STANDING UP FOR GAIA:
The Planetary Medicine of James Lovelock

Independent British scientist James Lovelock is a planetary physician. His patient is the living organism called Earth and as a doctor he's very much the patient's advocate. It isn't every general practitioner who gets to name his client, but Lovelock is exceptional. About twenty years ago he formulated the outlines of his now famous Gaia Hypothesis which has been widely debated, repudiated, extolled, and metaphorically extended ever since.

Our Earth, postulated Lovelock on the basis of his worldwide atmospheric and climatological research, is a unified, self-regulating, living organism. The remarkable consistency of an unstable atmosphere at a constant composition over billions of years necessarily indicated some kind of automatic regulating agency and control system---"the presence of the invisible hand of life"--- in favor of life, Lovelock reasoned. For Lovelock the evolution of biological species and their material environment is so tightly coupled that together they comprise a single, indivisible living organism. Earth's minerals, plants, animals, oceans, atmosphere---all are components of one large self-sustaining organism. Homeostasis of the oceans, climate, atmosphere, and planetary crust (the environment) is maintained by "active feedback processes operated automatically and unconsciously" by the resident biota (life). Lovelock christened this planetary regulator Gaia, after the ancient Greek concept of an Earth goddess.

It was NASA's startling photographs in the late 1960s of our bluewhite planet that initially birthed the Gaia Hypothesis in his thinking, says Lovelock. That rivetting astronautical view of our home planet as a whole entity inspired Lovelock with an unconventional "top-down approach to Earth and life science, the approach that physiologists use for living systems." A physiological model for understanding the Earth had actually been suggested in 1785 by James Hutton, the father of modern geology, when he lectured before the Royal Society of Edinburgh, Scotland. "I consider the Earth to be a super-organism," Hutton declared, "and that its proper study should be by physiology." But that was the 18th century when scientists were still comfortable with a total systems model like physiology.

Mainstream science in our day is still dominated by that "apartheid of Victorian biology and geology," a late19th century conceptual remnant that divides the world into incommunicable geological and biological models, says Lovelock. Scientific specialists abound, each with his separate, proprietary turf, each with her expertise of minutiae, but almost nobody dares to take the holistic generalist's view---except Lovelock. With that characteristic flair of the English nonconformist, Lovelock would have none of this "disastrously fragmented science" and set out to remold scientific vision on a Gaian scale.

If Gaia is the organic regulator, how does She do it? To answer this Lovelock forwards the "old fashioned transdiciplinary" approach of geophysiology, a bold revisioning that sees geological and biological processes as interdependent, automatic phases of a single evolving planetary system, the superorganism called Gaia. "With geophysiology, a single evolutionary science, a theory of the living Earth, describes the history of the whole planet. We have to model the global system on the basis that we're dealing with a responsive physiological system, not just an inert, dead planet that happens to have life on it, which is the standard model most scientists use."

Geophysiology, then, is about the blood and nerves and sinews and health of our planet, metaphorically speaking. It's the foundation text for any study of planetary medicine. For Lovelock it's the crucial whole systems science that takes a top-down look at the whole Earth. "Geophysiology offers a different view and a different set of priorities for global environmental problems," explains Lovelock. With this, Lovelock established the "essential theoretical basis"

for the profession of planetary medicine. "We need, as well as science, an empirical approach like medicine for our environmental ills." As the first in what he hopes will be a new breed of planet doctors, Lovelock diagnoses complex, intractable environmental problems---acid rain, ozone depletion, nuclear radiation, methane pollution, greenhouse gases---as health crises and "perturbations" in the homeostatic life of a 4 billion year old living planet.

"There is nothing to stop us from going through a routine examination of the temperature charts and the biochemical analyses of the body fluids of Gaia's planetary biology," Lovelock says. "With any class of environmental problem, such as tropical rain forest clearance, we look at the whole system, try to envisage what it would do in a state of health, then compare that with what's happening to it now. We look for physical signs of damage, the way a physician does. We measure temperature, pulse rate, and come to empirical conclusions, rather than exact scientific answers. These conclusions suggest remedies, treatments, or at least palliations. We can take action in advance of hard and fast scientific conclusions and expensive models based on these issues. Inevitably there will be mistakes, but the net effect will be beneficial."

Geophysiology is a very young but practical discipline, still at the information-gathering stage, much like 19th century biology when Victorian scientists trekked through remote jungles to collect exotic biological specimens, says Lovelock. Advocates for holism in medicine, whether for individuals or planets, are not universally popular, especially among their awed or outraged colleagues. So Lovelock hasn't been unanimously enthroned as the Gaia guru by establishment science. "Big science rejects Gaia but has little to offer instead," cautions Lovelock. If the Gaia Hypothesis turns out to be a "fair description" of the Earth's operating system, "then most assuredly we have been visiting the wrong specialists for the diagnosis and cure of our global ills."

For many outside the bastions of science, and for a few brave souls within its orthodoxy, Lovelock is the right specialist. For them, Lovelock's Gaia Hypothesis has taken root not only as a potent, poetic, feminized metaphor of planetary holism, but as a self-evident, even urgent, truth. "If the Earth is like this, then to survive, we face the hard task of reintegrating creation, learning again to be part of the Earth and not separate from it. I don't believe in branches of science. There's just one big mystery out there and we all have to join in." Curiously, even those who strenuously disagree with Lovelock's Gaia, still join in the discussion about the mystery. Perhaps that's why *New Scientist* , in their report on a key 1988 scientific conference on Gaia in the U.S., said "a revolution comes of age."

"It's a potent ecumenical force," comments Lovelock. "It's the only subject with which you can fill a meeting hall with scientists from zoology to astronomy. No other topic will get scientists from across the board to discuss it, even philosophers, politicians, and theologians. That fact alone makes Gaia worthwhile for me. That's where it may have absolutely done good."

Yet the ecumenism of Gaia generates a paradoxical situation. Lovelock, now 72 and a renowned scientist, inventor, experimenter, and author---renowned almost despite his provocative hypothesis---puts forward a scientific model that most conventional scientists reject or ridicule while the nonscientific, intuitive types take it up as a brilliant metaphor for the contemporary environment and an emergent new spirituality. "All scientific theories if large are subject to being turned into metaphysics, which is like a black hole. Darwin's theory of evolution was subject to all kinds of metaphorical abuse." Peer review may be an excellent system for sorting out the sloppy from the meticulous in research at the "picayune" level, says Lovelock with a shrug. "But with large ideas like Gaia it's dreadful. It becomes a form of censorship."

Lovelock presented the latest formulations of his large idea to a consortium of thirty students in the inaugural month-long course of the brand new Schumacher College in Totnes, Devon, in England's bucolic southwest. Students of all ages, from mid-20s to early 80s, travelled from a dozen countries---Zambia, Australia, Japan, Hungary, Canada, the U.S.---to participate in discussions, computer modelling, and field trips with Lovelock in January 1991 on the theme of Gaia's physiological health and the requirements of planetary medicine. The experience was a

pleasant surprise, a novelty for the retiring, hermitic scientist-writer Lovelock, who never thinks of himself as a public teacher and even dislikes lecturing. "Quite honestly I have nothing against which to judge the outcome. They've been a very good audience here, very perceptive, and quite often they've asked very interesting questions. From my point of view, it seems to have been quite successful."

That's the kind of outcome Satish Kumar, Schumacher's founder and president, a former Jain monk, and editor of the prestigious literary journal *Resurgence*, hoped for. Schumacher College, Britain's first totally "green" adult education alternative institution, was inspired by the "small-is-beautiful" of the late E.F. Schumacher, one of the 1970's pop philosophers.. Backed by a L750,000 grant the school was launched as an international center for "studies informed by ecological and spiritual values and a fresher shade of college green," says Kumar. Schumacher College is a complete way of life, a contemplative *ecostery*, explains Kumar---a unique combination of monastery and academy under the aegis of ecology, in which, largely, students are responsible for the physical operations of the college.

We live in a cultural "turning point" in which ecology, spirit, and science can meet, says Kumar, so it's the college's intention to wed matter and meaning, form and spirit. Other radical luminaries of new thought and spirituality such as physicist David Bohm, economist Hazel Henderson, biologist Rupert Sheldrake, cultural historian Theodore Roszak, and Zen abbot Tenshin Reb Anderson, were scheduled to follow Lovelock's maiden voyage at ecosteric Schumacher College.

Lovelock may be a fellow luminary with peers like Bohm and Sheldrake, but in person he's soft-spoken, modest, inquisitive, with a manner that considerably underscores his international reputation---and bravura. Here's a slender, short-statured man with a flock of wavy white hair, ordinary dark-framed glasses, and a pixiesh, gentle expression who has thrown the gauntlet at almost every discipline of modern science. Lovelock, casually dressed in thick blue sweater, green corduroys, and soft suede shoes, relaxes comfortably in a stuffed chair, speaking informally, almost tentatively, to the circle of respectful, but critical students in the Schumacher seminar room.

Notwithstanding his low-key persona, Lovelock's professional credentials are formidable. He holds a Ph.D. in medicine, has taught at Yale and Harvard, is a member of Britain's Royal Society, is president of the Marine Biology Association, visiting professor in cybernetics at Reading University, life sciences consultant to NASA, gas chromotographer and inventor-on-retainer for America's computer giant, Hewlett Packard. Lovelock was the 1991 recipient of the Amsterdam Prize for the Environment, awarded by the Royal Netherlands Academy of Arts and Sciences, and the Rosentiel Award in Oceanographic Science, presented by the University of Miami. Among the reading public Lovelock is best known for his popular works, *Gaia: A New Look at Life on Earth* (Oxford University Press,1979), *The Ages of Gaia: A Biography of Our Living Earth* (Norton,1988), and his latest and highly illustrated, *Gaia: The Case for Planetary Medicine* (Gaia Books, 1991).

Lovelock is really an old-fashioned homebody scientist. That's the key to both his charm and iconoclasm. He lives with his wife, Helen, at Coombe Mill---"a small cottage with thick mud-and-straw walls and a slate roof, an English adobe"--- on the River Carey in a remote, neighborless 30 acre dell of Devon. If this renovated water mill is now his laboratory, den, meeting place, then Lovelock is the mill's *genius loci*.

"I have always thought that science was something to be done at home, like writing or composing music," observes Lovelock, who takes the advice to "think globally, act locally" most seriously. "I practice global science as a family business done at home, not as some vast remote and potentially dangerous activity." Lovelock often wonders if the loss of soul from science isn't the result of sensory deprivation, an aberration caused by too much time spent by scientists in cities and artificial environments. "How can you love the living world if you can no longer hear

bird song through the noise of traffic or smell the sweetness of fresh air?" And how can you provide planetary medicine when you never make a house call and see the patient?

In his first assignment as an independent planetary physician Lovelock saw a great deal of Gaia. He spent six months in 1971 aboard the Shackleton on a self-financed "small science" ocean voyage from England to Antartica and back. Lovelock used his own invention, a highly sensitive, homemade gas chromatograph equipped with an electron capture detector, to monitor atmospheric concentrations of chlorofluorocarbons (CFCs), a major industrial pollutant. Lovelock determined that CFCs and other gases were not only ubiquitous but actually accumulating in the atmosphere without loss or removal. In conjunction with a few other researchers, Lovelock forecast that this "Gaian mechanism" of photochemistry could eventually deplete stratospheric ozone, increase ultra-violet radiation, possibly cause human skin cancer, and precipitate greenhouse, planetary warming effects. Much of this has since transpired.

In Lovelock's Gaian diagnostics, "ozonemia is the dermatologist's dilemma." The fear of skin cancer, the apparent medical consequence of ozone depletion, led at first to a "global hypochondria" and the panicky ozone wars that sought to reduce the level of ultra-violet exposure to zero. This was a humanist but not a Gaian analysis, based on inadequate atmospheric modelling, and thus "one of the truly great scientific myths of the century," contends Lovelock. Ultraviolet radiation is part of our natural environment and has been there as long as life itself, states Lovelock, and it's not really the point anyway. Ozone depletion is "a warning of other more serious surprises yet to come"---the "carbon dioxide fever" and the climate-threatening greenhouse effect, for example. Ozonemia is one aspect of a complex interdependent Gaian web of rain forest clearance, chemicalized agriculture, methane gas pollution, acid rain, and desertification. These are all dangerous "geocidal acts," warns Lovelock, perturbations that could precipitate a planetary "shudder" and a sudden Gaian shift to a new, possibly post-human, homeostasis.

Lovelock's geophysiology makes these intricate connections clear. Tropical rain forests are being removed at a staggering rate. Not only are these massive deciduous forests useful in removing atmospheric carbon dioxide, but they are intimately involved in microclimate regulation. Forests sustain the climate; trees and rain are a closed-loop ecosystem. The rain forests evaporate vast volumes of water vapor, gases, and particles, assist in cloud formation, and keep their microregions cool and moist. Typically rain forests are burned away and replaced with "crude cattle farms" to support a voracious Western meat addiction. Once 70-80 percent of a tropical forest is burned away, the reminder cannot sustain the climate and whole ecosystem collapses, leaving "the billion poor of those regions without support in a vast global desert," explains Lovelock. Estimates state that by 2000 A.D. 65 percent of the humid rain forests will have been burned away.

"This is a threat greater in scale than a major nuclear war," claims Lovelock. "Chain saws are an invention more evil than the hydrogen bomb." In fact as a rule of thumb Lovelock excoriates the "three deadly C's: cars, cattle, and chain saws." They're harmless in moderation but malign in excess. Gaia's atmospheric balance is further perturbed in the North when agrochemical nitrate residues and sewage effluents in Britain, for example, wash into the North Sea. There they release sulfur gases which are taken into the atmosphere as "acid indigestion," mix with automotive combustion products, and fall on agricultural land as acid rain.

"The source of the acid rain problem may be as much if not more from farming than it is from industry. If you treat the problem by curtailing industry from making sulfur dioxide, you may find this hasn't cured the disease." Nor has it addressed the overwhelming incidence of methane. Methane gas "from rice paddies and cattle farts" is "probably the most dangerous substance we're injecting into the atmosphere," a greenhouse gas that will soon overtake carbon dioxide as an ozone depleter, Lovelock predicts.

Lovelock's geophysiology gives him both the tool for diagnosis and the means for prescription. Overall, the planetary outlook isn't that bleak, actually---that is, from Gaia's point of

view. "Nothing we do will wipe out the system. I don't have to be optimistic for Gaia. She's looked after herself for so long, She won't be worried by us." But when Gaia recovers from her present interglacial warm period, her planetary fever, She may do so with an apocalyptic shudder. Left to herself, Gaia would be relaxing into another normal, comfortable ice age, explains Lovelock. "She may be unable to releax because we've been busy removing her skin and using it as farmland and adding a vast blanket of greenhouse gases to the already feverish patient. In these circumstances Gaia is much more likely to shudder and move over to a new stable state fit for a different and more amenable biota."

How amenable a biota is humankind, anyway? "We are a responsive species and therefore one that will pull back from geocide in time," emphasizes Lovelock. Lovelock is optimistic, but he's really not a humanist. He doesn't categorically put the human interests first in this "very democratic planetary community," the super-organism called Gaia. This is no tenure for anyone, any species, on this planet. Humankind may represent Gaia learning to think consciously, but this is becomes a dangerous assumption if it promotes arrogance. If we seriously foul our nest and treat our planet badly, we can be voted out and destroy ourselves, warns Lovelock. Meanwhile, he's taken on the vacant position of "shop steward" and "speaker of the house" for the other Earth household "partners in Gaia, the bacteria and the less attractive forms of life."

More than steward, Lovelock sees himself as an Earth trustee, which entails accountability to future generations. "I see the world as a living organism of which we are a part---not the owner, nor the tenant, not even a passenger on that obsolete metaphor 'spaceship Earth.'" When we think geophysiologically, when we understand our intimate place in the superorganic life of Gaia, we will profoundly reconsider our present habits of exploitation. We'll see with a shock that our contemporary frenzy of agriculture and forestry is global ecocide. "Would we mine our livers for nutrients? Would we raze our hair and plant our scalps with tomatoes?" Probably not, but we might plant some trees, adds Lovelock.

Gaian homeostasis begins with the local activity of individual organisms, says Lovelock---and that includes the responsive human. "It is always from the action of individuals that powerful local, regional, and global systems evolve. Living with Gaia is a personal responsibility and each of us will develop a personal solution to the problem," suggests Lovelock. Lovelock's response was arboreal. Since they moved to Coombe Mill, James and Helen Lovelock have planted 10,000 new trees on their 30 acre Devon estate. "I always advocate planting trees. It's surprising how few trees you need to plant to overcome the effects of carbon dioxide emissions from cars."

Lovelock estimates that 10 trees per person per lifetime would produce 1000 tons of C02, about enough to consume all the carbon dioxide one human produces through cars and technology in a lifespan. We could also drive less, cut down on meat and dairy products consumption, and generally be more ecologically conscientious as consumers. "It gives you a gloating feeling of righteousness, that you're on the side of the angels," concludes Lovelock with a twinkly grin. That's the kind of planetary medicine a lot of Westerners could start administering to a feverish Gaia today.