destructive act, rather than the by-product of development of energy resources which has greatly increased the quality of life for many. There is no mention of much progress in environmental stewardship, for example, by closing coal-fired power plants, by lessening runoff of nutrients into water bodies, or by curbing industrial and vehicular air pollution. Nevertheless, the book's importance is confirmed by its parallels with the May 2015 encyclical of Pope Francis, *Laudato si' Care for Our Common Home*, http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html. This relatively brief encyclical has better advice than *Creation in Crisis* on practical actions to take to lessen the ecological crisis, but it has to summarize much, whereas Kureethadam provides a good resource for those wanting more details. ASA members need to pay attention to the message of this book, although its liberal and Roman Catholic theology will be an obstacle for some evangelicals.

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Ethics

COSMIC COMMONS: Spirit, Science, and Space by John Hart. Eugene, OR: Cascade, 2013. xi + 415 pages. Paperback; $40.00. ISBN: 9781610973182.

John Hart is professor of Christian ethics at Boston University's School of Theology (2004 to present). For two decades before, he was a professor, theology department chair, and founding director of the Environmental Studies Program at Carroll College, a Roman Catholic liberal arts college in Helena, Montana. Hart has three graduate degrees, including the PhD from Union Theological Seminary in New York City, and has worked as principal writer of various pastoral letters for the Midwestern Catholic, the Western US, and the Canadian Catholic bishops regional groups. In addition, he has participated in native spiritual leaders and human rights initiatives, which involved being a member of the delegation of the International Indian Treaty Council (an NGO) to the United Nations International Human Rights Commission, Geneva, Switzerland (1987, 1990), and as an invited observer at the World Conference of Indigenous Peoples, Rio de Janeiro, Brazil, which was connected with the UN Earth Summit (1992). Hart is widely published as an academic theologian, including four books prior to the one under review: *The Spirit of the Earth—A Theology of the Land* (Paulist Press, 1984); *Ethics and Technology: Innovation and Transformation in Community Contexts* (Pilgrim Press, 1997); *What Are They Saying about … Environmental Theology?* (Paulist Press, 2004); and *Sacramental Commons: Christian Ecological Ethics* (Rowman & Littlefield's Nature's Meaning Series, 2006).

These credentials need to be emphasized so that readers do not dismiss out of hand—as most academics and scientists have been instinctively trained to do—the thought experiment that is at the heart of *Cosmic Commons*: how might human beings prepare themselves for meeting and interacting with extraterrestrial intelligent (ETI) beings should they exist in the universe? Hart's pilgrimage to this topic began with formal training in social ethics, developed through engagements with environmental theologies, and has been honed over prolonged conversation with native, indigenous, and Amerindian conversation partners. Amid growing discussions of the need for humankind to attempt space travel, and perhaps even to colonize and inhabit other planetary environments, Hart is particularly concerned that we will be propelled by morally deficient and behaviorally destructive models of exploration and conquest such as those encoded in what scholars have called the "Discovery Doctrine." He argues that we should be guided by more recent ethically cogent and ecologically friendly guidelines such as those produced by the United Nations on Earth and outer space, rather than by a doctrine which facilitated European genocide in the Americas over the past five hundred years. Encounters with ETI premised on "Discovery" mentality and attitudes could be tragic, not only for alien creatures but surely for the human species, particularly if these "others" are more technologically advanced in their destructive capacities than we are.

There are four steps to Hart's thought-experiment, each (part) of which includes three chapters. *Terra Firma*, Part I, uncovers both the economic and political roots of Earth's socioecological crisis, the latter especially as unfolded in the history of the Americas, and overviews initial steps that humanity has taken toward restoration of the Earth's socioecological commons. Part 2, *Terra Conscientia*, follows through on the trajectory charted by deployment of "Discovery" commitments as applied to possible ETI "contact," retrieves voices, specifically from the Christian theological tradition, that are suggestive of alternative postures and convictions for considering the possibility of ETI, and outlines an overarching socio-eco-ethical framework for such "contact" between *Homo sapiens* and others. *Terra Incognita*, Part 3, presses forward into imaginative construals of "contact" along three lines: (1) theoretically through the filling out of Hart's proposed "cosmosocioecological praxis ethics"; (2) documentarily through analytical assessment of internationally developed and agreed upon space documents and principles developed in the last generation; and (3) historically through scholarly assessment of alleged prior encounters with ETI, including in Roswell, New Mexico, in 1947, and in the Hudson River Valley, New York region, in the early 1980s—topics taken up at greater length in Hart's companion *Encountering ETI: Aliens in* Avatar *and the Americas* (Cascade Books, 2014).

The final section of the book details Hart's normative proposals toward envisioning "cosmic coexistence" (on cosmic consciousness and cohesion), articulating a "cosmic charter" (on constructive consultation and consociation), and building a "cosmic commons" (on celestial cohabitation, conservation, and compassion).

Pascal's "wager" seems apropos at this juncture: even if there were no ETI elsewhere in the cosmos, Hart's work would be helpful at least for thinking about how our approach to outer space would be ethically responsible, environmentally sustainable, and theologically informed. But if we neglected such offerings, and "contact" were to occur, it would be confrontational rather than productive of commonality, and in that case, no second chance may exist for us to retrace our steps. Beyond such possibilities, however, I suggest that at least for religious persons and others who are uninclined to think that intelligent life is reducible to terrestriality or materiality, this volume invites consideration of how we might interact with creatures that "have a different form of existence," what some have called "Extra-Dimensional Intelligence" (pp. 286, 295). This would require perhaps another book, but the seeds reorienting human values toward such possibilities are sown here. Academics and theologically oriented readers can be assured that *Cosmic Commons* is well worth the investment of time (it is not a short book) and money (nor is it cheap, relatively speaking) since its "fictional" character builds concretely on what we know and seeks to anticipate, at least ethically, how we might further understand and better orient ourselves toward what otherwise "now we see in a mirror, dimly" (1 Cor. 13:12, NRVS).

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History of Science

DARWIN'S DICE: The Idea of CHANCE in the Thought of Charles Darwin by Curtis Johnson. New York: Oxford University Press, 2015. xxxii + 253 pages, endnotes with each chapter, appendix on primary sources, bibliography, index nominum. Hardcover; $31.95. ISBN: 9780199361410.

In the 1920s, quantum physicists proposed that indeterminacy was part of the nature of elementary particles. In 1953, James Watson and Francis Crick announced their discovery of the structure of the DNA molecule, thereby providing a mechanism that can account for mutations—the random modification of a single nucleotide. Following upon these discoveries, the phrase "we live in a chance-governed world" has today become cliché. Charles Darwin knew none of this and yet chance variation was a critical factor in his theory of evolution. Thus Darwin is often linked to the chance-governed-world notion. So what did Darwin actually understand by "chance"?

Darwin was a nineteenth-century scientist who shared the Enlightenment perspective that the natural world was governed by deterministic laws; "chance" for Darwin was shorthand for "cause unknown." Nevertheless, Darwin viewed chance events as gratuitous and "accidental." Darwin reconciled this apparent inconsistency by defining "chance" as meaning that variations among offspring were independent of the adaptive needs or opportunities of species; this is the definition of "chance" that distinguishes the way randomness is used in biology today from other sciences. That is, variations could be deterministically produced by unknown causes acting according to unknown laws but still be gratuitous from the perspective of the species' needs.

However, "chance" for Darwin also had other aspects—sometimes Darwin used "chance" in the sense of probability—what is the chance that a particular offspring will survive? He also used it in a deeper sense. "Cause unknown" at times conveyed the additional meaning of "cause unknowable." That is, he saw many chance variations as unknowable because they were not guided by a directing rational agency; he came to this conclusion because

> there seems to me too much misery in the world … I am inclined to look at everything as resulting from designed laws, with the details, whether good or bad, left to the working out of what we may call chance. (p. xviii)

This was the heart of the problem with Darwin's theory for his contemporaries; no one could object to "unknown causes"; however, causes that were not designed and irrational posed a serious obstacle. Nevertheless, while these concepts are clearly presented, this book could have benefitted from a more systematic analysis of Darwin's concept of chance. While Johnson attempts this in the first chapter, new meanings and nuances on meanings pop up in subsequent chapters making it difficult to nail down exactly what chance meant to Darwin.

Darwin's Dice is not a book about Darwinism. It is a book about Darwin's views of chance. However, Johnson does briefly discuss Darwinism; in particular, he suggests that for Darwin, the most important feature of his theory was not natural selection but variation among offspring. Without variation, natural selection would not have alternatives to select among. Darwin thought a lot about the causes of variation—he pioneered the study—but he never succeeded in discovering them. This is not surprising given that Mendel's work on