A ROUGH RIDE TO THE FUTURE
James LOVELOCK

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Going through the books on the shelves of my favourite bookshop my eye fell on "A rough ride to the future" by James Lovelock. What? Lovelock?! Is this the renowned Lovelock who, in the late 60s-early 70s, came up with the Gaia hypothesis? Is this likely? Wouldn't he be quite old by now for still being writing and publishing? Then reading the back cover: "*James Lovelock, the visionary who gave the world Gaia theory, has lost none of his power to provoke…his ideas are fascinating*". So, indeed this book published in 2014, is by Lovelock, then well in his nineties (he was born in 1919). This book is part a memoir of his long life in science and part on his visions on whether humankind can survive climate change and population growth.

For those who don't know him yet, James Lovelock is a scientist-inventor. And he insists on the "inventor". He was never part of any research institute or university. He worked independently with his own laboratory in his home. Initially he was involved in the development of medical instruments. His early career was during World War II when he worked for the UK Defence on specific soldier-proof equipment: it had to be robust enough for use on the battlefield and capable of use after only a few minutes of training. No glassware or primitive electronics of the 1940s would do. Lovelock defines "invention" as a response to an urgent real-life need: invention is driven by necessity.

The topic of invention comes back frequently. Lovelock states that while humankind has been an inventor all along, the rate of new inventions has significantly accelerated since the 18th century when a chain reaction followed Thomas Newcomen's steam engine of 1712. What others would call the Industrial Revolution, Lovelock sees it as the start of a new era: the Anthropocene. According to Lovelock, the emergence of this crucial period, with massive greenhouse gas emissions leading to climate change and ecological changes, may change the Earth and its future as much as did the origin of life more than 3 billion years ago.

In 1957, Lovelock had invented the ECD (Electron Capture Detector). This had a profound effect on the views on industrial poisons that have either innocently or carelessly contaminated the natural environment. The ECD was intimately involved in the consequences of Rachel Carson's revelations in her famous book "Silent Spring" (1962). It turned out that the high sensitivity of the ECD allowed for detection of DDT and other poisonous substances farmers then used. It allowed to confirm Carson's claim that pesticides were everywhere in the world. In the process, Lovelock became especially interested in the gas composition of the atmosphere. He realised that the composition of the atmosphere whether on Earth, on Mars or somewhere else, would allow understanding if there was life on a planet. Life can only exist if there are nutriments. But the nutriments are consumed, so for sustaining life, a constant flux of nutriments is necessary. The notion of a "constant flux" means that the system is not stable. So if the gas composition of an atmosphere is stable, it is very unlikely that there is life. Similarly, if the gas composition of an atmosphere is unstable, this is a strong indication for life. Lovelock has designed equipment that was included in NASA spacecraft that were sent to space to investigate the atmosphere of Mars.

Lovelock was aware of French Grenoble-based research on gas analyses carried out on ice cores from the South Pole obtained by deep drilling and covering a large geological timespan. These results allowed for knowing the evolution of the composition of the atmosphere in the past. Such understanding also allows for evaluating the average Earth temperature of the respective geological periods in history. Combining the results on the evolution of the temperature of the Earth over geological time, with the temperature which may be expected based on the evolution of the Earth itself (volcanic activity), evolution of the sun (and progressive heating) including the consequences of the distance between the Sun and Earth, it appears that the expected temperature of the Earth would be progressively increasing and probably be much warmer than the Earth appears to be at present. Furthermore, despite temperature fluctuations in the geological past, these fluctuations have remained within a rather small range; a range compatible with life as we know it. The Gaia hypothesis of Lovelock is that Earth as a living system, is able to control her temperature within a certain range. The "thermostat" is based on a readjustment of life to certain conditions that will allow avoiding running out of control: avoidance of overheating and undercooling beyond the temperature compatible for life. If the Earth is too cold (resulting from, for example, volcanic ashes limiting sun warmth after periods of extensive eruptions), the living cells will react by releasing more greenhouse gases, and hence allowing for the warming up of the atmosphere. On the other hand, in order to cool down, organic matter can be buried by the sediments in periods of intensive erosion. The Gaia hypothesis is about self-regulation by the living Earth (the planet Earth and its living inhabitants, whether cellular or complex life forms). Lovelock simulated such evolution with computer models of "Daisyworld". But if Lovelock is the spiritual father of Gaia, then Lynn Margulis is the spiritual mother. She was an eminent biologist who suggested that an important if not crucial step in evolution took place when eukaryotic life appeared. It occurred when one form of unicellular prokaryotic life was ingested by another. Usually when this happens, the form of life ingested is eaten, but on rare occasions the two forms enter a symbiotic union of mutual benefit and form a single eukaryotic cell that can reproduce as a new species. This happened some 2 billion year ago. (Another example of symbiosis are muscle cells).

Now this is all about the past, how does Lovelock see the future? It is unlikely that we will stop using hydrocarbon energy and limit greenhouse gas emission soon. Even if greenhouse gas emission is stopped, climate change will not stabilise immediately. It takes time to take decisions on world scale, and once we decide it may be too late. Despite the good intentions of the Kyoto Convention, Copenhagen and Rio, not much has changed effectively so far. It is therefore unlikely that we will be able to stop climate change soon.

According to Lovelock, Gaia will be able to settle on a new albeit slightly warmer equilibrium. However this slightly warmer equilibrium may not be suitable for human life as it is today. When reading science fiction, migration to other planets is often brought up. This would be in fully isolated living units with total control of the atmosphere in terms of air, water, food production, etc. Life on other planets is not an option for Lovelock. However, he thinks that in order for humans to survive, our future living places may have to be confined to fully climate controlled cities. Life outside of the cities might be impossible beyond a certain stage of climate change. We might be living the type of life similar to insect colonies, like ants or termites, within a well-defined habitat tailored to our needs. … And surprisingly, the "needs" bring us back to "inventions" and "inventors". The Anthropocene, the era of inventions, is only just beginning.