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EARTHLY POWERS

Our world is packed with living things, but is it right to suggest, James Lovelock did in his "Gaia" hypoasthesis of 1979, that the earth as a whole should be seen as one great organism? Lovelock is a scientist --an atmospheric chemist -- but is Gaia a scientific hypothesis, testable and potentially disprovable? Or is it, as Karl Popper said of Charles Darwin's notion of evolution by means of natural selection, "a metaphysical agenda for doing science"? Is Gaia just a metaphor? And if so, is it a useful one--or is it, as Richard Dawkins would say, "bad poetry"?

Part science, part mysticism, Gaia certainly runs as a powerful thread through the modern green movement, sometimes embarrassing its founder but prompting serious symposia nonetheless (like the continuing series at the Linnean Society of London, chaired by Melvyn Bragg). But does it justify such interest? Or does it merely obfuscate?

Gaia enthusiasts seek to be literal. A plant or an animal is compounded from many different cells and yet functions as a unified organism. Many different organisms live on earth, and they in turn combine to form the equally unified super-organism of Gaia.

When the body of an animal is knocked off balance-too hot, too cold, too dehydrated, too waterlogged--it corrects itself; and such self-correction is felicitously termed "homeostasis". The great 19th-century French physiologist Claude Bernard spoke of the body's milieu interieur, and homeostasis is the body' s attempt to keep that milieu constant. But when the stresses get too great, the homeostatic mechanisms fail and the body becomes sick, in need of therapy. The world, too, is self-correcting, the Gaia enthusiasts claim, but we have insulted it too much, and it is now in need of a physician. Vide all those Scandinavian lakes that ought to hum with life and now just reflect the sun; they are jewels to look upon, right enough, but just as sterile.

It all sounds very good, but the parallels are not quite accurate. For homeostasis to work we need two ingredients -- an agenda and a series of what are called negative feedbacks. The agenda ensures that the system in question- whether it' s a body, the planet or a steam engine- should "know" how it is supposed to be and is programmed to recognise deviation: too little calcium in the blood, too much pressure in the boilers, whatever. Negative feedbacks are self-correcting mechanisms; the more something happens, the more it stops itself happening.

Engines, for example, are fitted with thermostats; the hotter they get, the more the thermostat shuts off the heat. Just about every gland in the body has some kind of feedback loop to ensure, directly or indirectly, that it can shut itself off. As the pituitary gland secretes growth hormone, so it sets an endocrine cascade in chain which, in the end, suppresses its own secretion. The body is riddled with such mechanisms right down to the molecular level.

Some creatures are more adept at homeostasis than others: garden snails are easily dried

out and overheated, and highly vulnerable to salt, and would have to live restricted lives even if they had the wit to do otherwise. We human beings, in sharp contrast, can keep our milieu interieur within respectable limits in deserts and deep sea, and live the while on roots or raw flesh.

But where, in this earth, is an agenda? Where is the set of rules which says that Gaia ought to be this way? The fossil record suggests that over the past four bill ion years our world has taken many different forms -- sometimes frozen almost to the equator, and sometimes (most recently only 120,000 years or so ago) so warm that there were palm trees on the north coast of Canada, looking across an ice-free Arctic Ocean to their Siberian counterparts. Earthly life is robust; it adjusts to wildly different circumstances. But living things apparently have no collective idea of how they ought to be.

Where are the negative feedbacks that could keep the earth on track, if indeed it had one? There are plenty, of course. Increased carbon dioxide in the atmosphere causes the temperature to rise, which in turn promotes plant growth and, as plants grow, they photosynthesise and take up the extra carbon dioxide.

That, at least, is the theory, even if the earth's climatic history throws doubt on its efficiency. But there are positive feedback loops as well. As the earth cools, the ice spreads, and as it spreads, it reflects more sunlight (or increases the earth's "albedo", as the climatologists say) and so exacerbates the cooling. A different but logistically comparable positive feedback apparently caused Venus to boil over some time in its past, and it has stayed boiled.

Certainly, life's presence on earth must be ameliorative. There is no doubt that trees prevent the erosion of the soil in which they grow, and that deforestation leads to floods. But if the earth is again given a severe kick, it will veer off into a quite new state where, say, mosses or silverfish might reign supreme and human beings are not even a memory; and there is no shortage of potential blows, from asteroids and volcanoes to nuclear winter and the greenhouse effect. Life is definitely robust; but Gaia as a whole is not so much homeostatic as protean.

But then the interactions and relationships between the earth' s many organisms is profoundly different from that of the body's cells. Each and every one of our cells carries a copy of the body's agenda, a life-plan, in the form of a genome: a complete set of genes. The genetic programme does not "determine" every detail of our lives but it does make us what we are: us, human and mosses, mosses. Individual genes indeed are "selfish", as Dawkins proclaims, but often (as in the body, under most circumstances) a selfish gene succeeds by co-operating with its fellows. So in practice in any one cell most of the genes are shut off and the few that stay active (or "expressed") turn the cell into a specialist-liver, lung and so on- that could not survive alone, but thrives in co-operation with all the others. Thus the genome as a whole produces a supremely co-operative collective of cells -- truly an organism- even though its individual genes may be the most absolute solipsists.

The different creatures on earth all have roughly the same kind of genes: all are made of DNA, and they all make proteins (unless we suggest that prions, the agents of BSE and CJD, are an alternative life form -- which is not an absurd idea). But, unlike the different cells in the body, the different organisms do not all have the same genes, so they do not all have the same agenda. Algae which feed on carbon dioxide and produce oxygen may indeed work in harmony with animals which soak up oxygen and exhale carbon dioxide. But they are not actively co-operating. Each has merely adapted to the other.

In political terms, the co-operative of the body cells is effectively totalitarian, with everyone marching to the same genetic drum. But the harmony of earth's many creatures is an Adam Smith laissez-faire. There is no drum. Each individual pulls on its own rope. The apparent order is imposed as if by Smith's hidden hand. Of course it is true -- just as Smith envisaged -- that because each creature is adapted to all the others, each therefore needs all the others. The degree of interdependence is not the issue; only the source and the nature of it.

But although Gaia may have very little literal validity- we can't really see earthly life as a collective organism- it may be worthwhile as a metaphor. For very few people, especially those in high places, truly appreciate our fellow creatures. Like many a modem politician, George Bush spoke much of "the environment", but for him it meant the golf course. He really could not tell the difference, and couldn't have cared less. In artsy politician-speak, "wilderness" is "waste-land" and if "biodiversity" means anything at all, it means "resource". In the present crowded world (though perhaps less so in a future, less crowded one) wilderness and wildlife must pay their way as far as possible.

Conservationists must be "realistic" and pay for the natural world through tourism and all the rest. But conservation based only on financial return is precarious indeed; the way to make money from mangroves is not to bring in the birdwatchers but to sweep aside the

trees and build a casino. Conservation needs an extra ingredient, a factor X: an appreciation of our fellow creatures; a love for them that makes their obliteration too horrible to contemplate, like the death of one's own children. Gaia in its strong form-the claim that all creatures collectively form one organism-really does not work. But Gaia in a more modest guise- pointing out that we and our fellow creatures are all in the same boat and need each other, and suggesting that we must be physician to the whole because we are the only ones with the wherewithal to do so -- is well worth pursuing.

Colin Tudge's latest book, "Neanderthals, Bandits and Farmers: how agriculture really began ", is published by Weidenfeld & Nicolson at 4.99

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