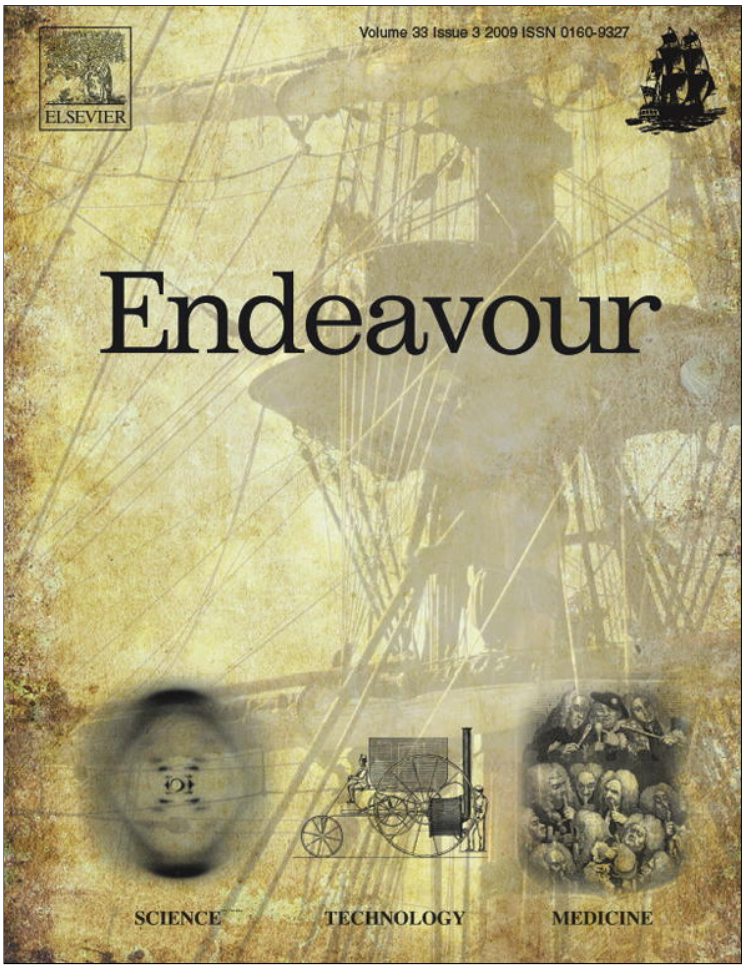

social works through the individual', can change how we think about the history of science. Instead of wondering how far a given theory or individual may be reduced to a bundle of social or cultural influences, it becomes more pressing to explore the motivations connecting action in apparently disparate, even fragmented, domains of experience.

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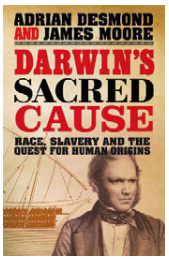
Book review

Charles Darwin's real torment

Darwin's Sacred Cause. Race, Slavery and the Quest for Human Origins by A. Desmond and J. Moore, Penguin, 2009. 512 pp., £25, ISBN 9781846140358

Marga Vicedo*

Institute for the History and Philosophy of Science and Technology, 91 Charles St. West, University of Toronto, Toronto, ON, M5S 1K7 Canada



"Light will be thrown on the origin of man and his history," asserted Charles Darwin in his 1859 book *On the Origin of Species*. Although the postulation of a common origin for all life had to include humans, Darwin avoided the subject of human evolution until his 1871 *The Descent of Man and Selection in Relation to Sex*. Here, Darwin's combination of man and sex confounded readers. For many scholars, Darwin simply put two books together, one on human races, the other on sexual selection. In general, Darwin's writings on humans have always been a bit of a conundrum. But now, Adrian Desmond and James Moore tell us that to understand the omission of humans from *The Origin*, his delay in publishing on humans, and the puzzling structure and contents of *The Descent*, we need to see the end in the beginning. According to Desmond and Moore, throughout his life Darwin's main drive was to prove the common origin of all human races. This "sacred cause" led him to pursue his views about a common origin for all life obsessively, and to publish in specific ways about natural selection, sexual selection and human evolution. Rather than seeing those as three separate categories, we need to see them as deeply intertwined with each other in Darwin's life and work. His goal in the three areas was to explain variation, and to show the common origin of the incredible diversity present among all life forms. But the drive fueling his unrelenting pursuit of evidence in studies of a variety of organisms, including pigeons, barnacles, finches, and sea spores, was not Darwin's curiosity about the natural world or his dogged empiricism, but his abhorrence of slavery.

Desmond and Moore, who have proven their craft in previous volumes about Darwin and other major figures and issues in Victorian science, pursue a major puzzle, mine their sources exhaustively, look for clues beyond the lighted corners, and present their case in a spellbinding narrative. This is good history, and a very good detective story. We have first a mystery: *The Descent*. We have a perpetrator: Darwin. The deed and the author are public. To find a motive, they dig deeper among the author's private passions. Once discovered, that answer not only solves the major puzzle, but it also helps us to understand the perpetrator's ideas and actions.

Desmond's and Moore's account places several key issues in a new light. It first recasts the significance of Darwin's experiences while a young fellow. Rather than seeing his early years as a barren period, Darwin's encounter with phrenology at Edinburgh and with a religious based opposition to slavery during this Cambridge years are now key elements in his formation. We recognize the full impact of his family's influence since Darwin's grandfathers, Erasmus Darwin and Josiah Wedgwood, and Darwin's sisters supported the abolitionist movement. Desmond and Moore's account also recasts the significance of events during Darwin's voyage aboard the *Beagle*. What left the deepest mark on Darwin was not the Galapagos, but Brazil and Tierra del Fuego; not the finches, but the screams of tortured slaves. We also appreciate the drama of Darwin's relations with both friends and foes, from his displeasure with Charles Lyell's complacent attitude towards American plantation owners to his disagreement with Louis Agassiz's views about the separate creation of the human races. Their book also explains the strange way Darwin finally presented his views on human evolution. In their view, *The Descent* is not about race *and* sex. There are not two texts, but one focusing on how sexual selection can explain the existent variation among races descended from a common ancestry. All in all, Desmond and Morris give us a new Darwin. Their book portrays him as a man consumed not by biological puzzles but moral passions, a man who confronted the evil of evils of his time through what he saw as the strongest weapon: science.

Desmond and Moore make an irrefutable case for paying more attention to passions and moral passions within the history of science. In the case of Darwin, this does not mean

*Tel.: +1 416 978 1500; fax: +1 416 978 3003.
Vicedo, M. (marga.vicedo@utoronto.ca).
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that the case is closed and we need investigate no further. Scholars will find much to debate. Primarily, they will want to clarify the precise influence of Darwin's sacred cause on his science. After this book, we cannot doubt that Darwin's views on slavery and evolution evolved in the context of the saga of the Anglo-American abolition movement. But how much the moral passion drove the man and his science will still be up for passionate debate.

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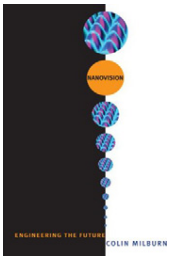
Book review

Science fiction transforming reality

Nanovision: Engineering the Future by C. Milburn, Duke University Press, 2008. 296 pp., £17.99 ISBN 978-0822342656

Christine Wenc*



Nanovision is an analysis of the connections between science fiction and nanotechnology and the implications of those connections. Weaving together semiotics, deconstruction, history of science, and something approaching prophecy, Colin Milburn writes that 'nanovision', the term he coins to mean the fundamental alteration in perceptual consciousness that thinking and doing nanotechnology both requires and generates, has the potential to utterly redefine how we understand and interpret the world.

One nanometer is one billionth of a meter; a strand of human hair is about 75,000 nm across. Nanotechnology is usually defined as research and engineering done on the 1–100 nm range; matter is manipulated on the atomic scale, and nanoparticles of a substance can have characteristics that are quite different from the same substance on a larger scale. Because the old rules no longer apply, working with nanotechnology requires a speculative approach. The most common speculation by industry is that nanotechnology will revolutionize how we invent and manufacture everything, from houses to pharmaceuticals. Milburn shows that this speculation extends to how we define reality.

Using examples from short stories to the *Terminator* movies, Milburn demonstrates the myriad ways in which nanotechnology and science fiction have been historically interconnected and how science fiction might provide a vocabulary suitable to a new nano reality. Some SF is simply description of how nanomaterials and machines might be created and used, and a particularly compelling example is Milburn's analysis of Richard Feynman's 1959 speech at the California Institute of Technology, 'There's Plenty of Room at the Bottom,' usually cited as the moment 'real' nanotechnology was conceived. But Milburn makes it clear that Feynman could have easily gotten many of his ideas from science fiction available at the time, and makes a specific case for the influence of Robert Heinlein's novel *Waldo*, which Feynman apparently read shortly before giving the talk.

Science fiction also contains many ruminations on the horror (or promise) of 'gray goo', the theoretical result of uncontrolled nanobot self-replication which eventually converts the entire world into an undifferentiated molecular soup. Milburn postulates that even imagining this undifferentiation can result in the breakdown of all kinds of categories, and much of Milburn's book is devoted to showing how nanovision 'ultimately undermines humanism and its two sexes,' primarily in his chapter on 'The Horrors of Goo.' Milburn amply demonstrates the supposed terror with which man has greeted the possibility of undifferentiation and the resulting loss of objective boundaries, binary modes of analysis and singular truths. The goo is defined as the female, naturally, but Milburn takes an unexpected turn and suggests that overcoming this fear requires becoming intimate with the goo rather than fighting it. Making love to the nanoparticles, which is apparently how some scientists actually experience their work, is both a way to move to a deeper level of understanding as well as simply the best way to 'do' nanotechnology. We might call this Tantric Science.

Though the subject is quite compelling, and Milburn shows that the connection between science fiction and nanotech is incontrovertible, his writing style will unfortunately put off many readers who do not have experience with semiotics or do not have the stamina for sentences like this one, on the scanning tunneling microscope that 'allows nanovision to take place': 'This tropological conditioning of the instrument and its operation constitutes what I would call its *tropic protocol*: the diagrammatic and symbolic dimension underwriting and orienting the signifying operations of probe microscopy, the tropical horizon toward which these processes veer and against which they turn, the semiotic algorithm that sets out in advance an available vocabulary and an available phenomenology for the dynamic interaction of a human user with the instrument.' This leads to an interesting discussion of the 'manifest destiny' nanoscientists experience when they use the microscope; the way in which the microscope in some sense predetermines, by the phenomenological premises involved in its design, its later use and interpretation; and the way its use can also end up destabilizing the idea of control. Yet the way these interesting ideas are expressed greatly limits their ability to be communicated. Lay readers will likely find *Nanovision*

*Tel.: +1 617 325 1893; fax: +1 617 325 1893.
Wenc, C. (christine_wenc@post.harvard.edu)
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