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.

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Origins

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

support of our common ancestry with primates. The discussion shifts from the study of retroviruses to transposons (genes that actually "copy and paste" or "cut and paste" themselves throughout the genome) to pseudogenes (genes that do not code for functional protein), to the phenomenon of gene formation. The author keenly describes these various pieces of evidence as "very compelling." Christian or not, the supposed evolution of humans from a common primate ancestor has received attention for years, but only relatively recently have we had the necessary tools to investigate questions regarding the human and nonhuman primate genomes.

The similarity of the human genome to the chimp genome is reported to be anywhere from 96–99%. The author capitalizes on this similarity and not only provides the reader with details in support of this point, but also attempts to convince us that this likeness is the result of a common evolutionary lineage. He believes that the most convincing piece of information in support of this argument lies within the shared mutated regions of the chimp and human genomes. Mutations can exist in many forms: a change in a single building block of DNA, the insertion of a stretch of DNA into a gene, or even the deletion of part of a gene, to name a few. The basis for the author's argument that humans share a common ancestor with primates goes something like this: humans share genes with other mammalian species. Some of these shared genes are functional in certain species, but nonfunctional in others. For a species with a nonfunctional copy, a mutation must have occurred within the gene at some point, rendering it nonfunctional. When two species share the same mutation within the same gene, it is then believed that the species diverged from a common ancestor.

While I understand that the aim of this book was not to relate genetic evidence to the biblical account of creation, the book almost seemed incomplete without some mention of how all of this genetic evidence might coexist with faith. The closest that the author gets to this is in the epilogue, where he acknowledges that although humans and primates are similar genetically, many differences in cognition, intelligence, and spirituality separate us as species.

An additional critique is that the author's argument seemed to ignore the potential for new technologies to lead us to conclusions that challenge present understanding. For instance, the analysis of high-throughput genomic data is a relatively new area of science. As much faith as I place in the potential power of genomic data, I am equally aware of the assumptions, caveats, and potential errors that accompany such analyses. Unfortunately, the author fails to draw attention to this. He mentions that sophisticated algorithms and statistical analyses are performed to conduct the types of phylogenetic analyses that he spotlights, but he does not inform the reader of the potential biases or assumptions that accompany them. Numerous methods and software packages exist to sequence DNA, call genetic variants, and align DNA to a reference genome—each method with its associated error rates and inconsistencies. In fact, there is still much debate within the genetics, bioinformatics, and statistics communities regarding which software and methods are best for analyzing these data. This is a clear indication that there is still much to learn in this field of study. I was both surprised and a little disappointed that the author did not acknowledge these potential problems and shortcomings.

Lastly, I also think it important for the author to mention the *differences* between the human and chimp genomes. For example, what about the striking dissimilarity of the human Y chromosome to that of the chimp Y chromosome?

Human Evolution is a good read for anyone interested in phylogenetics, molecular genetics, or evolutionary biology, but will disappoint those looking for a theological perspective or discussion.

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Philosophy & Theology

CREATOR GOD, EVOLVING WORLD by Cynthia Crysdale and Neil Ormerod. Minneapolis, MN: Fortress Press, 2013. 168 pages. Paperback; $18.00. ISBN: 9780800698775.

Crysdale and Ormerod have written an excellent and accessible book for "those in the middle" of the culture wars on the issue of evolution and Christian faith. They argue that science and faith are complementary pursuits and do so assisted by the groundbreaking methodology of the late Jesuit philosopher and theologian Bernard Lonergan.

First, the authors furnish a brief overview of the emergence of modern science and the legacy of the problem of God's relation to nature bequeathed to us by the interaction of Newton and Laplace. Newton's system was deterministic, but it required "intermittent divine interventions" (p. 5) to keep things running smoothly. The central theological question here is, "Is God not only a primary cause but also a secondary cause, intervening occasionally to ensure God's order in the universe?" (p. 5). Newton's invocation of God as a secondary cause maintaining the solar system's stability, with Laplace's famous retort, has set the mold for the unfortunate "God of the gaps" pattern that science and faith have pursued for hundreds of years. Newton's