# WHY GAIA?

*The Gaia Hypothesis: Science on a Pagan Planet*, Michael Ruse, Chicago: University of Chicago Press, 2013. 272 pages.

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"*The Gaia Hypothesis: Science on a Pagan Planet* tells a story that comes out of the 1960s, a story that reflects all of the beliefs and enthusiasms and tensions of that decade." So begins Michael Ruse's fascinating, if at times puzzling, exploration of James Lovelock's famous idea that our planet is, in a serious scientific sense, a living organism with a tendency of taking care of (her)self. But why tell this particular story, especially considering that Gaia hardly makes an appearance in today's scientific or philosophical publications, and doesn't even seem quite that popular with the lay public as it used to be? Because, as Ruse tells us near the end of the book, at the onset of chapter seven: "the paradox that set us on our path [is] why the scientific community reacted so negatively to the Gaia hypothesis, whereas the public reaction was so positive."

As it turns out, there is a good answer to that conundrum, one that Ruse himself lays out clearly in the last chapter of the book, and which makes the reader wonder why this should count a paradox at all. But we will get there in due time. First, the basics: the so-called Gaia hypothesis is the brainchild of iconoclastic inventor-turned-independent-scientist James Lovelock, who later got significant help in elaborating (and promoting) his ideas from another iconoclast, biologist Lynn Margulis. By the time you get to the end of Ruse's engaging book, however, you won't have gained a particularly good understanding of what the hypothesis actually consists. But that's not Ruse's fault, it is Lovelock's (and Margulis'). At times it sounds like the entirely uncontroversial claim that the Earth's

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biosphere is a somewhat homeostatic system—i.e., a biophysical system that is resistant to major changes, at the least within a certain range (the planet's atmosphere, after all, did change dramatically early on, increasing its oxygen content as a result of the evolution of photosynthetic organisms—the anaerobic life forms that had up to that point been dominant did not appreciate the novelty). At other times the claim is downright preposterous: the Earth literally *is* a living organism (according to Lovelock) (Chapter 7),[1] a finding that allegedly puts in question the whole Darwinian view of biological evolution (according to Margulis) (Chapter 7), a position that can only be characterized as nonsense on stilts. At yet other moments, Gaia is presented as just a metaphor to help us wrap our minds around the complexities (and homeostatic properties) of the world's ecosystems (Chapter 8). It is this never-ending oscillation between the trivial and the bizarre that has led the majority of scientists to write off Gaia, to the chagrin of Lovelock, Margulis, and a large number of New Age tree huggers from the 1960s.

Indeed, the scientific reaction to Gaia was swift and ranging from the condescending to the unforgiving. Evolutionary biologist John Maynard Smith—never one to mince words—called it "an evil religion" (Chapter 2). Another evolutionary biologist, Stephen Jay Gould (whose own disagreements with Maynard Smith became legendary) said that "Gaia strikes me as a metaphor, not a mechanism" (Chapter 2). Ecologist Robert May, who eventually became president of the Royal Society, called Lovelock "a holy fool" (Chapter 2). The highly respected theoretical biologist W.D. Hamilton said that in order for the hypothesis to work, it would require "treaties between Neptune and Zeus, a Gaian Interpol, conventions about bills of lading for chemical transport by air and water, and so on" (Chapter 7). Finally, Richard Dawkins accused Lovelock of committing the fallacy of "the BBC theorem," assuming (or wishfully thinking) that the world is a harmonious place, just like in naive BBC nature documentaries (Chapter 2).

You get the gist: pretty much from the beginning, and with very few exceptions, the scientific establishment rejected Gaia on the grounds that it is not a scientific hypothesis at all, and that its main tenets actually go against pretty much all we know about biology and evolution. Take, for instance, the basic Gaian idea that Earth is an "organism." Although biologists do recognize a large variety of objects to which the label may be applied—from the straightforward example of individual vertebrates such

as ourselves to the so-called "super-organisms" that are the colonies of eusocial insects—it is hard to see in what sense a planet may be considered a legitimate instantiation of the concept. Organisms, without exceptions, come in populations, and these populations evolve by natural selection and other means, pretty much well characterized (though not necessarily exhaustively so: Pigliucci and Müller 2010) by standard population and quantitive genetic theory (Hartl and Clark 2006; Falconer and Mackay 1996, respectively). Earth is not a member of a population of planets, it doesn't produce variable offspring that inherits some of its characteristics and then competes for limited resources with other such offspring, and it most certainly doesn't evolve in anything like the biological sense of the term, it just changes over time (and so do other planets, stars, galaxies and the universe itself—without anyone having proposed that they are "organisms" of a sort).[2]

A second example of just how much Gaia is scientifically confused is its oft-cited connection with group selection (Okasha 2006). The concept has been around for a number of decades now, and its scientific fortunes wax and wane according to how it is presented and with the zeitgeist of each particular decade. Richard Dawkins is famously on record as dismissing (wrongly, in my mind) the whole idea of group selection, and he deployed precisely such a weapon against Gaia as well, according to Ruse: "The fatal flaw in Lovelock's hypothesis would instantly have occurred to him if he had wondered about the level of natural selection processes which would be required in order to produce the Earth's supposed adaptations. Homeostatic adaptations in individual bodies evolve because individuals with improved homeostatic apparatus pass on their genes more effectively than individuals with inferior homeostatic apparatus" (Chapter 2). But this simply shows that *both* Lovelock and Dawkins don't have a particularly good grasp either of the Gaia hypothesis or of group selection (or both). Even within the context of group selection Gaia makes no sense, since it isn't in any way a "group" that may compete with other such groups and differentially out-reproduce them. Group selection works just like kin, individual or gene-level selection: it requires populations of objects to compete with each other for resources and to produce offspring that reliably resembles them. "Gaia" doesn't qualify, quite independently of whether group selection is a viable theoretical possibility in general (it is) and whether it actually occurs in nature (arguably yes, but in a limited fashion).

Things only got worse with time. Margulis' eventual involvement with Gaia arguably gave it an initial boost. As Ruse points out, she was a strong-willed and highly respected scientist, who had both the intellectual credentials and the stamina of character to join Lovelock in the fight against what they perceived as an unjustified establishment skepticism (Chapter 1). Margulis had already done this once, when she almost single handedly convinced her colleagues of the correctness of the idea that several ancient episodes of hybridization and symbiosis were responsible for the evolution of complex eukaryotic cells (Margulis 1992). In particular, it is very well established today that mitochondria and chloroplasts—the organelles responsible for fueling basic metabolism and for carrying out photosynthesis respectively—were once independent bacterial species that got assimilated by larger cells and eventually co-evolved with their hosts (McFadden 1999; Gray et al. 1999, respectively).

The problem is that Margulis eventually went off the rails, taking a bit too seriously her role as a scientific iconoclast. For instance, as Ruse remarks, "Margulis…was prepared to agree with the 'intelligent design' critics of Darwinism, who claim that such 'microevolution' never adds up to the 'macroevolution' involved in the evolution of new groups" (Chapter 7). Margulis pushed the idea of symbiosis so far that eminent evolutionary biologist Paul Harvey said that he "could no longer take her seriously" (Chapter 7). She began to use Gaia as a wedge against the neo-Darwinian conception of evolution, saying that the hypothesis amounted to "big trouble in biology," and writing in a decidedly unkind fashion of "the physics-centered philosophy of mechanism and its runt offspring neo-Darwinism" (Chapter 7). You can easily see how this sort of thing would justifiably ruffle some feathers.

Lovelock himself didn't help things much in the public relations department either. He wrote that "The progress of good science is slow and unpredictable and all too often awaits the appearance of a key thought in the mind of a genius" (Chapter 7). Needless to say, that mind was bound to be his own. Ruse also says that Lovelock was prone to pat himself on the back for having the courage to change his mind about things. And he made things worse when he acknowledged profound religious influences on his work as a scientist. Naturally, there is no logically necessary connection between one's religious propensities and the soundness of one's scientific work, but Gaia had from the very beginning be marred with the suspicion of New Age mysticism, so critics felt vindicated when Lovelock

wrote "When I was a child I was marinated in Christian belief, and still it unconsciously guides my thinking and behavior" (Chapter 8).[3] He even went so far as directly linking Gaia to religion: "Science has left a moral vacuum behind…Gaia is important because it gave us something to which we were accountable…. Because of that ethical significance, Gaia starts to become more than just science. It begins to veer into that area previously occupied by religion" (Chapter 8). You don't need to be Richard Dawkins to feel somewhat uncomfortable while reading this sort of things as a scientist.

Could the status of Gaia get any less palatable for scientists? Yes, in good part because of the bad company kept by Lovelock and Margulis, increasingly desperate to find people who could support their notion. For instance, one of the people attracted to Gaia was none other than Fritjof Capra, the author of the nonsensical *The Tao of Physics* (2010) from which Ruse quotes this revealing snippet: "The earth, then, is a living system; it functions not just like an organism but actually seems to be an organism—Gaia, a living planetary being" (Chapter 2). Lovelock, predictably, reviewed Capra's book positively. Another highly questionable supporter of the Lovelock-Margulis team was Rupert Sheldrake, author of *A New Science of Life: The Hypothesis of Morphic Resonance* (1982), about which Nature's editor said that it was "an exercise in pseudo science." In a later book, *The Rebirth of Nature* (1994), Sheldrake wrote enthusiastically about Gaia: "Mother Nature is reasserting herself whether we like it or not. In particular, the acknowledgment that our planet is a living organism, Gaia, Mother Earth, strikes a responsive cord in millions of people; it reconnects us both with our personal, intuitive experience of nature and with the traditional understanding of nature as alive" (Chapter 2).

Overall, then, half of Ruse's paradox is easily resolved on the basis of Ruse's own account of the facts on the ground: Gaia is a vacuous, largely metaphorical, notion; it's not based on any plausible scientific understanding of organic evolution; and it was pushed in increasingly dubious fashion both by its originators and by a cadre of questionable secondary characters. Of course the scientific establishment reacted negatively at first, and with outright contempt as time went by.

Which brings me to the other side of Ruse's paradox: the enthusiasm with which part of the general public accepted Gaia. But that isn't any more difficult to understand than the reason why scientists have largely been against it. As Ruse himself clearly shows, the timing was right: Gaia

came out during the heydays of the New Age movement, at a time when Rachel Carson (1962) had published her famous and highly influential *Silent Spring* and when eco-feminists were (and still are), as the author himself points out, "somewhat selective about pseudoscience, having no objection to it when it meets their needs" (Chapter 6). Indeed, it is Ruse again that painstakingly shows how Lovelock very quickly turned away from the challenge of convincing other scientists within the constraints imposed by technical peer reviewed publications and embarked in a decades-long public relations campaign to gain popular traction for his ideas.

Lovelock was successful in this, as the term Gaia rapidly gained popular attention, with everything from a publishing house using the Gaia name (they put out *Gaia: an Atlas of Planet Management,* Myers 1984) to an institute for Gaia linked to the Cathedral of St. John the Divine in New York City (where in 1981 a Mother Earth celebration took place, with an appearance by Miss Gaia herself. There is a "Gaia Song" (Chapter 2) and a good number of popular books devoted to the idea. So the picture is complete: we have a concept that has been roundly rejected by science and equally solidly embraced by the public. Hence Ruse's "paradox."

And yet the solution of the alleged paradox, as I mentioned above, is actually quite simple: on the one hand, the general public is, unfortunately, prone to adopt all sorts of quasi- or even downright pseudo-scientific beliefs (Pigliucci and Boudry 2013). On the other hand, bad ideas are rejected by the scientific community even when they are advanced by otherwise credentialed scientists: witness the famously quick debacle that followed the initial announcement of the discovery of cold fusion (Taubes 1993). Here is Ruse, in the last chapter of the book: "Part of the answer is that they [Lovelock and Margulis] were heard, that they did get a full examination, and that in the opinion of many they failed the test" (Chapter 8). The only thing I would change here is that this is a *great* part of the answer, indeed, the only part that matters. The rest is (interesting) sociological commentary, on both the workings of science itself and on its reception by the public at large. Ruse talks about the insecurities of the scientific community, rooted into a complex combination of hostility to science by influential (in the US) fundamentalist Christianity, the popularity of New Age "thinking," and even a number of acrimonious controversies internal to science itself (including the one about group selection). He is very likely right, and the book is a refreshing reminder of just how much

the scientific enterprise is a social phenomenon, both in its inner workings (Longino 1990) and in how it is affected by the broader social milieu. But in the end Gaia succeeded and failed for the usual reasons: it gained favor with an all too uncritical public who is just as ready to imbibe the pseudo-scientific mumbo jumbo of a Deepak Chopra or Dr. Oz, and it earned the hostility of a scientific community which clearly and immediately saw the many flaws inherent in the idea itself.

**NOTES**

1 This book was reviewed in nonpaginated electronic format, citations refer to chapter numbers.
2 There is an exception to this idea that evolution in something like a biological sense applies—as far as we know—only to populations of organisms: physicist Lee Smolin's (1997) "cosmological natural selection." For an introduction and criticism of the concept, see Pigliucci (2012).
3 Let us set aside how exactly this religious guidance can be unconscious if Lovelock is so consciously aware of it.

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