The Gaia Hypothesis: What Is It?

First articulated by British atmospheric chemist James Lovelock, the Gaia hypothesis, succinctly, suggests that the Earth is a self-regulating, self-sustaining entity, which continually adjusts its environment in order to support life. Though a scientific theory, the Gaia hypothesis has, since its initial articulation in 1969, sparked a swirl of religious, New Age, and philosophical reflection, and challenged certain long-held assumptions about evolution, the importance of the human in determining environmental change, and the relationship between life and the environment.

While serving as a consultant for NASA during the 1960s, Lovelock worked on the Viking project, which assayed to determine whether life existed or was even possible on Mars. To probe these questions, Lovelock examined what sustained life on Earth, and, arguing from his strength as an atmospheric chemist, found his answer in the composition of the Earth's atmosphere, with its delicate balance of oxygen, hydrogen, nitrogen, methane, and traces of other elements. In attempting to answer the question of life's existence on Mars, Lovelock concentrated on the nature of the Earth's atmosphere and argued that "the entire range of living matter on Earth, from whales to viruses, from oaks to algae, could be regarded as constituting a single living entity, capable of manipulating the Earth's atmosphere to suit its overall needs and endowed with faculties and powers far beyond those of its constituent parts" (Lovelock 1979, 9).

Unlike Mars, with an atmosphere composed mainly of carbon dioxide, the Earth, Lovelock concluded, had a dynamic and self-regulating atmosphere. Just like an oven thermostat that maintains a constant temperature, the Earth's atmosphere sustained a stable balance of gases and temperature supportive of life. Because Mars had no suggestion of such a matrix or dynamic atmosphere, Lovelock concluded, it is lifeless.

For Lovelock, life is not surrounded by a passive environment to which it has accustomed itself. Rather, life creates and reshapes its own environment (Margulis and Sagan 1986, 267). Whereas traditional Earth scientists maintain that the Earth's climatic pattern is more geological than biological, and is therefore less robust and more vulnerable to lasting injury, the Gaia thesis purports that the Earth is like a self-regulating animal and may have organs that are especially important, such as the rain forest and wetlands, which are more vital to the global environment than are other parts of the system (Joseph 1990, 2). In other words, while Gaia may sustain the loss of its "big toe," i.e., the blue whale, it can ill afford to lose its "lungs," i.e., the tropical rain forests.

One could argue that historical antecedents of the Gaia theory reside in the work of G. F. Hegel, Baruch Spinoza, Alfred North Whitehead, and Herbert Spencer, all of whom spoke of nature in terms of an organism. Moreover, Aldo Leopold, deemed the father of the modern conservation movement, viewed the Earth as an "organism" possessing a certain degree of life. As philosopher Anthony Weston also points out, the Gaia theory has a particular relevance to
our time, with its general systems theory and interplanetary expeditions (Weston 1987, 219). Evolutionary philosopher Elisabet Sahtouris notes that early in this century, the Russian scientist V. I. Vernadsky viewed the biogeochemistry of the planet as a unity, but his work was not known to Lovelock until after the Gaia thesis was proposed (Sahtouris, "The Gaia Controversy," 1989, 57). Lovelock himself points to the nineteenth-century Scottish scientist James Hutton, the father of geology, as a Gaia forerunner. Hutton spoke of the Earth as a "superorganism," and was one of the first scientists to conceive of the Earth in a systems context (Joseph 1990, 83).

With the help of Lynn Margulis, formerly married to Carl Sagan and a microbiologist at Boston University, Lovelock has refined his thesis, and has been able to reinforce his ideas scientifically with reference to Margulis's research on microorganisms. Known amusingly as "The Wizard of Ooze" owing to her investigation of microbes in swamps, mudflats, and marshes around the world, Margulis maintains that symbiosis and cooperation have been as central to biological evolution as has the competitive conflict for survival that marks Darwinian theory (Joseph 1990, 8).

For Margulis and Sagan, interrelation, rather than competition, is the leitmotif of nature. Like Lovelock, they see the biosphere as "seamless," a grand, integrated, and living organism. They assert that the first bacteria acquired almost all the necessary knowledge about living in an integrated schema. "Life did not take over the globe by combat," they contend, "but by networking" (Margulis and Sagan 1986, 15). Attempting to show the importance of microorganisms for Gaia, Margulis is quick to demonstrate that life on earth has existed on the planet for 3.5 billion years, and that for the first 2 billion, only bacterial microorganisms existed. Mammals, including the human, she goes on to speculate, may exist solely to provide warm homes for such microorganisms (15-18).

For Bunyard and Goldsmith, co-editors of the British journal The Ecologist: Journal of the Post-Industrial Age, the Gaia hypothesis suggests that the biosphere, together with the atmospheric environment, constitute a unified natural system. This system is the fruit of organic forces that are highly coordinated by the system itself. Gaia has, in effect, created herself, not in a random manner, but actually in an objective-seeking fashion. This is suggested by the fact that the system is highly stable and can maintain its equilibrium despite internal and external dilemmas. It is actually a "cybernetic" system and thus must be seen as a grand cooperative project. Bunyard and Goldsmith aver that if "Gaia is a single natural system that has created herself in a coordinated and goal-directed way, then Gaia is clearly the unit of evolution, not the individual living thing as neo-Darwinists insist" (Bunyard and Goldsmith 1989, 7). In fact, they speculate, Gaia might be evolution itself. Competition becomes not the primary feature, but a secondary one, and survival of the fittest becomes not a highly individualistic exercise, but a cooperative attempt to weed out certain species for the benefit of the organic commonweal. They insist that now there is more evidence for Gaia as an evolutionary process than there is for neo-Darwinism (1989, 9).(2)
While many environmentalists initially warmed to the Gaia theorists, perceiving them to be natural allies in the eco-struggle, Lovelock and Margulis proved to be reluctant eco-partners. One of the reasons for this distancing lies in the minimal place the human holds in the overall Gaia theory as articulated by Lovelock and Margulis. For the Gaia theory originators, Gaia is a self-regulating system, a "creature," which moves forward into the future regardless of what humans do.

In his first full-blown, popular articulation of his theory, *Gaia: A New Look at Life on Earth*, Lovelock clearly distinguishes himself from mainstream environmentalists. In this imaginatively written work, Lovelock asserts that, contrary to the gloomy forecasts of environmentalists, life on Earth is robust, hardy, and extremely adaptable, as his analysis of Gaia regulation over the eons intimates. He suggests that large plants and animals are in fact probably less important than are bacteria deep in soils and seaboards. He compares "higher species," e.g., trees and mammals, to glitzy salesmen and show models used to display products; helpful but not essential. He goes as far as to say that even nuclear war would probably not affect Gaia drastically (Lovelock 1979, 40-43).

Pollution, for Lovelock, is as natural as are sea and sand, and is therefore not fulsome, but simply organic, an inevitable byproduct of "life at work." The early biosphere, he argues, must have experienced pollution and the depletion of resources, as we do in the modern world. He notes that the first entity to use zinc beneficially probably also produced mercury as a poisonous waste product. Microorganisms were later produced to break down the mercury, representing perhaps life's most ancient toxic waste disposal system (Lovelock 1979, 27-28).

While conceding that the devastation of modern industrial and technological development may prove "destructive and painful" for our own species, Lovelock doubts that it threatens the life of Gaia as a whole. (The ethical questions surrounding the "pain" for the human species are left unexplored.) In fact, he continues, "the very concept of pollution is anthropocentric and it may even be irrelevant in the Gaian context" (Lovelock 1979, 110). Acknowledging his lack of concern for the place of humanity within the Gaia framework, Lovelock admits that his work "is not primarily about people and livestock and pets; it is about the biosphere and the magic of Mother Earth" (112).

Yet Lovelock, in ascribing a peripheral role for humanity in the Gaian framework, neglects to take into account socio-economic factors of pollution. For example, in discussing Rachel Carson's galvanizing work, *Silent Spring*, which analyzed how DDT and other pesticides were destroying birds and other wildlife, Lovelock asserted that DDT "will probably be more carefully and economically employed in future" (115). (Lovelock's polyannish perspective is belied by the increased sale of DDT to the Third World after its use was banned in North America.)

Contending that chlorofluorocarbons (CFCs) are also "natural," Lovelock initially dismissed the fears of environmentalists that human-made CFCs
resulting from aerosol cans, refrigerators, and air conditioners could have any sizable impact on ozone depletion. Methyl chloride, produced by the seas, he countered, breaks down ozone, as do CFCs, showing that too much ozone is as dangerous as is too little for Gaia (Lovelock 1979, 80; 105). Gaia, he suggests, has the situation under control. Revealingly, however, Lovelock in 1988 conceded that he may have been wrong to oppose those who wanted to legislate a reduction in CFCs, saying that he would now support such legislative restrictions in light of the disturbing evidence of ozone depletion.

Lovelock's dismissal of the important ozone depletion problem, a condition he brought to light through his own research, is a fascinating case study. It highlights how scientists, enthralled by their own theories, can ignore data and minimize mammoth problems which belie their visions. It uncovers the limiting subjectivity of science and its all-too-human dimensions, and demonstrates how science itself is susceptible to social, political, and psychological pressures. Convinced that Gaia was robust and all-controlling, Lovelock had difficulty admitting that the pesky unfeathered bipeds of the human race could significantly injure it.