

Gaia Theory, created by James Lovelock, describes Earth as a living organism with “vital organs” and a crucial system of checks and balances. This painting is my abstract idea of what Gaia Theory represents as a whole. The sphere full of nature resembles the Earth as a living organism as the vines keep everything inside as well as connect the elements on the outside of the sphere. The animals are representative of the “vital organs” of the Earth, that Lovelock described, the scarlet macaw symbolizing the rain forest, a silver surfperch to symbolize the coastal seas, and the polar bear for the arctic.

I was intrigued to learn of others’ opinions and additions to Lovelock’s theory, and have modeled my painting on that system of scientific questioning and modification. The arctic polar bear, for example, is included as a nod to another scientist’s later addition of the arctic as a “vital organ,” which was meant to help prove the validity of The Gaia Theory. I decided to add the elements of humanity as well, since we should be a part of the cycle as stewards. I added a factory to symbolize industrialization, a farm to symbolize agriculture, and a house to symbolize society and community.

Devon

The Gaia Theory was created by James Lovelock in 1960, but there are two theories due to critiques from Lovelock's colleagues. First known as "The Gaia Hypothesis," it explains how "the Earth's organisms regulate the physical and chemical components of the Earth system so as to maintain the planet as an optimal habitat for life" (Enting 1). Gaia Theory is the revision of the Gaia Hypothesis explaining "the combined physical, chemical, and biological components of the Earth system regulate the planet so as to maintain it as a habitat for life" (Enting 1). I believe that The Gaia Theory has an interesting perspective on science behind it. Learning about this topic truly intrigued me to dive in deeper to really understand what Lovelock was trying to prove with The Gaia Theory. So why is Gaia Theory looked down upon in the scientific world?

This theory has been discussed for over forty years, during which many scientists critiqued and despised Lovelock's theory because it was not a serious scientific topic at the time. Richard Dawkins, the creator of the Darwinism and Darwinian evolution, criticized the Gaia Theory for being impossible in the light of his research. Dawkins states "the emergence of Gaian self-regulation through the course of evolution is allegedly extremely improbable." (Dawkins 2). Dawkins also stated how the planet would not survive long if it had Gaian self-regulation and continues to argue how it contradicts the Darwinian evolution. Darwin's evolution is based on how the Earth's economic resources cannot be multiplied, and explains how populations will grow without limit and with ever increasing velocity. His idea of Natural Selection is that all living things of different species correlated together in a single process of development. Even Dawkins theory had its flaws, explaining how transitional forms explode into new life forms and challenges the ability of random mutation as part of natural selection, but it was not rejected like Lovelock's theory. More contemporaries of Lovelock also share a distaste for his theory. Many academics and colleagues of Lovelock shared their opinion in an article published in *The New Scientist* in 2013. Here they discussed how the Gaia Theory is "a beautiful, but flawed theory" (New Scientist 1). T.H. Huxley a biologist explains Lovelock's theory as "the great tragedy of science- the slaying of a beautiful hypothesis by an ugly fact" (New Scientist 1). Huxley's quote is absolutely true since scientists over the years have already figured out the Earth system which he refers to Richard Dawkins Darwinian Evolution. Therefore the Gaia Theory in his terms is just another elegant hypothesis. John Maynard Smith called it "an evil religion," Stephen Jay Gould branded it "a metaphor, not a mechanism," Paul Ehrlich referred to Lovelock as "radical and dangerous," and Robert May named Lovelock "A holy fool" (New Scientist 2). Lovelock was disheartened by these reactions from his colleagues and felt that his twenty years of research was a "dead loss." (New Scientist 2). "External doubts aside, he kept his hopes up and his head held high" (New Scientist 2) as more negative opinions continued to surface.

Though Lovelock's theory was not popular in the scientific world, he obtained a degree of celebrity among the public specifically gaining favor among philosophers, poets, writers, environmentalists, pagans, religious people, and many more. Michael Ruse, a philosopher, was the first to find the roots of Gaia Theory in Plato's research and writings labeling him "the first real Gaia enthusiast" as well as finding hints of Gaia within Darwin's theories. Ruse also found hints of Gaia throughout the impassioned nature writings of Ralph Waldo Emerson and Henry David Thoreau. Other places include the transcendental idealism of Immanuel Kant and Fredrich Schelling which is about nature and spirit or natural philosophy, and Herbert Spencer's Social Darwinism, which takes Darwin's theory and compares it to the changing of society. These new findings only fed Lovelock's growing popularity. He soon was invited by 21 publishers to publish books about his theory.

Why is the Gaia Theory so popular amongst the public? Could it be because this is the first ever “scientific expression of an ancient belief of Earth as a living creature” (Joseph 1)? In ancient times, Gaia was known as a Greek Goddess of the Earth, the daughter of Chaos and the mother and lover of the sky, Uranus, the mountains, Ourea, and the sea, Pontus. Bringing back an ancient culture and belief which combined religion and science helped the theory grow in popularity. The Gaia Theory, in other words, was “an organized principle causing biologists, geochemists, and atmospheric physicists to work/ collaborate together” (Joseph 15), causing another moment in history when religion and science correspond with each other.

What exactly was Lovelock’s objective in making this theory? To know, we must consider it in the context of his life and career. Unlike most scientists, Lovelock studied all the different branches of science rather than focus on just one. He also explained that his ultimate objective was to work like an artist or novelist. “He views art and science as the same principles.” Joseph said, in his 1990 book Gaia the Growth of an Idea, after interviewing Lovelock. Lovelock also enjoyed the “idea of creative freedom” (Joseph 17) which was exactly what helped him to improve and continue with his theory. His goal for the Gaia Theory was “to translate this notion of Earth, as a single coherent organism, into political and cultural policy.” (Joseph, 17). As earlier mentioned Lovelock studied in multiple science branches but, had a degree in chemistry and medicine, as well as taught engineering, physiology, and cybernetics at various England universities as well as Harvard, Yale, and Baylor. To think such a smart person like Lovelock could be labeled by his own colleagues “a holy fool” is challenging.

Lovelock’s research begins with his examinations of Venus and Mars. He found that Earth is made of the same elements as these planets, though for Earth the air is protection against the cold depths and fierce radiations of space. This helped him formulate, “an entity comprising a whole planet with a powerful capacity to regulate the climates needs” (Lovelock 1). Soon suggestions of Earth acting as a biological super organism or a planetary body that adjusts and regulates itself, began to form in the growth of his theory. Gaian scientists referred to this find as “geophysiology, the science of bodily process applied to the planet Earth” (Joseph 1). This caused more interest about how the Earth, “maintains itself through a complex system of corrective mechanism buffers” (Joseph 1). Soon, scientists and Lovelock began studying the Earth as if it were a human body. Scientists warned that if it acted like a body it must have vital organs and vulnerable points. They identified some of these vitals points as tropical rain forests and coastal seas. Lovelock then began to measure the amounts of pollution and gases present in the atmosphere with an Electron Capture Detector (ECD). Lovelock found by studying Mars and Venus once more, compared with Earth, all three planets had three types of gases present in their atmospheres. Oxidizing gases, neutral gases, and reducing gases, Geoffrey Cowley from Newsweek described how the Earth changed from “an inert chemical ball into an immense, self-regulating organism.” (Joseph 31). Lovelock also found that Earth’s atmosphere has reducing gases and oxidizing gases coexisting with each other. In other words, “this is an unstable situation as if we are breathing the air with premixed gases that go into a furnace or internal combustion engine” (Joseph 27). Lovelock, when naming his theory, wanted to call it the Biocybernetic Universal System Tendency/ Homeostasis, but decided on the Gaia Theory. “Gaia” is the fact to why it failed any serious scientific consideration. Since Gaia originated as a name for a goddess in ancient Greek mythology to have a scientific term named after a non-existent entity was unacceptable to scientists. His definition and little research at the time only made the Gaia Theory seem more like a metaphor or poetic construction. Continuing on with his research, Lovelock did not falter, but rather continued to study the growth of Redwood trees and

the mysteries behind chloroplast. After hearing the physicist Jerome Rothstein's theory of trees being alive, which are actually 97 percent dead, at the first large Gaian conference on August 1985. Lovelock decided to compare Earth as a tree starting with how the bark that protects the tree was exactly how the Earth atmosphere protects us. Lovelock next realized how the rocks and minerals were like the ancestral life, which is the inside of the tree that the bark protects. Observing every mineral sample that man has studied, all the way back to billions of years ago, that all the samples have been directly modified by the living organisms.

Microbiologist Lynn Margulis "believes deeply that she is studying the basis of all earthly life, the power and essence of Gaia" (Joseph 40). Margulis has studied cytoplasm over the ages, first originating from costal seas, and how it has adapted itself to regulate in hostile surroundings. Her research and her "fascination with the mechanisms of symbiosis" (Joseph 40) is linked closely with the Gaia theory's topic of life regulating its own environment. She believes that, working individually and collectively, many plants, animals, and microorganisms were able to make more suitable homes for themselves. As long as these life forms continue to sustain themselves and live on, the Gaia theory and the coevolution of life and environment are found to be linked with each other in this process.

Examples of Gaian environmental engineering first were discovered in Laguna Figueroa, along the western coast of Baja California Norte, Mexico. Here they studied three communities of huge stratified microbial communities in the hypersaline tidal channels. Here they found that the bacteria acted a lot like layers of skin within the water and on its surface, each of the communities relied on each other for survival. Marquis explains how "These multicellular layers are as complex and differentiated as animal tissue" (Joseph 41) Lovelock then began to label this part of the research "The Tissues of Gaia" (Joseph 41). This is important because it explains how biology is closely linked to the Gaia Theory's intentions. Explaining how these communities functioning together shows how it is possible for the Earth to function just like these organisms.

If Lovelock had so many biologists and philosophers why was Gaia Theory still not taken seriously? This question has not yet been answered and there is discussion probably still happening. After reviewing many different critical arguments against the Gaia Theory and articles proving the Gaia theory to be scientifically inaccurate, I am bewildered and astounded at what I have learned through these sources. I am truly interested in Lovelock's Gaia Theory. Comparing Dawkins criticism, it seems to me that Dawkins was truly against Lovelock's theory and even tried to prove him wrong. One big question is then why did Michael Ruse find evidence of Gaia within Darwinian evolution if Dawkins himself stated it went against his theory? There is not yet an answer to this question. Dawkins believed that his theory was not even near to the roots of Gaia, while Michael Ruse probably thought it could be hidden evidence of Gaia. Another possibility is that the scientists created these as "false sources" just to belittle the other or keep the argument going. Like when Michael Ruse accused of Dawkins' theory for having hints of Gaia, why would have Dawkins argued this if there was living proof in his work. Another possibility could be that Michael Ruse's belief in the Gaia Theory was different from what Lovelock was trying to get through to people. Ruse then insisted that Dawkin's theory was exactly like Gaia, in his own terms. There are many possibilities to the different types of research and new information found on Gaia, but no one knows who is correct.

New evidence was exposed in 2012 by the University of Maryland. They found a theory of how sulfur can help scientists find hidden interactions of ocean organisms with the atmosphere and land which is great evidence of the Gaia Theory. They explained how a sulfur compound is

created by ocean organism would then be oxidized and transferred back into the air. Therefore “the sulfur compound itself, or its atmospheric oxidation product, would have to return sulfur from the sea to the land surfaces” (Harry 1). The first people to discover and publish this discovery was first author Harry Ouduro, geochemist James Farquahr, and marine biologist Kathryn Van Alstyne. This work according to Oduro was the first present measurement of isotopic composition which showed a link between metabolism compounds and ocean organism which would be then emitted from the ocean and back into the atmosphere. This process greatly influenced the role of climate regulation which is by regulating and balancing the Earth’s radiation. They did have some troubles including correctly measuring both the sulfur isotopic composition and the sulfur compound itself. This work is the most recent discovery to test and connect the Gaia Theory with dimethylsulfide emissions and sulfate aerosols.

With all of these different biologists’ research backing up the Gaia theory, why is it still not considered to be science? The reason is probably due to the time eras, during the time Lovelock created the Gaia Theory in 1960’s he was still a radical 18 year old and was not considered seriously. Later in 2013-2014, there’s more research that helped to prove Gaia’s Theory, but since there has not been any accurate information for so long they still regard the theory as impossible. Though there may still be criticism against the theory it doesn’t stop Lovelock and his supports from continuing their research to help improve and maybe even justify it as real. Lovelock still lives in Devon, England and gets interviewed by many of his supports or curious people wondering if anything new has arouse from his theory. There is still ongoing mystery, but Lovelock continues to share and spread the Gaia Theory learning from the criticism he received, improving the theory so that it can finally be accepted.

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