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Michael Ruse. *The Gaia Hypothesis: Science on a Pagan Planet.* Chicago: University of Chicago Press, 2013. XIV, 251 pp.

In the early 1970s, two well-respected scientists – James Lovelock and Lynn Margulis – published a series of technical papers in which they defended the ‘Gaia hypothesis’¹. While those papers received scant attention, the same cannot be said for Lovelock’s *Gaia*², a non-technical work that was enthusiastically embraced by many in the general public, but vehemently condemned by many in the scientific establishment. The task that Michael Ruse sets himself in this book is to understand and explain these reactions to the ‘Gaia hypothesis.’

The explanatory framework that Ruse provides involves two different time-scales. On the one hand, Ruse is interested in the immediate background to the publication of the work of Lovelock and Margulis: What was it about the 1960s that fertilised the soil for publication of serious scientific work on the ‘Gaia hypothesis?’ On the other hand, Ruse is also interested in the broader sweep of human intellectual history: What are the historical antecedents of the thoughts of those who embraced the ‘Gaia hypothesis,’ and the thoughts of those who vehemently condemned it?

Ruse’s book is structured by his identification of three broadly different approaches to thought about life and the earth: (a) *mechanism* – bottom-up, reductionist, orthodox Darwinian biological science, exemplified in the thoughts of Charles Darwin, Richard Dawkins, John Maynard-Smith, Ford Doolittle, and William Hamilton; (b) *organicism* – top-down, holistic, emergentist, heterodox Spencerian biological science, exemplified in the thought of Herbert Spencer, the Harvard Holists – Louis Agassiz, Lawrence Henderson, Walter Cannon, and William Wheeler – the Chicago Ecologists – Warder Allee, Sewall Wright, and Alfred Emerson – Stephen Jay Gould, Richard Lewontin, and Edward Wilson; and (c) *hylozoism* – ‘non-scientific’ views that take the earth to be a living organism, exemplified in Rudolf Steiner’s anthroposophy, the ecological philosophies of Henry David Thoreau, John Muir, Aldo Leopold, Peter Ouspensky, Teilhard de Chardin, Marjorie Spock, Rupert Sheldrake, Arne Naess, and neopagan Oberon Raven-

- 1 Lovelock, James E. 1972. “Gaia as Seen through the Atmosphere.” *Atmospheric Environment* 6:579–80; Lovelock, James E., and Lynn Margulis. 1974a. “Homeostatic Tendencies of the Earth’s Atmosphere.” *Origins of Life* 5:93–103; 1974b. “Atmospheric Homeostasis by and for the Biosphere: The Gaia Hypothesis.” *Tellus* 26:1–10; Margulis, Lynn, and James E. Lovelock. 1974. “Biological Modulation of the Earth’s Atmosphere.” *Icarus* 21:471–89.
- 2 Lovelock, James E. 1979. *Gaia, a New Look at Life on Earth.* New York; Oxford: Oxford University Press.

heart. Ruse traces the ancestry of both organicism and hylozoism to Plato's *Timaeus*; he observes, with careful detail, that the notion of a world soul is to be found in the Stoics, in Plotinus, in various examples of Christian syncretism, in Copernicus, in Kepler, in Thomas More, in Schelling, and in Goethe.

Ruse positions Lovelock and Margulis with respect to these approaches. On the one hand, Lovelock belongs squarely with the *mechanists*. Lovelock is “an anorak of the first order” (7), “conventional” (181), “ignorant of major intellectual traditions” (186), “bolshie” (187), and possessed of “a genius for instrument making” (7). Through his friendship with William Golding, Lovelock had some exposure to anthroposophy and hylozoic forms of thought, but this played no conscious role in his thinking about life on earth. On the other hand, Margulis belongs squarely with the *organicists*. Margulis was philosophically opposed to “the physics-centred philosophy of mechanism and its runt offspring neo-Darwinism” (175³). Her “holism ... owe[d] nothing to Anglo-Saxon thought and everything to German idealism” (198).

Given the background material that he assembles, Ruse has a relatively easy time explaining widespread public enthusiasm for the ‘Gaia hypothesis.’ Contemporary anxieties about the future of life on earth find ready partners in long-established modes of hylozoic thought. In an age in which there is widespread fascination with ancient mysteries, and in which value is attached to earth-centred, organic, ecologically-friendly, and anti-technological modes of thought, it would be far more surprising if the ‘Gaia hypothesis’ did not find broad public support.

Explaining the vehement condemnation of the ‘Gaia hypothesis’ is perhaps slightly less straightforward. While it is predictable that mechanists will have no time for the ‘Gaia hypothesis,’ it is harder to see why organicists could not be sympathetic to it. While everyone can agree that the biosphere is a large network of waste products that are also nutrients – and hence that the biosphere involves a large number of interlocking *positive* feedback loops – mechanists are bound to deny that any of these waste/nutrient networks is a *negative* feedback loop. On the mechanist view, there is nothing that *guarantees* the stability of these waste/nutrient networks: There are no final causes in nature. But there are many serious scientists who do not subscribe to organicism rather than to mechanism. Why did *those* scientists not speak out on behalf of the ‘Gaia hypothesis?’

Ruse’s answer is that the organicists turned on the ‘Gaia hypothesis’ because of their own insecurities. While there was quite heated disagree-

3 Citing Margulis, Lynn, and Dorion Sagan. 1997. *Slanted Truths: Essays on Gaia, Symbiosis and Evolution*. Secaucus: Copernicus Books, 271.

ment between the mechanists and the organicists, there was even more bitter infighting between the leading organicists, exemplified in the dispute between Lewontin and Wilson over sociobiological explanations of human behaviour. Moreover, the mechanists and organicists were jointly subject to attack from external parties, including many occupying university posts in the humanities and many conservative evangelical Christians. In these circumstances, organicists were not inclined to risk exposure on another flank. In particular, if scientific credentials were to play an important part in the response to the attacks from other external parties, then organicists could ill-afford association with positions tainted by accusations of pseudo-science. But there were *aspects* of the popular defences of the ‘Gaia hypothesis’ – by Lovelock and Margulis – that invited just such accusations.

Ruse’s final assessment of the ‘Gaia hypothesis’ is equivocal. He suggests that it fails as science but succeeds as philosophy (223). But he also says that, in the realm of science, in one sense, there is real success (222–23). He says that Lovelock and Margulis are heroes (224), and yet he also says that the ‘Gaia hypothesis’ was doomed to failure (224). What is going on here?

I suspect that part of what is going on is that the description the ‘Gaia hypothesis’ is insufficiently precise. Suppose that – sticking reasonably close to Margulis and Lovelock (1974, 475) – we formulate the ‘Gaia hypothesis’ as follows: ‘Life actively maintains environmental conditions that are (at least locally) optimal for life.’ There are at least two different ways in which the claim can be read. On the one hand, it can be taken as the claim that there are whole-of-planet positive feedback systems involving living organisms. On the other hand, it can be taken as the claim that there are whole-of-planet negative feedback systems involving living organisms. Taken according to the former reading, the ‘Gaia hypothesis’ encapsulates “the Earth systems revolution” (222), and so is a real success. But, taken according to the latter reading, the ‘Gaia hypothesis’ is unsubstantiated speculation that is inconsistent with bottom-up, reductionist, orthodox Darwinian biological science. While Lovelock’s contribution (in Charlson et al. 1987⁴) is a seminal work on whole-of-planet positive feedback systems involving living organisms, it does nothing towards establishing that there are whole-of-planet negative feedback systems involving living organisms.

According to Ruse, the ‘Gaia hypothesis’ is “a philosophical and historical meditation on the nature of science ... [which] aims to show how today’s thinking about empirical questions is deeply influenced by the past.” On

4 Charlson, Robert J., James E. Lovelock, Meinrat O. Andreae, and Stephen G. Warren. 1987. “Oceanic Phytoplankton, Atmospheric Sulphur, Cloud Albedo and Climate.” *Nature* 326:655–61.

his telling, while the ‘Gaia hypothesis’ is “used as a tool to explore broadly important questions,” the work “is not really a book about Gaia” (IX). I’m not sure that Ruse’s book really does support interesting generalisations about ways in which today’s thinking about empirical questions is deeply influenced by the past. But Ruse clearly does have an interesting story to tell about ways in which the Gaia controversy was – and perhaps still is – shaped by historical forces. Moreover, he is able to draw on a large body of previous work⁵ that informs the story that he tells. I enjoyed the book immensely.

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Jan Cornelius Schmidt. *Das Andere der Natur: Neue Wege zur Naturphilosophie.* Stuttgart: Hirzel, 2015. 360 pp.

Since Jacques Monod, popular science writers have often cultivated an existentialist pathos by embracing the accidental and contingent implications of biology, even when they can seem meaningless. Physicists, by contrast, have often held on to the predictability and regularity of natural law. This emphasis on chance in biology gives a unique twist to Darwin’s statement “that, whilst this planet has gone cycling on according to the fixed law of gravity ... endless forms most beautiful and most wonderful have been, and are being evolved”¹. If repeatability, testing, explanation by reduction, and predictability are the hallmarks of classic science, then in modern biology, chance and accident may seem like powerful ways to assert individuality at the same time.

The book under review, by contrast, argues that the world view of classic modern science is, in its core assumptions, ill-suited to grasp a significant part of physical reality, perhaps even the larger part. Schmidt, who holds a doctorate in physics and a *Habilitation* in philosophy and teaches phi-

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- 5 Ruse, Michael. 1979. *Sociobiology: Sense or Nonsense?* Dordrecht: Reidel; 1982. *Darwinism Defended: A Guide to the Evolution Controversies.* Reading, MA: Benjamin/Cummings; 1996. *Monad to Man: The Concept of Progress in Evolutionary Biology.* Cambridge, MA: Harvard University Press; 1999. *The Darwinian Revolution: Science Red in Tooth and Claw.* Chicago: University of Chicago Press; 2003. *Darwin and Design: Does Evolution Have a Purpose?* Cambridge, MA: Harvard University Press.
- 1 Darwin, Charles. [1859] 2009. *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life.* Cambridge: Cambridge University Press, 429.

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