James Lovelock

James Lovelock obituary

Scientist, environmentalist, inventor and exponent of the Gaia theory of the Earth as a self-regulating system

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Wed 27 Jul 2022 11.54 EDT

The scientist James Lovelock's discoveries had an immense influence on our understanding of the global impact of humankind, and on the search for extraterrestrial life. A vigorous writer and speaker, he became a hero to the green movement, although he was one of its most formidable critics.

His research highlighted some of the issues that became the most intense environmental concerns of the late 20th and early 21st centuries, among them the insidious spread through the living world of industrial pollutants; the destruction of the ozone layer; and the potential menace of global heating. He supported nuclear power and defended the chemical industries – and his warnings took an increasingly apocalyptic note.

"The planet we live on has merely to shrug to take some fraction of a million people to their deaths," Lovelock wrote in 2006. "But this is nothing compared with what may soon happen; we are now so abusing the Earth that it may rise and move back into the hot state it was in 55m years ago, and if it does, most of us, and our descendants, will die." In a speech to the Royal Society, he described the 2007 report of the Intergovernmental Panel on Climate Change as "the scariest official document I have ever read".

Lovelock, who has died on his 103rd birthday, was best known through the Gaia theory, a controversial idea that he proposed in the 1960s and developed with the US biologist Lynn Margulis in the 70s. They suggested a radically different way of looking at the evolution of life. Their proposition challenged the view of Earth as just a lump of rock, a passive host to millions of species of plants and animals that simply adapted to their environment. Gaia held that those countless millions of organisms not only competed, but also cooperated to maintain an environment in which life could be sustained: a process of co-evolution.

It was a conjecture that jarred with many scholars, such as Richard Dawkins, the evolutionary biologist, who regarded the notion as a profound heresy against Charles Darwin's theory of natural selection anchored in the thesis of survival of the fittest.

Gaia was an instant inspiration for the green movement; but it took years to get overt recognition from the scientific establishment. That came in 1988 when the American Geophysical Union held a meeting in San Diego, California, that drew leading physicists, biologists and climatologists to weigh the evidence for Gaia and debate its implications for the future of science.

In 2001, more than 1,000 scientists met in Amsterdam to declare that the planet "behaves as a single self-regulating system comprised of physical, chemical, biological and human components". In effect, Lovelock and Margulis had won the day: the details could be debated, but the broad argument was settled.

Early in his career, Lovelock devised techniques to freeze and then re-animate cell tissue, and even whole animals such as hamsters. Just for fun, in 1954, he used microwave radiation from a continuous wave magnetron to cook a potato. “It may have been the first working microwave oven used to cook food that was then eaten,” he wrote. “If it was, then I did invent it.”

He worked with the actors Leo McKern and Joan Greenwood on a BBC drama, The Critical Point (1957), about the experimental freezing of a human, and used a home-made electronic sound generator to simulate the failing breath, the fading heartbeat and the death rattle of an actor. He was later told that his tape inspired the BBC to found its pioneering radiophonic workshop.

He designed new types of extraordinarily sensitive instruments that could detect the presence of unimaginably tiny concentrations of man-made chemicals in gases. When they were used to study the chemistry of the atmosphere they pointed the finger at the spread of chlorofluorocarbons (CFCs) as the source of destruction of the ozone layer. Similarly, they revealed the accumulation of residues of pesticides in the tissues of virtually all living creatures, from penguins in Antarctica to mothers’ milk in Europe and the US.

Throughout his life he went on delivering inventive ideas. With Chris Rapley, then director of the Science Museum in London, Lovelock proposed in the journal Nature in 2007 a way by which humans could churn the world’s oceans to stimulate algal growth, draw down extra carbon dioxide from the atmosphere, increase the formation of sunlight-reflecting clouds and thus damp down global heating.

Lovelock was born in Letchworth Garden City, Hertfordshire, but was brought up in Brixton, south London, where his parents, Tom and Nellie, ran a shop selling picture frames. He was educated at the local grammar, the Strand school. At an early age, he discovered the public library, which he said fired a fascination with science. By comparison, he found science lessons at school dull.

In the unfettered freedom of the library, he soaked up information with equal relish from science fiction or any science textbook that caught his interest, on astronomy, natural history, biology, physics and chemistry. Lovelock’s practical flair was also given free rein. He recalled inventing a gadget as a schoolboy, an airspeed indicator that he held out of the window during train journeys.

His parents could not support their son at university, so Lovelock got a job as a laboratory technician in industry, and studied for a BSc at evening classes. In 1940 he joined the National Institute for Medical Research at Mill Hill, where he stayed for 20 years. Then a Quaker, he was a conscientious objector during the second world war.

While at the NIMR, he took a PhD in biomedical science and made the most important of his inventions, the electron capture detector. It was a matchbox size device that could detect and measure tiny traces of toxic chemicals. Like many great inventors Lovelock was not really a team player. He craved independence. The electron capture detector earned him enough money to get that freedom, and in later years he liked to describe himself as an “independent scientist since 1964”.

“Any artist or novelist would understand,” he wrote in his autobiography, Homage to Gaia (2000), “some of us do not produce their best when directed.”

Lovelock’s transition to independence began when he left the NIMR in 1961 to work for Nasa, the US space agency. He was invited to design experiments for the Surveyor series of unmanned spacecraft that were to examine the surface of the moon before the US government would authorise a lunar landing attempt by the Apollo astronauts.

He moved from the moon project to work with Nasa’s interplanetary exploration team at the Jet Propulsion Laboratory (JPL), Pasadena, California, on ideas for looking for signs of life on Mars. He was surprised at the shortage of suggestions from the universities and research institutes to a request from Nasa for proposals to study the biological aspects of the Red Planet.

He attributed the lack of interest to an obsession with molecular biology and genetic evolution triggered by the stunning discovery by Francis Crick and James Watson of how the genetic code was carried by DNA. Lovelock was disappointed in the shift in the focus of research in biology from the big picture to the small. The study of life concentrated more on a closer examination of molecules and atoms rather than on whole organisms, with the implication that the whole was never more than the sum of its parts and scientists could figure out how organisms worked by taking them to pieces.

Lovelock’s experiments to look for signs of life on Mars were conceived quite differently, through a holistic approach rather than a reductionist one; and his approach had an important influence in the thinking he and Margulis shared in establishing the principles of the Gaia theory.

Nasa plans to look for evidence of extraterrestrial life were targeted initially on Earth’s neighbouring planets, Venus and Mars. Lovelock predicted from a study of the chemical composition of their atmospheres that both Mars and Venus would be lifeless. Then, with a bit of pure lateral thinking, he wondered how Earth might appear to an extraterrestrial intelligence.

He pursued the idea in a conversation with Dian Hitchcock, a colleague at JPL, about why there were such extreme differences between the atmosphere of Earth and those of Mars and Venus. He said the conclusion he reached was probably the moment Gaia was born.

The atmospheres of both Mars and Venus comprised over 95% carbon dioxide, with small amounts of nitrogen, oxygen and other gases. In contrast, the Earth's atmosphere was 77% nitrogen and 21% oxygen, with traces of carbon dioxide and other gases. He looked for an explanation as to what made the Earth's atmosphere so different, and unique in our solar system. The evidence that the sun's energy had increased 30% during the three and a half billion years life had existed on the planet, and yet the Earth's surface temperature had remained constant, particularly puzzled him.

Lovelock reckoned that, according to standard physics, the planet's surface should have boiled with the increasing heat, rather than remain cool. The only explanation, he decided, was that the Earth was a self-regulating system that had found a way to preserve its equilibrium: and that the organisms on Earth had kept their environment stable. He reasoned that the Earth's atmosphere was a continually changing balance of gases because of its living and breathing inhabitants, while the Martian atmosphere was static.

The regulatory mechanism began when the earliest life-forms in the ancient oceans extracted carbon dioxide from the atmosphere and released oxygen back into it. Over vast spans of geological time, the concentration of carbon dioxide in the Earth's atmosphere declined to the present composition to favour the oxygen-dependent organisms. Lovelock and Margulis argued that the biosphere of planet Earth could be considered a self-evolving and self-regulating system that unconsciously and subtly manipulated atmosphere, water and rocks to its own advantage.

When he was developing his theory, Lovelock described his ideas to his then friend and neighbour in the Wiltshire village of Bowerchalke, the novelist William Golding, and asked his advice on a suitable name. Golding suggested Gaia, after the Greek goddess who drew the living world forth from Chaos.

As an illustration of the Gaia theory, Lovelock invented the Daisyworld model of coevolution. Daisyworld involved a field of black and white daisies. If the temperature rose, the black flowers absorbed more heat than the white ones, and withered. The white daisies proliferated. Eventually, the white daisies reflected more heat back into space, cooling the planet down again and allowed the black daisies to re-emerge.

Although Gaia exerted a great influence on the green movement, Lovelock had, by his own admission, "never been wholly on the side of environmentalism". He acted as a consultant to corporate groups such as Hewlett-Packard and Shell, and in Homage to Gaia wrote: "Too many greens are not just ignorant of science, they hate science." He likened them to "some global over-anxious mother figure who is so concerned about small risks that she ignores the real dangers". He wished they "would grow up" and focus on the real problem: "How can we feed, house and clothe the abundant human race without destroying the habitats of other creatures?"

Unlike most environmentalists, Lovelock favoured nuclear energy. "Some time in the next century, when the adverse effects of climate change begin to bite, people will look back in anger at those who now so foolishly continue to pollute by burning fossil fuel instead of accepting the beneficence of nuclear power. Is our distrust of nuclear power and genetically modified food soundly based?" he asked.

He filed more than 40 patents, and wrote more than 200 scientific papers, as well as several books on the Gaia theory. He was awarded scientific medals, and showered with international prizes and honorary doctorates by British and other universities.

From his first book, Gaia: A New Look at Life on Earth (1979), to his last, published when he was 99, Lovelock wrote elegantly and persuasively. He remained an optimist. In Novacene: The Coming Age of Hyperintelligence (2019), he delivered what he called "a shout of joy" for the colossal expansion of human knowledge during his lifetime, and hoped for the potential salvation of humanity by a new generation of artificially intelligent cyborgs that would – unlike many of his fellow humans – understand the importance of other living things in maintaining a habitable planet.

In 1977, Lovelock and his wife Helen – already ill with multiple sclerosis – moved from Bowerchalke to Coombe Mill, near the Devon/Cornwall border, which grew into a 35-acre woodland experimental farm. In later years he lived in Abbotsbury, near the Dorset coast.

Helen (nee Hyslop), whom he had married in 1942, died in 1989. His second wife, Sandy (nee Orchard), whom he married in 1991, survives him, along with two sons, Andrew and John, and two daughters, Jane and Christine, from his first marriage.

James Ephraim Lovelock, chemist, biomedical scientist and inventor, born 26 July 1919; died 26 July 2022

Pearce Wright died in 2005

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