population baselines so that changes can be documented, or the reverse—comparing reported numbers with baselines established in past decades.

The book includes several citizen-science-related scenarios in eleven, sometimes lengthy, chapters. The author lives in Northern California, and many of the ecosystems and associated projects and people she details occur there. These include California's original habitats and how they have been altered in the last two hundred or so years, citizen science and Silicon Valley technology, the redwood forest, Pacific tide pools, the founding of the California Academy of Sciences (by citizen scientists, not professionals!), and Mt. Tamalpais ecosystems.

My favorite account was the story in chapter 9 of a champion citizen scientist, Ed Ricketts, and his friends Joseph Campbell and John Steinbeck. Hannibal's picture of Monterey, California, in the 1930s and the development of the classic natural history books *Between Pacific Tides* and *The Log from the Sea of Cortez* are fascinating. The intriguing and enduring relationships among these brilliant characters are also explored. Campbell is the author of *The Hero with a Thousand Faces* (1949) and the originator of the phrase "follow your bliss"; Steinbeck received a Pulitzer Prize for *The Grapes of Wrath* (1939) and authored many other outstanding books. Ricketts's holistic approach to science in general and ecology in particular comes together in *The Log from the Sea of Cortez* (co-created with Steinbeck), which can be rightfully considered a manifesto of citizen science if not even a bible. Darwin is to evolution what Ricketts is to the integration of science with its sister humanities. Hannibal carries this sense of integration throughout her book, quite intentionally. "I'm trying

to do in this book what they [Ricketts and Steinbeck] were trying to do—put it all together, the personal, the historical, the scientific" (p. 7). This is an appropriate approach to a defense of citizen science, which combines the layperson's love of nature with the desire to do something to make a difference, and it results in valuable contributions to professional scientific efforts.

Hannibal weaves these various components together smoothly and in an appealing way. She points out that crucial themes from *The Grapes of Wrath* continue to resonate today, from the perspective of land use and climate change to the consequences of human dissociation from the land, which leads to destruction of that land and then to the destruction of humanity itself. As the subtitle indicates, extinction is a recurring theme of her book. Disappearing species drive the urgency behind her calls for cooperation between nonscientists and scientists. She details the way citizen science efforts bridge academic and applied sciences and the growing validation by academic scientists of the value of data acquired by nonprofessionals. It is becoming more and more widely recognized that "citizen science monitoring … is probably the only tool that can really scale to aggregate big enough numbers of local observations to create a picture of global consequence" (p. 59).

A significant point Hannibal makes in support of citizen science is that it is a way to cultivate a scientifically oriented society—something that is desperately needed. Understanding the ability of species to change in response to climate conditions requires interdisciplinary scientists and huge networks of citizen scientists (p. 287). One of many scientists Hannibal interviewed, Julia Parrish, works with between 750 and 800 volunteers monitoring beaches from Northern California to Alaska. She comments,

> Scientists alone can't begin to document what's normal, let alone how fast things are changing. We need a willing army to make that happen. In short, we need citizens—the locals who watch, and know, and love their backyards, their environments. (p. 80)

The book includes some chapters that become overly long and seem to veer away from the chapter's theme. Some readers may find the recurring personal account of the author's experiencing the death of her father tiresome—but its link to the disappearance of species and the fragile nature of life is both relevant and sad. Any reader who is interested in the natural history of California would find *Citizen Science* intriguing. As well, academics who question the value of data acquired by nonprofessional scientists would be wise to read the perspectives of scientists that Hannibal presents in order to understand the significance of citizen scientists' contributions. This book would also be of great benefit to anyone who wants to know more about the burgeoning approach to "doing science" that citizen science has become.

Moreover, from a Christian reader's perspective, the biblical mandate for stewardship of God's invaluable creation supports the entire concept of citizen participation in the scientific effort splendidly. We who claim relationship with the Creator can joyfully support scrutiny of the creation; it yields not only data but opportunity to marvel.

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TECHNOLOGY

TEN ARGUMENTS FOR DELETING YOUR SOCIAL MEDIA ACCOUNTS RIGHT NOW by Jaron Lanier. New York: Henry Holt, 2018. 160 pages. Hardcover; $18.00. ISBN: 9781250196682.

As one who rarely uses social media, I found it easy to agree with Jaron Lanier. As stated in the title of the book, Lanier offers ten arguments as to why readers would be better off not using social media, particularly social media services provided by Facebook and Google.

A problem Lanier introduces early in his book is that social media automatically optimize for attention, and this usually means presenting negative information. This can come in the form of negative news feeds or encouraging negative, argumentative, and unhelpful discussions. This is not necessarily intentional from the makers of social media platforms; the process of automatically testing users with small random changes leads to promoting negative content in social media over positive content. The purpose of this automation is to make users available and susceptible to advertisers, who are the actual customers for social media companies. Additionally, users may unknowingly interact with automated users and consequently adopt the viewpoint selected by advertisers. Similarly, social media can initially be helpful with early adopters with impressive results, but it subsequently lends itself to trolls taking over after the human users have been sufficiently modeled.

As mentioned in his title, Lanier's proposed solution is to encourage widespread deletion of social media accounts. He specifies that it is not the social media platform itself that is the problem, but the application of current algorithms that ruin the platform. At the end of his eighth argument, he suggests the need for users to pay for social media platforms, own their

data, and set the price for using their data. Earning money on valuable data should be normal and easy for the user. The hope is to use and reward social media platforms that promote positive interactions, but he feels that this cannot happen with the current methods of the dominant players, particularly when advertisers are the customers. Consequently, mass deletion of social media accounts is the necessary next step.

Overall, Lanier's arguments are timely for users concerned with privacy, personal choice, and advertisers' influence over their minds and values. Each argument in the book is supported with references, although I would like to see more references to support his eighth argument (although this chapter relies on his previous work, and presumably on the research presented there, it does not stand on its own when compared to other chapters in the present book).

While not written from a Christian perspective, I find it easy to agree with a writer who places people over profits and machines. Lanier presents the costs of using such social media platforms, such as creating people who act less humanely, behave more troll-like, are sadder, and have less empathy for others. The benefits go to advertisers who pay to manipulate users for profit or political benefit. Additionally, Lanier presents arguments that long-term use of social media decreases the user's ability to recognize truth, since platforms remove the context of facts (except for podcasts at the moment).

Consequently, Lanier unwittingly provides an argument that aligns with the Bible's instructions in 2 Corinthians 10:5, where Paul tells his readers to take captive every thought. Similarly, I found that his arguments agree with Romans 12:2, where readers are instructed to renew their minds to test and approve of God's will. It seems that social media have been competing for the attention of our hearts and minds, with purposes at odds with biblical instruction.

Argument ten relates most directly to spirituality and religion, in that he states "SOCIAL MEDIA HATES YOUR SOUL." While not favorable toward religion, this argument highlights parallels between religion and social media. For example, Larnier argues that social media platforms erode users' free will and transfer decision-making power to companies; he compares this to how (he assumes) the church makes decisions for its constituents. Another example is how social media use group mentality thinking to encourage users to treat others badly, similar to how he sees religious conflicts engaging people more intensely. Larnier sees his suggestions to reject the current version of social media platforms, while not rejecting the core of social media, as similar to the Protestant Reformation during which Protestants rejected harmful practices such as indulgences. Larnier also sees social media as defining truth for its users by selecting the context for facts. He aligns this with the church defining truth within a religious framework, including a reference that some religious people still think the sun orbits the earth. Like religious frameworks, social media provide ultimate purposes for its users, although he mentions that they are poor choices for ultimate purposes, stating that the purposes of Google and Facebook are to organize information and give users a sense of purpose and community.

The part I appreciated from argument ten was the suggestion that people are using social media platforms in a spiritual and religious way. I hope this encourages readers to reflect on the use of such platforms in their lives, so that they can be empowered to use them as a tool, rather than the other way around. As for the church, argument ten observes that social media compete to define truth and purpose for people. This point is helpful as it stands, but the negative portrayal of religion and the church is not. While I realize that the church has issues to work on, it was grating that every issue of comparison presented religion in a negative light without acknowledging a valuable role for the church in society. One gets the impression that Lanier wants people to quit both their social media accounts and their church.

One could do without some of the colorful language used in parts of the book, but the language does not diminish Lanier's arguments. The book convincingly warns its readers of the destructive effects of social media on individuals and society. It is timely for both thought and action.

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EVERYBODY LIES: Big Data, New Data, and What the Internet Can Tell Us about Who We Really Are by Seth Stephens-Davidowitz. New York: Dey Street Books, 2018. 352 pages. Paperback; $16.99. ISBN: 9780062390868.

Everybody Lies, as the subtitle suggests, is Seth Stephens-Davidowitz's book about "Big Data" and what it tells us about ourselves. He is quite explicit that he is inspired by *Freakonomics* and hopes to apply its irreverent but quantitative approach to new kinds of data that have been enabled by the internet.

Stephens-Davidowitz is an economist; however, his choice of topics strikes me as being rather sociological. More important to his work are his data sources. Key sources include search strings in Google, search strings used at the website Pornhub, Facebook posts, tweets, word frequency counts from Google Ngrams, and more. Stephens-Davidowitz makes a good case that this sort of data, only recently available to the public, has been underused by researchers. However, while some of this avoidance stems from a lack of creativity, there are many statistical issues (such as self-selection, nonrandom groups) that make it hard to meet academic standards with these sources.

Much of the book looks at the search strings used to find things on the internet, and these provide a good example of the challenges of these new data types. The companies the author works with to obtain this data provide him the anonymized strings with some counts on how often it occurred and possibly certain background data such as geographic area or gender. However, the statistics about the search strings are less helpful if we cannot relate them back to a population that we understand. There is no guarantee that internet users are "representative" of the population.

Unlike survey questions, in which everyone gets the same questions and answers, everyone gets to type in their own search string. This leaves the researcher on her own to decide when two different strings are "equivalent" and thus should have their counts combined. Stephens-Davidowitz makes a good case that the same terms in a different order can make a difference in meaning. For example, looking at searches with the names of candidates for political office, say A and B, a search string with A first and then B shows a preference for A, whereas a search string with B first and then A shows a preference for B, possibly even an unconscious preference. Even if one accepts this case, how is one to generalize it? Does the order matter for two different competing products? Does the order of my grocery list matter? It might at first appear that we must accept any difference as significant, but that probably gives us too many different categories from which to draw conclusions. However, trying to combine multiple terms into one category gives us a problem with researcher bias. If nothing else, the researcher has to assume a particular understanding of what the user really means, even when it is expressed differently.

We have counts for the search strings, but this does not mean that the count represents unique users. For example, if one has a simple situation in which the search string is A or B, it is possible that five users do search A and one user does search B five times. Based on the count, A and B are equally likely, but if I care about the underlying population of users, a particular user is five times more likely to search for A then for B. The number of times someone makes the same search would seem to be associated with a particular user, not random. For instance, the address I am most likely to search for in google maps is my home address, as a starting or ending point.

Many of the topics that interest Stephens-Davidowitz are those in which people tend to avoid the truth; hence the book's title *Everybody Lies*, or at least they lie on surveys. The topics in the book include sex (quite a bit), race, cheating on taxes, and more. The difficulty with these topics is well enough known to have its own technical name: social desirability bias. This is a bias in which people answer questions in a manner that will be viewed favorably by others, a form of hypocrisy. As La Rochefoucauld said: "Hypocrisy is the homage which vice renders to virtue." While inconvenient for social scientists, this is an inevitable consequence of having a conscience—even if badly damaged—in a fallen world. People retain a sense of what is and what should be.

In an effort to work around the inaccuracies caused by this bias, the author looks for sources in which someone voluntarily discloses information, which, in his work, is often a search string. He may have found a way around the problem, but such remains unclear. When the user enters a search string, it is voluntary, and the string is one of their own choosing. It is unprompted by a survey, and it is anonymous. This appears to avoid social desirability bias; even so, there is no reason to think that we have avoided a self-selection problem. The very approach we use to avoid social desirability bias, that of a user voluntarily picking a search string, means that the user is self-selecting. The social sciences have long been concerned about self-selection and have been dubious of studies that fail to account for it.

Everybody Lies succeeds, in the spirit of *Freakonomics*, in telling some good stories that tie back to quantitative thinking. Stephens-Davidowitz shows creativity in finding information from new data sources. However, this often takes us into areas where we do not understand the data well. A common problem with his work is a desire to delve into areas involving social desirability bias, areas that people are reluctant to talk about. In trying to handle this, he almost certainly strays into the problems of self-selection, which makes his samples unrepresentative and, in turn, makes it difficult to draw valid conclusions. While *Everybody Lies* opens up vistas of new possibilities, its explanatory reliability is questionable.

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