

Book Reviews

the point where we can move to 100% renewables. Issues of mining are mentioned as disadvantages of renewables, but renewables' dirty secret of toxic manufacturing and the tonnes of ensuing e-waste that will be upon us in a few decades is not mentioned. The problems of nuclear seem fewer and fewer when the big picture is considered. I would have liked to see more discussion of carbon capture, utilization, and sequestration (CCUS) technologies as a way forward. CCUS will allow the continued use of carbon at some level, but eventually will pave the way to a zero net carbon use. CCUS is going to be necessary to undo some of the damage that has already been done; namely, we must not only reduce carbon emissions, but we must also remove some of the carbon already in the atmosphere. And lastly, I think some mention of geo-engineering as a possible way forward would have been helpful.

One technical error worth mentioning is in chapter 2, where it is stated that the average person's carbon footprint globally is 4 tonnes per person. Of course, these numbers are hard to nail down, but with estimates of greenhouse gas levels at 50–55 Gigatonnes of CO₂ equivalents and 7.4 billion people on the planet, you get 6–7 tonnes per person. This makes the US footprint only three times the global average not four (still a disturbingly disproportionate amount).

While Favaro says there is still time to take care of climate change if we act soon, his general message was too apocalyptic for me. I am not sure that falling sky arguments are the best way to motivate the target audience to action. One memorable line from chapter 8 still rings in my head. "We need to be unafraid to react with disgust when someone denies climate change." Such language conveys his passion about the issue. It does little, I think, to move the conversation (and action) forward in a productive way.

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HISTORY OF SCIENCE

THE GENE: An Intimate History by Siddhartha Mukherjee. New York: Scribner, 2016. xi + 592 pages, including glossary, notes, selected bibliography, and index. Hardcover; \$32.00. ISBN: 9781476733500.

By now most enthusiasts of science history have at least heard of Siddhartha Mukherjee, whose initial venture into authorship, *The Emperor of All Maladies*, earned him the 2011 Pulitzer Prize for general non-fiction. While in his residency training in oncology, Mukherjee wrote his so-called "biography of cancer" with a voice of authenticity that only seems possible

for someone who is personally immersed in the story he is telling. But as Mukherjee himself admits, the exhausting experience of composing such a vast and personal story seemed to rule out the possibility that he would write another book on the history of scientific discovery. Thankfully, this turned out not to be the case.

Now a practicing oncologist and assistant professor at Columbia University Medical Center, Mukherjee has recently tackled another topic close to his heart, the development of modern genetics. Many of the best aspects of Mukherjee's second book, *The Gene: An Intimate History* (2016), reflect qualities that made his initial work an international best seller. Mukherjee excels at relaying fine detail without losing the broader context of his narrative, masterfully weaving his explanation of complex scientific concepts together with the stories of the people involved in their discovery. As one might expect, prominent figures such as James Watson and Francis Crick feature in this book, but so also do less famous individuals such as Theodosius Dobzhansky, who also contributed key pieces to the puzzle of modern genetics. One cannot separate the history of science from the actors that achieved the discovery, and in this respect the "biography of the gene" that we have today is inseparably connected to the idiosyncrasies of those who studied it over the past two centuries.

This is not to say, however, that Mukherjee's story is simply a celebration of human achievement through the power of science. *The Gene* is punctuated with frequent examples of scientific achievement placed side-by-side with miserable human failure, particularly when the emerging science of genetics was used as a tool to understand—or even engineer—society at large. Mukherjee carefully and honestly acknowledges the incredible evil that emerged alongside genetic science during the twentieth century, linking racism, Nazism, and the eugenics movement to errant interpretations of legitimate scientific discovery.¹ Human depravity is writ large in the history of genetic discovery, serving as a caution to those who want to see only this field as the panacea for humanity's ills.

In between the triumph of scientific discovery and the disaster of social engineering lies a significantly grayer area in which genetics intersects with behavioral psychology. Here the going gets a bit tougher—and more subjective—as the comfortable certainty of Mendelian genetics is blurred by the influence of environmental factors that are much more difficult to quantify. Mukherjee is especially engaging in this context and does not shy away from some of the more controversial aspects of genetics,

including those that touch on gender, gender identity and sexuality.² While readers may differ—even significantly—with Mukherjee’s essentially secular worldview regarding these issues, he remains well balanced and apolitical in his approach to interpreting the role of genetics in complex social behaviors. Absent from the book is any suggestion that the role of biology in behavior allows for abdication of human responsibility regarding the choices we make.

This is a tenuous balance to strike. How is it that we are bound to our genetics, but at the same time responsible for the outcomes in our lives? Mukherjee’s unique answer to this paradox is perhaps the most insightful of his comments regarding the connection between heredity and complex social behavior. Rather than using the somewhat worn-out nature/nurture dichotomy, Mukherjee instead turns to mathematics for an appropriate analogy to explain how genes contribute to who we are or might become. Our inherited genetic makeup, he suggests, is very much like “the first derivative of a point [which] is not its position in space, but its propensity to change its position” (p. 355). Or to put it more succinctly, our genes are directive, not determinative. While our heredity may indeed limit the scope of possible outcomes, both experience and environment—not to mention a stiff dose of providential serendipity—play equally important roles in who we become.

Our understanding of precisely how our inherited genetic composition interacts with the experiences and environment that flavor our life is still in its infancy. Mukherjee touches on these issues throughout the latter third of his book, providing a few prime examples of how our experiences in the world can alter the effect of our genes in ways that early geneticists would never have imagined.³ This field of study, known as epigenetics, offers at least a partial insight into the remarkable flexibility and adaptability of our genome. Mukherjee states this elegantly:

It is a testament to the unsettling beauty of the genome that it can make the real world “stick.” Our genes do not keep spitting out stereotypical responses to idiosyncratic environments: if they did, we too would devolve into windup automatons. (p. 390)

And this conclusion that we are not merely products of our genes offers some degree of hope for individuals who fear their own inheritance. This is certainly the case for Mukherjee, as clarified by the medical history of his own family interposed within the narrative of scientific discovery in *The Gene*. Each section of the book begins with a brief glimpse into the story of mental illness that has plagued his family for two generations, culminating in the lives of two of his

paternal uncles who struggled with schizophrenia. Mukherjee’s personal grief and anxiety regarding the genetic blight on his family is what makes *The Gene* truly “an intimate history” for him. The biography of the gene is his story—and our story.

Notes

¹See especially, the foresight of Bateson, 63; Francis Galton, *Pride & Davenport*, 120; rise of Nazism and its “applied biology” approach to genetics, 119–32.

²See especially, gender determination, 355–69; research on the “gay gene,” 371–79.

³See especially, effects of the Dutch Hongerwinter, 392–413; cellular reprogramming, 404–7.

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PHILOSOPHY

NEUROEXISTENTIALISM: Meaning, Morals, & Purpose in the Age of Neuroscience by Gregg D. Caruso and Owen Flanagan, eds. New York: Oxford University Press, 2018. xviii + 372 pages. Paperback; \$35.00. ISBN: 9780190460730.

Is humankind no more than a “victim of neuronal circumstances,” “just a pack of neurons”? In other words, is humankind naïve in denying epiphenomenalism, the notion that all mental processes can be reduced without remainder to brain-biology? Is existentialism’s “self,” a self-making born of radical commitment with its inescapable risk, finally no self at all, and the anguish pertaining to such risk no more than a neurological twitch? Is the freedom essential to existentialism (the capacity for choice that issues in self-determination) as indefensible—and ridiculous—as a denial of the law of gravity? Despite the prevalence and force of assorted determinisms that bear upon the human, has neuroscience eliminated that self-determination apart from which human agency disappears, guilt is impossible, and the criminal justice system replaced by a social engineering that reprograms those heretofore deemed deviant?

In its exploration of and, for the most part, affinities with the above, the book identifies three kinds of existentialism. In two or three sentences it speaks of first-wave existentialism, found in Kierkegaard, Dostoevsky, and Nietzsche and probing human selfhood in light of God (or, in the case of Nietzsche, of God’s absence). Again, briefly, second-wave existentialism, represented by Sartre, Camus, and de Beauvoir, is said to be a post-Holocaust attempt at creating a human authenticity (contrasted with the inauthenticity of Sartre’s “bad faith” or Heidegger’s “the herd” or even Nietzsche’s “the they”) with