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Michael Ruse: *The Gaia Hypothesis: Science on a Pagan Planet*. Chicago: University of Chicago Press, 2013, 265 pp., ISBN 9780226731704 (hdbk) \$26.00 £18.00

Many analysts have been puzzled about the meaning of the Gaia hypothesis. While over the past decades several scientific conferences have been organised which made reference to “the Gaia hypothesis”, it has long been clear that there is no agreement on its contents. Should one focus on its teleological version, which states that the biosphere maintains homeostasis of its environment “by and for itself” (in some sense)? Or on the even stronger optimising version, which specifies in addition that the environment is manipulated to be optimal for the biota? Both versions of the Gaia hypothesis are difficult to engage with for scientists, however, since they are not *scientific* hypotheses: they are of a metaphysical character.

Alternatively, instead of focusing on these metaphysical versions, one could focus on the homeostatic version without teleology, which maintains that the biota influence the environment in a way that causes a homeostasis in the face of a changing external forcing (e.g., keeping a planet’s temperature relatively constant under significantly increasing solar forcing, typically over geological timescales of hundreds of millions to billions of years). Testing such a hypothesis is not a straightforward matter, but at least it is a version of the Gaia hypothesis that is scientifically interesting. It is more interesting at least than weaker versions of the Gaia hypothesis, which merely describe the well-established fact in Earth system science that the biota and the abiotic world are strongly coupled.

In *The Gaia Hypothesis* by the acclaimed philosopher of science Michael Ruse, the genesis, evolution and reception of the Gaia hypothesis as it was put forward, defended and refined by the inventor and independent scientist James Lovelock and his co-worker in the 1970s, the biologist Lynn Margulis (who later became famous for her work on symbiosis), is carefully documented. Ruse shows that while Lovelock and his supporters have consistently tried to accommodate scientific criticism of the Gaia hypothesis by seemingly getting rid of the metaphysical versions, the attractiveness of the Gaia hypothesis for the general public remained precisely what Lovelock exclaimed to Ruse when he spoke about the Earth as Gaia in his interview in 2011: “It is most certainly an organism—and alive!” (p. 224).

Within scientific circles, “over the years Lovelock and his supporters had striven to cleanse Gaia of its crudest teleological excesses and other offensive features” (p. 217). But, as Ruse interestingly argues, even while the Gaia hypothesis (not the metaphysical versions) had by the end of the twentieth century achieved some degree of scientific acceptance, there were also external reasons why ‘critics no longer felt the need to cry “pseudoscience”’ (pp. 217–218). In particular “the

status of evolutionary biology was much more secure than it had been twenty years previously" (p. 218).

One of the added values that we had Ruse write this definitive history of the Gaia hypothesis is that he is so well versed in the history and philosophy of evolutionary biology and in the history of ideas. He is therefore able to offer, in the middle of his book (after a chapter on Plato, Platonism and *Naturphilosophie*), three rich chapters on "mechanism" (focusing on the reductive nature of evolutionary biology and its precursors in philosophy of nature), "organicism" (highlighting the holistic nature of much ecology) and "hylozoism" (turning to some recent thinkers who have accepted that the world is living) that help resolve the paradox that plays a central role in Ruse's story: in the 1970s and 1980s there were simultaneous but opposite reactions to the Gaia hypothesis in science and among the general public: biologists reacted very negatively while there was an enthusiastic reception by the general public, especially in America.

In the early 1980s, as Ruse indicates, "[e]volutionary biologists were tearing themselves apart" (p. 210) and were also under attack from outside (partly a broad public reaction to the "selfish gene" metaphor but also, more narrowly, a different attack from conservative evangelical Christians calling themselves "creationists"). "So when Gaia came bumbling in, it was seen as not just wrong but radically upsetting" (p. 213). The Gaia hypothesis was wrong because among other things it ignored the individual-group barrier and it used teleological language. And it was upsetting since "[a]bove all, it was associated with social and religious beliefs that were anathema to all evolutionists" (p. 214).

As Ruse shows, these beliefs relate to hylozoism, "a tradition of thinking about the world and its environment that was especially strong in America, going back to the transcendentalists" (p. 198). American transcendentalism is a philosophy that was popular at the end of the 19th century and is described in Ruse's chapter on "organicism". Ruse does qualify the "generality" of the public that was enthusiast about the Gaia hypothesis. While "we should not assume that only people of the more extreme left or radical movements would welcome it . . . the Gaia hypothesis obviously did and still does on balance appeal more to those challenging conventional norms" (p. 200).

This book is original, well researched (it also has a basis in interviews with all main protagonists), timely (the hypothesis seems to have run out of steam) and well written. Ruse's analysis is even-handed. His final assessment is that "[f]ailure as science is balanced by success as philosophy. . . . Lovelock and Margulis were big people with a big vision. Whether science likes it or not, the vision lives on" (p. 223). In short, *The Gaia Hypothesis* is highly recommended reading.

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