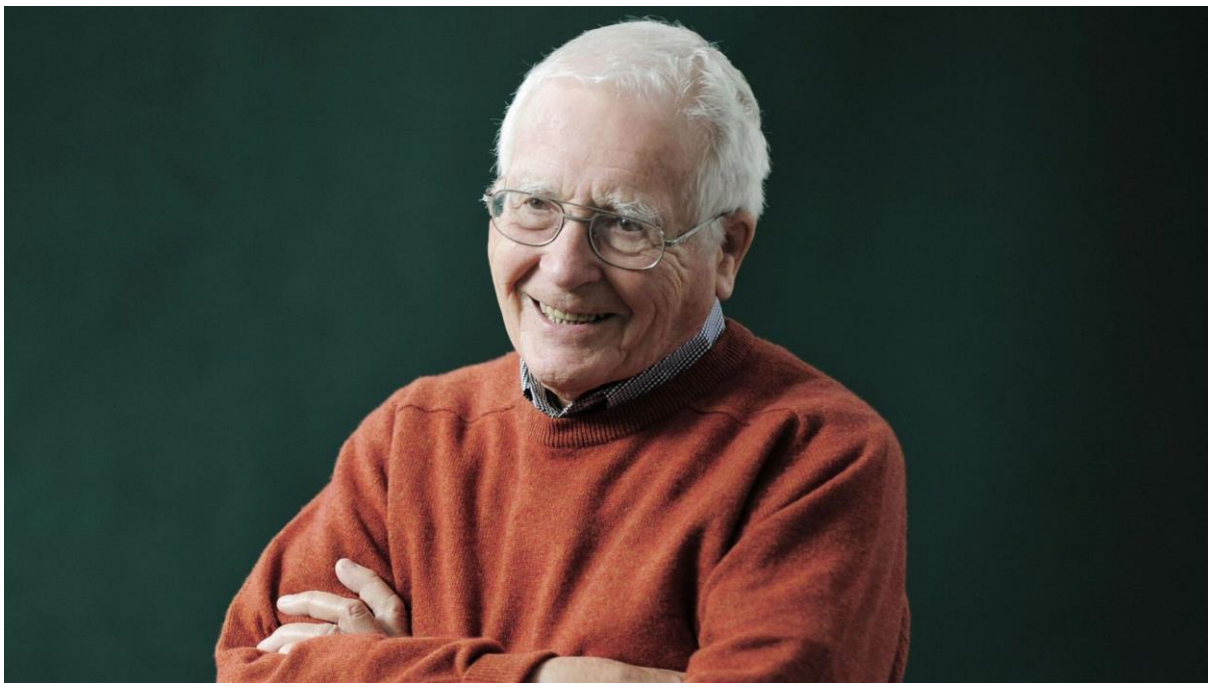
In Memoriam: James Lovelock

Died on his 103rd birthday, 26 July 2022

www.voiceforarran.com September 2022 Sally Campbell

"*My main reason for not relaxing into contented retirement is that like most of you I am deeply concerned about the probability of massively harmful climate change and the need to do something about it now.*"

– James Lovelock in a talk at the Geological Society of London, 5th May 2011.



As an ecologist, I was interested early on in complexity which in simple terms really is how everything affects everything, as clearly illustrated in the tidal cycles on the seashore, effects of sea temperatures, waves, pollution, types of sea shore and animals and plants. Human interactions too leaving their imprint on the marine environment, from fishing to cruising to tourism and containers for trade. We are all realising that these effects collectively influence our world climate and the future of life as we know it on planet Earth.

It was also James Lovelock, born in 1919 and who died on his 103rd birthday in July this year who gave me inspiration. He was an independent thinker, scientist and futurist. He had a PhD in Medicine. Curiosity drove him and accuracy pleased him. He was raised as a Quaker and was a conscientious objector during WW2, working

instead on burns research to assist those injured in conflict. But natural systems fascinated him too, from early in his life.

His first great invention was the electron capture detector in 1957 and he used it, coupled with gas chromatography, to determine the widespread presence of chlorohydrocarbons in the atmosphere. He became the first to discover human made gases were building up in the atmosphere which led to the global debate about the ozone hole over Antarctica, and indeed the whole issue of persistent man-made chemicals and global warming.

Ozone depletion. Man-made compounds such as chlorofluorocarbons (CFCs), hydrofluorocarbons (HCFCs) and other halons destroy ozone in the upper atmosphere (stratosphere). The stratospheric ozone layer makes life possible by shielding the earth from harmful ultraviolet (UV-B) rays radiated from the sun. Decreased concentration of stratospheric ozone allows increased amounts of UV-B to reach the earth's surface, hence increased dangers of skin damage and skin cancer.

What are chlorohydrocarbons? Rachel Carson refers to these chemicals and pesticides in *Silent Spring* (1962) as "biocides" or "life-killers". She specifically writes about Chlordane, Heptachlor, Dieldrin, and Aldrin. All of these are used on crops and are in the same family as DDT. Each of these chemicals build up in the food chain rather than degrade, causing these persistent chemicals to become more chronically toxic than DDT. These chlorohydrocarbons have been shown to cause seizures, sterility, and death.

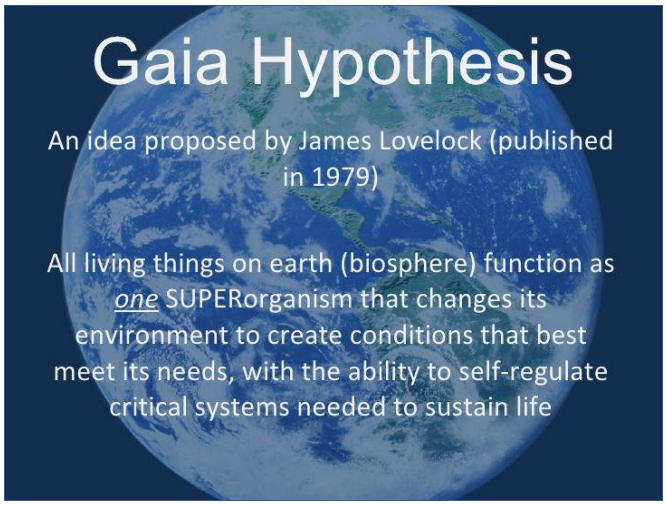
They are often not readily degradable. They "hang-around" in soil and air. For example, Dieldrin entered the environment when farmers used these compounds to kill pests on crops. Dieldrin adheres to soil and may stay there unchanged for many years. Plants can take up dieldrin from the soil and store it in their leaves and roots. Fish or animals that eat dieldrin-contaminated materials store a large amount of the dieldrin in their fat. Contaminated foods might include fish or shellfish from contaminated lakes or streams, root crops, dairy products, and meats. Exposure to

dieldrin also occurs when you drink water, breathe air, or come into contact with contaminated soil at hazardous waste sites. Skin contact and breathing of dieldrin by workers who used these chemicals to kill insects were at one time common.

Due to their persistence and lipophilicity (easily dissolved in fats, oils, lipids, and non-polar solvents such as hexane or toluene), they tend to concentrate in organisms and in the food web. Because of these properties and the research enabled by Lovelock's gas chromatography detectors applied to studies of our atmosphere, many chlorinated hydrocarbons were detected and blamed for natural ozone depletion; now known as members of the so called "dirty dozen", a group of 12 persistent organic pollutants (POPs) have been banned, or their uses restricted by the Stockholm Convention of 2004, thanks in a large part to the use of Lovelock's development of the analytical detector as means of quantifying their presence.

GAIA HYPOTHESIS

But Lovelock was never just about science and data; he possessed a heightened intuition and feeling. He became well known for proposing the GAIA HYPOTHESIS in the 1970's which he determined that the Earth functions as a self-regulating system.



James Lovelock changed the way human beings look at the Earth.

One of his greatest contributions was to our understanding of the climatic systems of the Earth and our interactions with it.

In science and life, the reward for a curious mind is to look for one thing and find another that is even more interesting. He saw his real gift as the ability to cross boundaries and combine fields. As he eloquently put it "My role has been to bring

separate things and ideas together and make the whole more than the sum of the parts." This idea and understanding of complexity were his lasting gifts to science and the environment.

The Gaia hypothesis, also known as the Gaia theory, Gaia paradigm, or the Gaia principle, proposes that living organisms interact with their inorganic surroundings on Earth to form a synergistic and self-regulating, complex system that helps to maintain and perpetuate in a dynamic sense the conditions for life on the planet. The Gaia hypothesis, named after the ancient Greek goddess of Earth, posits that Earth and its biological systems behave as a huge single entity. This entity has closely controlled self-regulatory negative feedback loops that keep the conditions on the planet within boundaries that are favourable to life.

LIFE SHAPES THE ENVIRONMENT

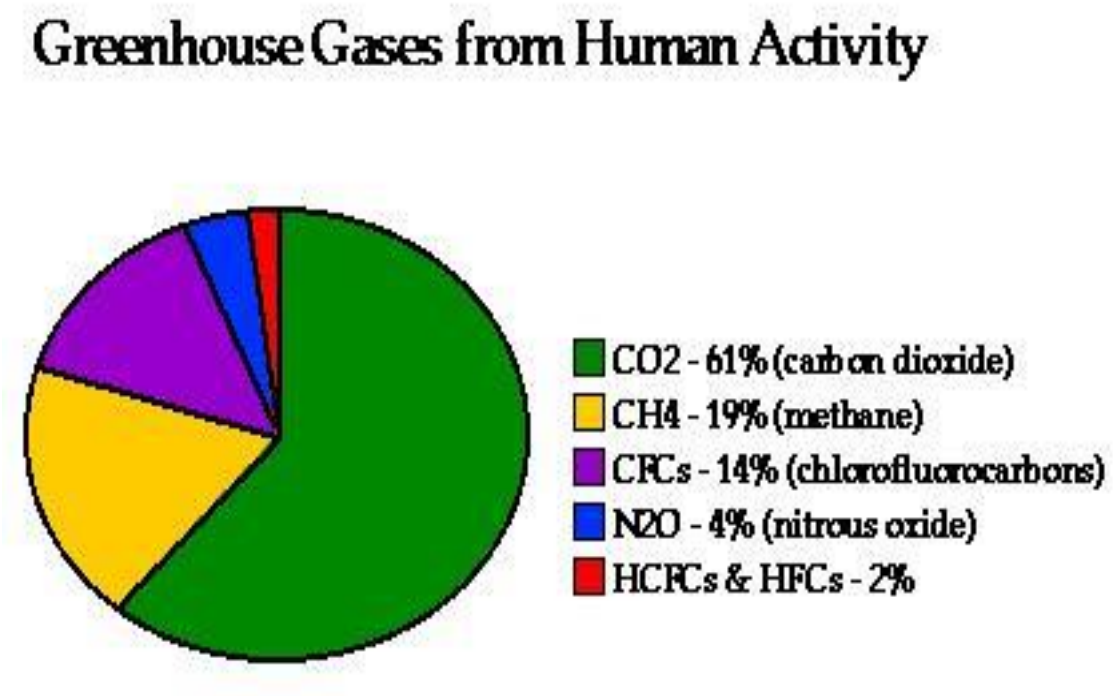
Gaia theory was radical in the 1970s and 80s because it challenged the prevailing Darwinian view that life was shaped by the environment. He was often at loggerheads with his contemporaries in academia who had built careers by specialising in ever-more narrow niches. He was unafraid to speak out. Gaia is a step further than the Darwinian view by suggesting the reverse is just as true: life shapes the environment. The idea that algae and other tiny, unglamourous creatures do most of the hard work in maintaining chemical balance of the atmosphere was considered ridiculous but is now a fundamental part of Earth system science.

OUR CLIMATE AND FUTURE ENVIRONMENT

James Lovelock said the planet behaved like a living organism and this metaphor, which further infuriated the neo-Darwinists, ensured this holistic of theories spread far beyond academia and into modern popular culture. In the 2020s, he proposed a method of climate engineering to restore carbon dioxide consuming algae. He believed in Nuclear Energy and considered the fossil fuel interests had been behind the opposition to nuclear energy; he cited the effects of carbon dioxide as being harmful to the environment and warned of global warming due to the harmful

greenhouse effect. He wrote 4 books on the hypothesis; Gaia: a new look at life on Earth Oxford University Press (1979); The Ages of Gaia (W.W. Norton,1988); Gaia: the practical science of planetary medicine, (Gaia Books,1991) and Homage to Gaia (2000).

For me, his understanding of the complexity and interdependence of all systems in the world is key, which of course involves each one of us as part of that complexity; making changes through our actions, for the wellbeing or otherwise of our climate and future environment. Survival, is of course the driver for each of us taking responsibility for the future of our planet and all that lives on it. Out of Gaia theory has emerged models of climate and how greenhouse gases play their part. It is now up to us to make choices based on science and data; we each have a role to play through our choice of lifestyles and behaviour changes.



hydrochlorofluorocarbons (HCFCs) and Hydrofluorocarbons (HFCs)

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Lovelock wrote of his electron capture detector:
http:ecolo.org/lovelock/lovedeten.htm

" When devising a series of ionisation detectors for gas chromatography in the mid 1950's I had no notion that one of them, the electron capture detector, would significantly affect the development of environmental thinking.

It was invented in 1957, and is still among the most sensitive of chemical analytical methods in existence; moreover, it is specifically sensitive to those chemicals that are a threat to the environment. Its use led to the discovery of the ubiquitous distribution of pesticide residues in the natural environment, and to Rachel Carson's book, The Silent Spring, which can be said to have started the environmental movement. It was later used to discover and measure the abundance of PCBs, chlorofluorcarbons and nitrous oxide in the atmosphere. Most recently, the detector has made possible a system of atmospheric and oceanic tracer technology. Perfluorocarbons, which are otherwise inert and harmless, are easily detected tracers by electron capture. This system has enabled meteorologists to follow the movement of air masses across continents and is now finding use in ocean research."

"*I cannot overstate how profoundly transformative his contribution was,"* Professor Pitman, Australian climate scientist says "*There are many people who think he has had more impact on our understanding of the Earth than any other singular scientist through the 20th century.*"

I can't help but agree wholeheartedly!

Sally Campbell
August 2022

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