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).

Reviewed by Amos Yong, Professor of Theology & Mission, Fuller Theological Seminary, Pasadena, CA 91182.



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-governedworld 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

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inheritance and the concepts of the DNA molecule and mutations were unavailable to him. He believed that the causes were real, deterministic forces. He accepted the Lamarckian idea of use-inheritance and the notion that external circumstances could exert influence on the reproductive organs; however, later in his career, he came to believe that the nature of the organism was a more significant cause of variation than the nature of the conditions surrounding the organism. That is, he moved closer to the contemporary idea of random variations acted upon by natural selection.

Johnson forcefully argues that Darwin's understanding of the role of chance in his theory of evolution never changed. However, Darwin's ways of expressing this role changed enormously. By the sixth edition of the The Origin of Species, the word "chance" had almost dropped out of the book. This theme is Johnson's main focus and he spends four of his ten chapters on it, tracing a path that began with the word "chance" and ended with the phrase "spontaneous variation," using a number of other terms along the way. This evolution of terminology was Darwin's way of responding to criticism and making his theory more palatable to his contemporaries without changing the theory. Johnson also discusses two major examples Darwin used to communicate his theory. The first illustrates how order can arise from chance: an architect picks up random pieces of stone that have fallen from a precipice and fashions them into a beautiful building. The architect in Darwin's metaphor is not an intelligent designer but laws of nature. The second example is giraffes, used by some of his critics to argue for use-inheritance. Darwin did not dismiss use-inheritance but used this example to argue that chance variation plus natural selection were more important.

Johnson addresses Darwin's religious views at several points; however, from my point of view, he is too heavy-handed in revealing his preference for atheism and applauding Darwin whenever he seems to move closer to it. Darwin saw no role for an active God in nature; early in his career, he wrote that he saw no problems with the deistic notion that God had created the laws that governed nature. Later in his career he doubted this perspective, although he never embraced atheism in his public or private writings. An 1860 letter to Asa Gray articulates his ambiguity:

I see a bird which I want for food, take my gun and kill it, I do this *designedly*. — An innocent & good man stands under a tree and is killed by a flash of lightning. Do you believe … that God *designedly* killed that man? Many or most persons do believe this; I can't and don't. If you believe so, do you believe that when a swallow snaps up a gnat that God designed that that particular sparrow shd. [sic] snap up that particular gnat at that particular instant? I believe that the man and the gnat are in the same predicament. If the death of neither man nor gnat are designed, I see no reason to believe that the *first* birth or production should be necessarily designed. Yet I cannot persuade myself that electricity acts, that the tree grows, that man aspires to the loftiest conceptions all from blind, brute force. (p. xix)

Darwin never settled his uncertainty about God. He also never wavered in his faithfulness to Enlightenment science, but, as far as we can tell, he never could bring himself to fully embrace materialism.

The book concludes with two chapters exploring some of Darwin's philosophical reflections. One examines Darwin's denial of the existence of human free will on grounds that the world is governed by deterministic laws; in this sense, he regarded free will and chance as the same. The other discusses Darwin's view of human morality in light of his denial of free will. In brief, Darwin argued that humans make moral choices based on seeking pleasure; he also believed in an inborn moral sense that made certain states of affairs more pleasurable than others.

I would recommend this book but only to a somewhat specialized audience—readers who want to look carefully into this aspect of Darwin's thought, scholars who want to explore how biology acquired its unique definition of randomness, and anyone interested in exploring the way contemporary culture understands chance.

Reviewed by James Bradley, Professor Emeritus of Mathematics, Calvin College, Grand Rapids, MI 49546.



HUMAN EVOLUTION: Genes, Genealogies and Phylogenies by Graeme Finlay. New York: Cambridge University Press, 2013. 359 pages. Hardcover; \$79.99. ISBN: 9781107040120.

Human Evolution is an interesting read that will appeal to a broad scientific audience and anyone interested in evolutionary biology. The author's purpose is to persuade the reader that humans and primates (namely chimps) diverged from a common ancestor. In the prologue, the author makes it clear that his intent is not to dance between genetic evidence and theology to explain human origins, but simply to relay scientific facts. He proceeds to do so by presenting the reader with various examples of genetic mechanisms and accompanying diagrams. True to his word, there is no mention of God, a creator, or any reflection on Christian beliefs or principles in these examples.

The book is arranged into four sections, each section a collection of a distinct type of genetic evidence in