The Gaia Hypothesis: Is the Earth Alive?

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More than one astronaut looking back at our planet has been awed into concluding that this blue and green globe is, in fact, a living being. Of course, many native peoples the world over have always believed (and functioned on the premise) that the earth is alive.

And now contemporary scientists are talking more and more about the Gaia hypothesis: the proposition that, in some ways, the planet does behave like a living system. (Gaia pronounced "Guy-uh" — was the Greek goddess of the earth.)

"What's that?" you say. "Scientists are saying the earth is alive?" Well, the honest answer to that is "No, but . . ." And the "but" becomes quite fascinating.

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British scientist James Lovelock, the person most responsible for the Gaia hypothesis, was working for NASA when he first reached his living system insight questioning is the earth alive? Surprisingly, though, at the time he was creating tests to detect life on Mars!

Lovelock had taken the approach that, rather than have satellites take minute soil tests on the red planet (using what he described as "glorified flea detectors"), scientists should look at Mars' atmosphere to see if it has any concentrations of gases that could exist only if they were maintained by living organisms. To test that idea, Lovelock looked at the atmosphere of our own planet. Sure enough, earth's air contains large quantities of highly reactive gases — such as oxygen and methane — that naturally break down into other compounds. "If chemical thermodynamics alone mattered," he wrote, "almost all the oxygen and most of the nitrogen in the atmosphere ought to have ended up in the sea combined as nitrate ion."

This simple discovery later developed into one of Lovelock's original arguments for Gaia: Something is maintaining numerous reactive gases in our atmosphere in an equilibrium steady state. (Mars, by the way, flunked the "active atmosphere" test.)

The second, and even more compelling, argument was that over the millenia the earth has somehow regulated its own temperature. When life began on our planet four billion years ago, the sun was 30% cooler than it is today. Yet, from then until now, the temperature of the earth's surface has remained within the critical life-supporting range of 15 degrees to 30 degrees Celsiu. The level of CO, has dropped a hundred fold in those four billion years, reducing the "greenhouse" heat-holding effect of the atmosphere even while the sun was radiating more heat. The result? The earth has kept itself at a constant temperature . . . just as our own bodies do!

Temperature and a reactive atmosphere are just two of the factors kept in balance by the earth. One must also notice that if — as Lovelock states — "humidity or salinity or acidity or any one of a number of other variables had strayed outside a narrow range of values for any length of time, life would have been annihilated."

The interactive mechanisms that accomplish this self — regulation are too complex for current science to quantify, so Lovelock often uses a simplified model of an imaginary "Daisy World" to suggest how the system might work. Suppose there was a planet that supported only two plant species, white daisies and black daisies. Since the white ones reflect more heat than black ones, they would fare better when the planet was unusually hot. The reverse would also be true: Black daisies, being better heat absorbers, could survive better during cool periods.

But what would happen if Daisy World was cool for an extended time? Black daisies would take over more and more of the land surface, increasing the absorption capacity of the planet and thereby warming it up. In time, the temperature would rise to the best range for white daisies. Those would spread, and the black ones would largely die back. But that event would increase the heat reflectiveness of the planet, thus eventually cooling its surface.

By such means, the black and white daisies would balance each other and keep the planet's temperature from ever getting too hot or too cold to support plant life. On a much more complex level, the organisms on our own planet must work together to stabilize the earth.

In sum (again quoting Lovelock), "The Gaia hypothesis sees the earth as a self-regulating system able to maintain the climate, the atmosphere, the soil, and the ocean composition at a fixed state that's favorable for life. It's often taken that the capacity for self regulation in the face of perturbation, change, disasters, and so on is a very strong characteristic of living things and, in that sense, the earth is a living thing."

But Really, is the Earth Alive?

Lovelock is saying that the evolution of life and the evolution of the planet have not been separate phenomena but one single, tightly coupled process. Life does not simply adapt to its environment but, through various feedback loops, coevolves with it. This unifying, whole systems view is beginning to gain ground with scientists. And the fascinating search for Gaia's mechanisms is already leading to new areas of exploration. Biologist Lynn Margulis, who worked closely with Lovelock on the original hypothesis, now studies the roles that hardy microorganisms may play in regulating the atmosphere. She's found 200 or so mostly dormant microorganisms in tiny culture samples, each ready under the right conditions — to perform its function and give off its particular gaseous emission, depending on surrounding conditions. Atmospheric scientist Pat Zimmerman examined the intestinal bacteria of termites as a source of atmospheric methane and learned that since there are about 1,500 pounds of termites per human being on earth, and since the wood nibblers go through the equivalent of one-third of the new plant carbon created every year, they may produce half of the methane in the atmosphere!

But Lovelock's words have at times suggested that the planet's totality of life is deliberately working to better its condition and increase itself. Adding such an aspect of purposefulness (even consciousness) to Gaia grates on most otherwise sympathetic scientists. Any hints that the whole system may indeed be alive are taboo to them — that's talking religion. And as Stanford Research Institute senior policy analyst Don Michael puts it, "Science and spirit are different realms. They are not in conflict, but there's no interface between the two." Lovelock himself now seems to back away from such implications: "There's no foresight or planning involved on the part of life in regulating the planet. It's just a kind of automatic process."

What If?

That hasn't stopped many non-scientists from drawing their own conclusions about the implications of the Gaia hypothesis. Like several other environmentalists, Nancy Todd, co-founder of the New Alchemy Institute, sees Gaia as a means of helping humans be better planetary stewards. "Gaia," she states, "is the only metaphor scientific and mythologic enough to see us through our present crisis and lead to a resacralization of the world."

Indigenous peoples who have always felt themselves in communication with a living planet feel that interest in Gaia is a sign that technological cultures are beginning to agree with them. Prem Das, a shaman — healer in Tepic, Mexico, tells outsiders that of course the planet is alive: "The Earth is speaking all the time. But it doesn't speak English. It speaks Earthese. We just need to learn how to listen."

Psychologist Jim Swan-producer of a national symposium called "Is the Earth a Living Organism?" — feels

the Gaia hypothesis may herald a paradigmatic shift that would affect almost all areas of thought and be greatly beneficial to society. He says, "You can't prove earth is alive scientifically, because living is a property beyond the very limited structure of current science. But you can know it for yourself through direct experience — through vision quests in sacred places, for example. And such knowledge has incredible practical utility. Science based on it would help bind us to each other, not blow each other up. Experience of the living earth can also have great benefits for mental and physical health — especially in our society, which rejects feeling, intuitive modes of being. The experience can also change your life priorities. Almost all our country's great environmentalists — including Burroughs, Thoreau, Carson, and Muir — have felt a oneness with the planet and had that as a motivation for their actions."

Earthly Thoughts in the Meantime

While Gaian scientists stay clear of such thoughts, the hypothesis is beginning to motivate their actions, as well. Dr. Stephen Schneider of the National Center for Atmospheric Research points out that although Gaia's regulatory mechanisms may help assure the long-term existence of life on the planet, they may not assure the short-term survival of our own individual species — a species that may be making the planet too hot for its own good. "And I'm a chauvinist for human beings," he confesses.

Even Lovelock, for all his British aplomb, agrees: "The clearing of the tropical forests and the addition of carbon dioxide to the atmosphere by fossil fuel burning act both in the same way to stress a system which is already near the limit of its capacity to regulate. And the effect of this perturbation might cause us to jump to a new stable state in the very near future. I imagine if the system does flip to a different stable state, there will be a sudden and enormous change in speciation, just as there was when the dinosaurs vanished. There will be a new biota that will be fit for the new environment. But I doubt it will be very comfortable for us."

So, if widely understood, the Gaia hypothesis could help us avoid such a catastrophe. Whether the idea is adopted as a new spiritual credo or an automatic mechanism, it may be a notion whose time has come . . . not a moment too soon.

EDITOR'S NOTE: Lovelock's book *Gaia: A New Look at Life on Earth* is available from Oxford University Press, NJ.