Gaia Hypothesis

This will serve as an introduction to the Gaia hypothesis;
It is a review (published in 1989) of James Lovelock's The Ages of Gaia

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What is the hypothesis of Gaia ? Stated simply, the idea is that we may have discovered a living being bigger, more ancient, and more complex than anything from our wildest dreams. That being, called Gaia, is the Earth.

More precisely: that about one billion years after it's formation, our planet was occupied by a meta-life form which began an ongoing process of transforming this planet into its own substance. All the life forms of the planet are part of Gaia. In a way analogous to the myriad different cell colonies which make up our organs and bodies, the life forms of earth in their diversity coevolve and contribute interactively to produce and sustain the optimal conditions for the growth and prosperity not of themselves, but of the larger whole, Gaia. That the very makeup of the atmosphere, seas, and terrestrial crust is the result of radical interventions carried out by Gaia through the evolving diversity of living creatures.

Encountering the Earth from space, a witness would know immediately that the planet was alive. The atmosphere would give it away. The atmospheric compositions of our sister planets, venus and mars, are: 95-96% carbon dioxide, 3-4% nitrogen, with traces of oxygen, argon and methane. The earth's atmosphere at present is 79% nitrogen, 21% oxygen with traces of carbon dioxide, methane and argon. The difference is Gaia, which transforms the outer layer of the planet into environments suitable to its further growth. For example, bacteria and photosynthetic algae began some 2.8 billions of years ago extracting the carbon dioxide and releasing oxygen into the atmosphere, setting the stage for larger and more energetic creatures powered by combustion, including, ultimately, ourselves.

That is how James Lovelock discovered Gaia; from outer space.In the 1960's, during the space race which followed the launching of Sputnik, he was asked by the Jet Propulsion Laboratory and Nasa to help design experiments to detect life on Mars.The Viking lander gathered and tested some Martian soil for life with no results. Lovelock had predicted as much, by analyzing the atmosphere of Mars: it is in a dead equilibrium. By contrast, the atmosphere of Earth is in a "far from equilib rium" state- meaning that there was some other complex process going on which maintained such an unlikely balance. It occurred to him that if the Viking lander had landed on the frozen waste of antarctica, it might not have found any trace of life on Earth either. But a sure giveaway would be a complete atmospheric analysis... which the Viking lander was not equipped to do. Lovelock's approach was not popular at Nasa because Nasa needed a good reason to land on Mars, and the best was to look for life. Viking found nothing on Mars, but Lovelock had seen the Earth from the perspective of an ET looking for evidence of life. And he began thinking that what he was seeing was not so much a planet adorned with diverse life forms, but a planet transfigured and transformed by a self-evolving and self-regulating living system.By the nature of its activity it seemed to qualify as a living being. He named that being Gaia, after the Greek goddess which drew the living world forth from Chaos.

"The name of the living planet, Gaia, is not a synonym for the biosphere-that part of the Earth where living things are seen normally to exist. Still less is Gaia the same as the biota, which is simply the collection of all individual living organisms. The biota and the biosphere taken together form a part but not all of Gaia. Just as the shell is part of the snail, so the rocks, the air, and the oceans are part of Gaia.

Gaia, as we shall see, has continuity with the past back to the origins of life, and in the future as long as life persists. Gaia, as a total planetary being, has properties that are not necesarily discernable by just knowing individual species or populations of organisms living together... Specifically, the Gaia hypothesis says that the temperature,oxidation, state, acidity, and certain aspects of the rocks and waters are kept constant, and that this homeostasis is maintained by active feedback processes operated automatically and unconsciously by the biota."

Even the shifting of the tectonic plates, resulting in the changing shapes of the continents, may result from the massive limestone deposits left in the earth by bioforms eons ago.

"You may find it hard to swallow the notion that anything as large and apparently inanimate as the Earth is alive. Surely, you may say, the Earth is almost wholly rock, and nearly all incandescent with heat. The difficulty can be lessened if you let the image of a giant redwood tree enter your mind.The tree undoubtedly is alive, yet 99% of it is dead.The great tree is an ancient spire of dead wood,made of lignin and cellulose by the ancestors of the thin layer of living cells which constitute its bark. How like the Earth, and more so when we realize that many of the atoms of the rocks far down into the magma were once part of the ancestral life of which we all have come." The root question of Gaia's critics, and a central point in his theory concerns the difference between a planetary environment which might only be the aggregate result of myriad independent life forms coevolving and sharing the same host, and one which is ultimately created by life forms deployed, so to speak, to accomplish the purpose of the larger being. Is the idea of Gaia only a romantic and dramatized description of the terrestrial biosphere and its effects, or is there a planetary being, whose life cycle must be counted in the billions of years, which spawns these evolving life forms to suit the purpose of its being. Do our kidney cells ask each other these sorts of questions? While your white blood cells thrive and reproduce, going about their business,they are indisputably serving the life of the larger body which you use, though whatever consciousness they experience in their realm is certainly far from that which you, the larger being, the whole, experience.

Recent scientific work, such as in the field of complex systems, have begun to give us the impression that this opposition of terms, the larger caused by its constituents, or the costituents created by the larger, may be one of those oppositions which are the constructs of our own minds, and must be dropped if we are to understand the truth, which is neither the one nor the other, but more difficult to comprehend and more fascinating to behold. Perhaps there is awareness appropriate at every level.Perhaps that is a property of life.

And what might be the nature of its evolution, this planetary being called Gaia? Anthropocentrists to the last, we might assume that the production of the human species is a great step upward for Gaia, a sort of rapidly evolving brain tissue. Or that she prepares the earth as a cradle and crucible of consciousness evolving. Other analogies come to mind: are we part of her arsenal of interplanetary spores ?

And what might constitute a life cycle for such a being- might it be as strange as that of the slime mold ? What stage would Gaia be in now? Is our species part of her maturity or an incubation period ? Is Gaia herself somehow part of a larger living being, perhaps on a galactic scale ? If so how do the cells of this larger being remain in communication? Will we eventually be able to experience something of the awareness which Gaia has ?

Lovelock points out that Gaia, being ancient and resourceful enough to have carried out these successive changes of the planet in spite of asteroid collisions and other setbacks, is herself probably not endangered by the relatively momentary depradations of the human species, as it befouls and cripples the

bio-dynamics of its environment. Rather,the danger is to the human race, not only from our own actions, but also by Gaia's reaction to them.

He adds the caveat however, that the passage of a bullet is also momentary, but the damage nontheless lethal, and that we are not in a position yet to say whether or not some sudden, human caused imbalance, at a critical juncture, might be catastrophic to Gaia.

Lovelock first exposed his idea in his 1979 book, Gaia, a New Look at Life on Earth. The science behind the hypothesis was still sketchy, and it provoked a storm of criticism. It also provoked a lot of research, and the resulting body of information has encouraged Lovelock to publish this second book, a more confident and complete exposition of the Gaia hypothesis.The Ages of Gaia is easily readable for the educated layperson, but includes plenty of scientific depth.

Those of us who consider ourselves to be somehow involved in the birthing of a new age, should discover Gaia as well. The idea of Gaia may facilitate the task of converting destructive human activities to constructive and cooperative behavior. It is an idea which deeply startles us, and in the process, may help us as a species to make the necessary jump to planetary awareness.

Stephen Miller, 1989
All quotes from James Lovelock, taken from The Ages of Gaia

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