THE HISTORY OF GAIA THEORY pdf

1: Unigue Facts about the Globe: Gaia Theory

The Gaia hypothesis (/ Ëˆ Éi aÉª. É™ /, / Ëˆ Éi eÉª. É™ /, / Ëˆ Éi aÉª Ëˆ ÊŒ /), also known as the Gaia theory 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 the conditions for life on the.

Bring fact-checked results to the top of your browser search. The Gaia hypothesis The notion that the biosphere exerts important controls on the atmosphere and other parts of the Earth system has increasingly gained acceptance among earth and ecosystem scientists. While this concept has its origins in the work of American oceanographer Alfred C. Redfield in the mids, it was English scientist and inventor James Lovelock that gave it its modern currency in the late s. The goal of this superorganism is to produce a homeostatic , or balanced, Earth system. Nevertheless, it is now an operative norm in contemporary science that the biosphere and the atmosphere interact in such a way that an understanding of one requires an understanding of the other. Furthermore, the reality of two-way interactions between climate and life is well recognized. The evolution of life and the atmosphere Life on Earth began at least as early as 3. It was during this interval that life first began to exercise certain controls on the atmosphere. Though some nitrogen was also present, little if any oxygen was available. Chemical reactions with hydrogen sulfide , hydrogen , and reduced compounds of nitrogen and sulfur precluded any but the shortest lifetime for free oxygen in the atmosphere. As a result, life evolved in an atmosphere that was reducing high hydrogen content rather than oxidizing high oxygen content. In addition to their chemically reducing character, the predominant gases of this prebiotic atmosphere, with the exception of nitrogen, were largely transparent to incoming sunlight but opaque to outgoing terrestrial infrared radiation. As a result, these gases are called, perhaps improperly, greenhouse gases see greenhouse effect because they are able to slow the release of outgoing radiation back into space. This is possible because the greenhouse gas -rich Archean atmosphere was effective in retarding the loss of terrestrial radiation to space. The resulting long residence time of energy within the Earth-atmosphere system resulted in a warmer atmosphere than would have been possible otherwise. Depending on the amount of nitrogen present during the Archean Eon, it has been suggested that the atmosphere may have held more than 1, times as much carbon dioxide than it does today. Through their metabolic processes, organisms of the Archean Eon slowly changed the atmosphere. Hydrogen rose from trace amounts to about 1 part per million ppm of dry air. Methane concentrations increased from near zero to about ppm. Oxygen increased from near zero to 1 ppm, whereas nitrogen concentrations rose to encompass 99 percent of all atmospheric molecules excluding water vapour. Carbon dioxide concentrations decreased to only 0. The composition of the atmosphere, its radiation budget, its thermodynamics , and its fluid dynamics were transformed by life from the Archean Eon. American geochemist Robert Garrels calculated that, in the absence of life and given the burial rate of carbon in rocks , oxygen would be unavailable to form water, and free hydrogen would be lost to space. Without the presence of life and compounded by this loss of hydrogen, there would be no oceans , and Earth would have become merely a dusty planet by the middle of the Archean Eon. By the end of the Archean Eon 2. The atmosphere became transformed from a reducing atmosphere with carbon dioxide, limited oxygen, and anaerobic organisms that is, life-forms that do not require oxygen for respiration in control to one with an oxidizing atmosphere that was rich in oxygen , poor in carbon dioxide, and dominated by aerobic organisms that is, life-forms requiring oxygen for respiration.

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2: Global Change Lecture Notes: The Gaia Hypothesis

Gaia hypothesis 1 Gaia hypothesis The study of planetary habitability is partly based upon extrapolation from knowledge of the Earth's conditions, as the Earth is the only planet currently.

Small amounts emanate from volcanic activity, but usually it is combined with other elements, e. As explained in lecture, initially the liberated oxygen combined with oxidizable minerals such as iron, leaving a sedimentary record of red bands that tells us that a new atmospheric chemistry was being brought about by life. Other geological evidence suggests that oxygen levels on earth have been, within a factor of roughly two, at near-present values for the past billion years, during which complex multi-cellular life arose. The planet would be in serious danger of burning up. What has kept oxygen from building up to dangerous levels? One possible answer is the biological production of methane by bacteria. A short-lived molecule, methane might combine with oxygen to produce CO2, thus stabilizing oxygen concentrations. We know that climate has changed a great deal in the past, producing episodes of glaciation, and could warm significantly in the future, due to atmospheric pollution. However, climate change could be much more extreme. Earlier temperatures are very uncertain. Calculations also suggest that under this faint early sun, the earth should have been a frozen ball. However, life arose under these conditions, and there is geological evidence of flowing water from this time. It has been suggested that a kind of greenhouse warming was in effect at that time, involving such gases as methane, ammonia, and carbon dioxide, and that this is evidence of a kind of Gaian planetary temperature control mechanism. Lovelock and Margulis argue that life solved this one, also. A warming earth stimulated greater plankton production, removing CO2 from the atmosphere. When the plankton died they sank to the ocean floor, forming sediments, and thus removed CO2 from the system. Moreover, a warmer planet has more rain, which means more erosion and more nutrient runoff to the oceans. This also stimulates phytoplankton growth, removing CO2 from the atmosphere as before. Thus, Gaia maintains a fairly constant climate as the sun heats up. Life has other influences over the chemistry of the planet: Perhaps life regulates the physical and chemical environment of the planet so as to maintain suitable planetary conditions for the good of life itself. If so, then the planet can be thought of as a single, integrated, living entity with self-regulating abilities. This is the radical view that Lovelock and Margulis have espoused. It can be thought of as the "strong Gaian model. Alternatives to the Gaia Hypothesis Oxygen: Why did it take 2 billion years to build up? When it finally did build up, it forced then-existing life, which was poisoned by oxygen, to retreat to anaerobic lacking oxygen environments such as the bottom of swamps. Granted, this set the stage for the development of the ozone layer, which shields us from ultraviolet light, and permitted the evolution of aerobic life, but it was very self-sacrificing on the part of the major life forms existing some 2 billion years ago. This is hardly homeostatic homeostasis: As the sun warms, rains increase. Water in the atmosphere combines with CO2 to form a weak carbonic acid solution, and this could have weathered silicate minerals in the rocks on land. Formation of new sediments would store carbon, thus reducing its abundance in the atmosphere. Gaian advocates fight back by arguing that soil bacteria play a role in the weathering reaction. The idea that climate and life influence one another is profoundly important. In some form or another, it has been recognized for a long time. Life and climate "grew up together" and influenced one another over most of earth history. But this is not to say that life somehow manages and self-optimizes its own environment. It is this idea -- the "strong form of Gaia" -- that is most controversial. Influential Gaia, the weakest of the hypotheses, asserts that biota have a substantial influence over certain aspects of the abiotic world, such as temperature and the composition of the atmosphere. Co-evolutionary Gaia asserts that the biota influence their abiotic environment, and that the environment in turn influences the evolution of the biota by Darwinian process. At the same time, that environment has imposed constraints on the biota, so that life and the environment may be considered as two parts of a coupled system" Watson and Lovelock, Homeostatic Gaia asserts that the biota influence the abiotic world, and do so in a way that is stabilizing, by negative feedback linkages. Teleological Gaia asserts that the atmosphere is kept in homeostasis, not just by the biosphere, but by and for the biosphere. Optimizing Gaia asserts that the biota manipulate their physical environment for the purpose of creating biologically favorable,

or even optimal, conditions for themselves. Kirchner argues that the weak forms of the hypothesis are not new and that the strong forms are not correct or not testable. He suggests that many people point to evidence for one of the weak forms of Gaia, and then go on to claim a stronger form. Modeling Gaia You can model feedbacks using the classic Gaia example of Daisyworld with Stella or using this interactive Java applet. The latter is especially useful to get a first-order understanding of changing parameters. The Stella model permit more sophisticated analysis. Summary The Gaia Hypothesis states that life on earth controls the physical and chemical conditions of the environment the biotic controls the abiotic The hypothesis was formulated by James Lovelock and Lynn Margulis The hypothesis points to stable conditions, such as oxygen levels and climate, as evidence that living organisms maintain a life-sustaining environment The hypothesis has been defined and argued in numerous ways, and has as many critics as adherents. It is in need of more explicit formulation before it can be examined and tested as a true scientific theory. The model that life influences planetary processes i. This model is widely supported. The original Gaia hypothesis, that life controls planetary processes i. It is not widely accepted.

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3: Overview | Gaia Theory

The Gaia Hypothesis by Michael Ruse gets to the heart of the question Review: The Vanishing Face of Gaia by James Lovelock Might the climate face a similar crash to the economy?

This essay was translated by Stephen Muecke. Nevertheless, we took the precaution of washing our hands carefully with antiseptic soap a few times. And then we were off for the coast of Dorset, in the south of England, in the direction of Cornwall. At 98, James Lovelock is a very old man. I had never imagined I would meet the father of Gaia. I had read all his books, but I was not all that keen on his recent statements in the press, his somewhat bizarre political ideas, and his inflated enthusiasm for the nuclear industry. Nor was I one for visiting the places where my favorite authors wrote their books. But Harding, his friend and disciple, had assured me that Lovelock wanted to meet me. What could I say that would interest him? Had he not recently traumatized a Guardian journalist by telling her that humans only had a hundred years before the robots took over? As I was soon to learn, he was not the first to get tired. Looking through the window of the dining room where we had a light lunch, and seeing a snow storm approaching over the sea, covering the setting sun with dark clouds, I listened to this paradoxical and feisty old man, still with a fresh ring to his voice. How had he introduced something quite new into the history of science that had also been the object of so many misunderstandings? Misunderstanding What weight does the Gaia hypothesis have in the history of science? What does this new approach to political science represent? This was what I was thinking about as Stephan Harding drove me back to Exeter, capital of Devon, where I was to discover that a few centimeters of snow are enough to call a halt to trains, planes, taxis, and buses. This obliged me to extend my thinking, since I was stuck in a sufficiently well-heated hotel with a good supply of porridge â€¦ We cannot hide from the fact that there is a fundamental misunderstanding about Gaia. We think we are using the name of this mythological figure to designate the quite common time-honored idea that the Earth is a living organism. Lovelock is renowned, they say, simply because he recast in cybernetic language the ancient idea that the Earth is finely tuned. Facing up to her, as I say in Facing Gaia, means accepting another way of defining living things in their relations to the Earth, which is quite foreign to the way a superior and predetermined natural order is invoked. I often ask myself why it is so difficult to get across the idea that Gaia dismantles any project predicated on providence, and cannot be used to nourish the fantasy of a return to religiosity. You would think that Devon had become a laboratory for a new relationship with nature. So I was very surprised that the Gaia Stephan teaches is deeply animist, spiritual, and intuitive, a view that that I thought was not so compatible with my reading of Lovelock. When we speak of Gaia it is impossible not to take into account the multiplicity of its versions, including the wrong turns that Lovelock himself had left behind. Last year, he had defended an extraordinary thesis on the Gaia hypothesis. So I had gathered in my hands, in the course of only one day, all the pieces of the jigsaw puzzle. Going from Dartington to Exeter, I went from a kind of spiritual Gaia to a scientific one, while at the same time having the opportunity to go to the source, Lovelock himself, not far from Exeter. He would know, perhaps, how to decide between the two. At first glance there is nothing simpler than the Gaia hypothesis: This goes for the atmosphere, the soils, and the chemical composition of the oceans. We see it in termite mounds and beaver dams, which are not living in themselves, but without living organisms there would be no mounds or dams. So, the Gaia idea does not involve adding a soul to the terrestrial globe, or intentionality to living things, but it does recognize the prodigious ingenuity in the way living things fashion their own worlds. Lovelock came up with the hypothesis when he was in Pasadena, at the time the programs for detecting life on Mars were being launched. This was , and at the time he asked himself how a Martian planetologist might know there was life on Earth without the need to go there. His answer was as radical as it was simple: Far too much oxygen and methane, far too little CO2. As we were dining, Dutreuil recounted that as he was rummaging in the Lovelock archive at the Science Museum of London, he was able to document the source of this idea. If NASA had brought Lovelock to California, it was because he was already famous, not for his knowledge of geochemistry or biology â€” he was trained as a chemist â€” but because he was an extraordinary inventor of high-precision instruments. Through an amazing circumstantial

serendipity, he managed, because of his instruments, particularly the famous electron capture detector, to discern pollution thresholds that were previously unquantifiable. So who at the time was interested in these gas emanations? First and foremost the chemical industry, as in the well-known case of measuring ozone in the atmosphere. Lovelock first worked in that industry, giving him a very unusual luxury for the 20th century, his own laboratory, which made him independent of universities. The first Gaia idea came about with the following line of reasoning: If humans can so radically modify their environment in so little time, then other beings could have done it as well over hundreds of millions of years. You have to be an engineer and inventor like Lovelock to understand this entanglement. So Gaia has nothing to do with any New Age idea of the Earth in a millennial balance, but rather emerges, as Lenton emphasizes over dinner, from a very specific industrial and technological situation: Drugs, sex, cybernetics, the conquest of space, the Vietnam War, computers, and the nuclear threat: But Dutreuil is keen to point out that the most surprising aspect of this hypothesis is that it depends on the coupling of two diametrically opposed analyses. At the time, in the s, Margulis was a typical example of a maverick, a dissident stirring up the neo-Darwinians who were in full flight at the time. In their minds, evolution presupposed the existence of organisms sufficiently separable from the others so that one could say that they had a modicum of superior or inferior fitness. But Margulis challenged the very existence of separate individuals: A cell is independent entities superimposed on each other, in the same way that our organism depends not only on our genes, but on those of the infinitely more numerous critters that are in residence in our gut or crawling over our skin. Evolution certainly exists, but which direction is it coming from, and which interlinked participants are going to profit from it? That is what is not calculable. In that one concept, we get the whole idea of the superimposition of living beings folded into each other. In the course of a seminar that I attended the next day, before the snow came to engulf the south of England, the answer came to me quite clearly: Lenton has shown that the regulation can be very strong or very lax, depending on the scales of space and time. The homeostatis of an organism and the more erratic regulation of the climate are not of the same type. The Earth is not an organism. Unlike all living things, it lives off itself in a way, through continuous recycling with very little help from external matter apart, of course, from solar energy. Both were working with an image of the Earth, the globe, nature, the natural order, without taking into account the fact that they were dealing with a unique object requiring a general revision of scientific conceptions. So I was right after all to make the comparison with Galileo. As I was stuck under my duvet waiting for it to rain enough for the English to dare to venture out of doors, I understood this striking sentence in Lovelock: Before Gaia, the inhabitants of modern industrial societies saw nature as a domain of necessity, and when they looked toward their own society they saw it as the domain of freedom, as philosophers might say. There is no living or animated thing that obeys an order superior to itself, and that dominates it, or that it just has to adapt itself to, and this is true for bacteria as much as lions or human societies. This means that the issue of freedom and dependence is equally valid for humans as it is for the partners of the above natural world. Galileo invented a world of objects placed beside each other, without affecting each other, and entirely obeying the laws of physics. Lovelock and Margulis sketched a world of agents constantly interacting with each other. When I came back from this amazing day in Dorset, I said to myself that taking on board such a world had nothing to do with ecology, but quite simply with a politics of living things.

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4: Gaia hypothesis - Wikipedia, the free encyclopedia

The Gaia Hypothesis is the theory that living organisms and inorganic material are part of a dynamic system that shape Earth's biosphere, in Lynn Margulis's words, a "super organismic system" The earth is a self-regulating environment; a single, unified, cooperating and living system - a superorganism that regulates physical conditions to.

James Lovelock is not part of a university, research institute, or business firm. He is not a wealthy man. But, as James Broughton said, "the only limits are, as always, those of vision. It was his foresight that created the electron capture detector, an instrument that sparked our environmental consciousness to the point where we could see pesticide residues everywhere, even in the fat of Antarctic penguins. His vision was recognized by NASA in the s, when he was invited to be part of the Viking team investigating the existence of life on Mars. The NASA experience brought Lovelock to a grand vision of our own planet, the idea of the Earth as one big system, able to keep its temperature and composition constant in the face of change. This idea, while still controversial, is of value because it has inspired many experiments and experimenters, from scientists to politicians. It has inspired debates on the role of algae in the ocean and its control of our climate through the dimethyl sulphide mechanism. It has helped in the understanding that carbon dioxide pumped from the biota into the soil increases weathering and is a valuable sink for carbon. During his visit to UNU, Lovelock spoke of the evolution of the Earth and of the living organisms that inhabit it, and how these led to the Gaia theory, which sees the Earth as an active self-regulating system. He also recounted the current scientific problems of biodiversity and climate change from the perspective of the Gaian view. The notion of Gaia is not new. In a way it started about years ago, in , in an Edinburgh lecture given by Dr. Black, the discoverer of carbon dioxide. He gave the lecture on behalf of James Hutton, who was ill at the time. Hutton had written, "I consider the Earth to be a super-organism and that its proper study should be by physiology. He was the first scientist to challenge seriously the notion that the Earth and all upon it was created intact as described in the Old Testament. He did so through his own evolutionary theory, called uniformitarianism, in which he proposed that the material environment is continuously recycled at a more or less steady state, with origins in the remote past. In these battles Earth and life sciences were united in their rejection of creationism. Perhaps because of this common cause, biologists and geologists never seemed to notice that their own views were insufficient when taken separately, and also contradictory. As a result, two distinct and incompatible theories of evolution, Darwinism and geological evolution, became established and have existed separately from the middle of the last century until today. Biologists, although critical of Gaia theory, rarely comment on the Earth and the planets. Their view is normally through a microscope, not a telescope. They look at cells, genes and molecules, not planets. They are sometimes sufficiently irritated by Gaia theory to comment that the material conditions of the Earth were all explained completely by the abundance of oxygen and carbon dioxide in the air. That is how many biologists see the world today. They know that the cycle of carbon dioxide between plants and animals, although large, is a "do nothing" cycle. Organisms alone do not set the level of carbon dioxide in the air, only accept what is there. Plants and animals must always, at steady state, exchange equal quantities of carbon dioxide. Geochemists believe that their science explains it all. For example, the eminent geochemist H. To geochemists there is only one source of carbon dioxide, volcanoes and only one sink for the gas, the weathering of calcium silicate rocks. In recent years scientists have felt uneasy about these two extreme views, and many have opted for the conglomerate science of biogeochemistry. Biogeochemistry is, in fact, a province occupied by geochemists who think that they can explain the world by including in their geochemical models boxes labeled These boxes represent living organisms as reservoirs, sources and sinks of chemicals. They are now finding that no matter how large and expensive the computers they use, nor how intricate they make these biogeochemical models, they fail to produce results that map onto the real world. More seriously, these models, like those of population biology, are sometimes inherently unstable or prone to deterministic chaos. If we take the Earth to be a superorganism, then we would not expect an expert science of a part of the system, like biology or geochemistry, to be able to explain the whole system. If the Earth does resemble a living system, then such properties as climate and chemical composition require physiology for

their explanation. Try asking a biologist or biochemist how our own internal temperature is kept close to 37C. You will find them unable to answer in terms of their science. Temperature regulation can only be properly explained by physiology, the systems science of the body. I think that to explain the regulation of the climate and the chemical composition of the Earth also requires a physiological approach. This is the justification of Gaia theory, which sees the Earth as a physiological system. In I was invited to participate as an experimenter in the first NASA lunar and planetary explorations. They were for the most part based on experience with laboratory organisms here on Earth. The bacteriologists proposed sending culture media to grow bacteria from the martian soil. To me, this seemed an unsatisfactory approach. It could fail to detect the presence of life for many reasons. Martian life might not include bacteria, and even if it did, the biochemistry might be different. The experiment might land at a barren site. I suggested that they try a more general experiment, a planetary one, instead of a local search at the site of landing. For example, simply analyze the chemical composition of the martian atmosphere. If the planet were lifeless, it would be expected to have an atmosphere determined by physics and chemistry alone, and the chemical composition would be close to the chemical equilibrium state. But if the planet bore life, organisms at the surface would be obliged to use the atmosphere as a source of raw materials and as a depository for wastes. Such use of the atmosphere would change its chemical composition. It would depart from equilibrium in a way that would show the presence of life. I was joined in this study at this point by Dian Hitchcock and together we examined atmospheric evidence from the infrared astronomy of Mars. We compared this data with our knowledge of the sources and sinks of gases in the atmosphere of the one planet we knew bore life, Earth. We found an astonishing difference between the two planetary atmospheres. Mars was close to chemical equilibrium, and it was dominated by carbon dioxide. In our atmosphere, carbon dioxide is a mere trace gas, and the coexistence of abundant oxygen with methane and other reactive gases are conditions impossible on a lifeless planet. Even the abundant nitrogen and water are difficult to explain by geochemistry. Sadly, we concluded, Mars was probably lifeless. The Earth seen from space as a dappled white and blue sphere is now a visual cliche. But when we first saw it, few of us were untouched by the beauty of our planet. That view from outside has irreversibly altered our thoughts and feelings about the Earth. Strangely similar was the way the top-down view of atmospheric chemistry, gathered at JPL, became for me a revelation of the Earth. It revealed a gas mixture like that of the intake manifold of a car engine, oxygen and combustible gases mixed. This is very different from the exhausted, carbon dioxide dominated, atmospheres of Mars and Venus. Much more than this, we know that the chemical composition of our atmosphere is steady and constant. Changes do occur, but only slowly compared with the residence times of the gases. One afternoon in at the JPL, when thinking of these facts, the thought came to me in a flash that such constancy required the existence of an active control system. I realised that, in the long term, climate also might be actively regulated. The notion of a control system involving the whole planet and the life upon it was now firmly established in my mind. Sometime near the end of the s I discussed the idea with my neighbor, the novelist William Golding. He suggested the name Gaia as the only one appropriate for so powerful an entity. I first stated the Gaia hypothesis in , in the journal Atmospheric Environment. Shortly after this I began a collaboration with the biologist Lynn Margulis that has continued to this day. The first statement of the hypothesis was: What we should have said is: But it laid us open to the criticism that we had proposed a sentient Gaia able to control the Earth consciously. Nothing was further from our minds. From the start, Gaia has been a top-down systems view of the Earth, the hard science view of a physical chemist with an interest in control theory. This was never some trendy new age pseudo-science. Gaia is a proper theory that makes testable predictions. For example, here is the Gaian view of carbon dioxide. Michael Whitfield and I in a Nature paper proposed that the geochemical weathering of rocks was, by itself and in the absence of life, insufficient to account for the low contemporary level of carbon dioxide. In the real world, we observed, the system includes the organisms as well as their environment. This is a much more powerful pump for carbon dioxide than geochemistry alone, and should be able to remove carbon dioxide from the atmosphere and sustain a much cooler and, for the organisms, more comfortable climate than would otherwise be possible. We predicted that the removal of carbon dioxide from the air would depend on the growth rate of the organisms and would therefore be dependent upon the temperature. If the temperature was too low, carbon dioxide would

accumulate in the atmosphere, but as the temperature rose, carbon dioxide would be removed at a faster rate, and an equilibrium temperature would be established. In the American scientists Volk and Schwartzman confirmed part of this prediction by showing that the rate of rock weathering is increased by a factor of when organisms are present. This is much more than is needed to enable a powerful physiological regulation of climate and carbon dioxide. We think it could account for the fold decline in carbon dioxide since life began on Earth. I do not know whether Gaia theory is right or wrong. To me it is just a useful way of looking at the Earth. The model Daisyworld and its lessons for biodiversity By far the most useful and constructive criticism we received of early Gaia was from Ford Doolittle, who said that there was no way for organisms to regulate the climate other than by foresight and planning, which was impossible. I agree with him, and it was his criticism that forced me to rethink our proposal. My answer was a simple mathematical model of Gaia, called Daisyworld.

5: Atmospheric homeostasis by and for the biosphere: the Gaia hypothesis â€“ James Lovelock

Gaia hypothesis. The Gaia (pronounced GAY-ah) hypothesis is the idea that Earth is a living organism and can regulate its own environment. This idea argues that Earth is able to maintain conditions that are favorable for life to survive on it, and that it is the living things on Earth that give the planet this ability.

While some may discard this as merely the superstition of primitives, Western science seems to be catching up with their proposition. Gaia theory, as originally defined by James Lovelock, proposes that all ecosystems on earth, together with all its physical components, form one complex organism that maintains climatic and biochemical conditions in a preferred state of homeostasis. At the time he tried to establish new methods for detecting life on Mars. According to Lovelock this would be a relatively cheap and reliable way to detect life on other planets. Even though Gaia hypothesis has now been supported by a number of scientific experiments and provided several useful predictions, it has virtually been ignored by the scientific community until Only after the publication of an article in the new scientist in February of and the popular book The Quest for Gaia, did the hypothesis gain some momentum in the public arena. Although the theory gained the support of some environmentalists and climate scientists it was strongly rejected by many others in- and outside the scientific community. Criticisms of Gaia Hypothesis After the Gaia hypothesis had initially been formulated, it was largely ignored from to Once the hypothesis had gained more momentum, it started being criticized by major scientists, such as Ford Doolittle, Richard Dawkins and Jay Gould. Ford Doolittle for one, stated that there was nothing in the genome of individual organisms which could provide the feedback mechanisms that are proposed by Gaia Hypothesis. Furthermore, Richard Dawkins has said that organisms cannot act in concert as this would require foresight and planning from them. According to him feedback loops cannot stabilize the system and natural selection cannot lead to global altruism. At last, Jay Gould stated that since the actual mechanisms by which self-regulating homeostasis works cannot be scientifically described, Gaia hypothesis can merely be seen as a metaphor. All in all, to the above mentioned scientists, Gaia hypothesis was nothing more than a neo-pagan new age religion simply assuming a predetermined purpose for all things on earth. Weak Gaia In refining the theory, James Kirchner at the first Gaia Chapman conference, stated that there are two alternatives to Gaia hypothesis. In response to all of the above mentioned criticisms, Lovelock himself has stated: He further supposes that most criticisms of his work stem from a poor understanding of non-linear mathematics by his critics and a form of reductionism, in which all events have to be attributed to specific causes. In his view, some self-regulating phenomena may not be explainable at all in terms of mathematics. Nevertheless, Lovelock went even further to disprove his critics, by offering the mathematical Daisyworld model together with his colleague Andrew Watson. In the model, a planet is inhabited by only two plants: Their color influences how much light is reflected off the planet so that black daisies absorb light and warm the planet and white daisies reflect light and thus cool the planet. In the Daisyworld model, competition between the black and white daisies based on temperature effects and their growth rate leads to a balance of populations that tends to favor a planetary temperature that is close to optimal for the growth of daisies. Lovelock associates this with rampant global warming, in much the same way that the warming of the oceans is extending the oceanic thermocline layer of tropical oceans into the Arctic and Antarctic waters. According to Lovelock this prevents the rise of oceanic nutrients into the surface waters of the ocean and eliminates the algal blooms of phytoplankton oceanic food chains are dependent upon. As phytoplankton and forests are the main ways in which earth draws down greenhouse gases, Lovelock suspects that their elimination will cause most of the earth to be uninhabitable by the middle of this century. According to Lovelock, floods, droughts, famines and a massive extension of tropical deserts are to follow will make earthly life a struggle for survival. On the positive though, Lovelock sees these extreme conditions only as transitory changes. What do you think? Le me know in the comments below!

6: Gaia hypothesis - New World Encyclopedia

The Gaia Theory has inspired many leading figures of the past 20 years, including Vaclav Havel, John Todd (inventor), Freeman Dyson (physicist), Al Gore, Joseph Campbell (mythology expert), and Elisabet Sahtouris (microbiologist).

At one end of the spectrum is the undeniable statement that the organisms on the Earth have radically altered its composition. The history of evolution , ecology and climate show that the exact characteristics of this equilibrium intermittently have undergone rapid changes, which are believed to have caused extinctions and felled civilizations. Biologists and earth scientists usually view the factors that stabilize the characteristics of a period as an undirected emergent property or entelechy of the system; as each individual species pursues its own self-interest, for example, their combined actions tend to have counterbalancing effects on environmental change. However, proponents will point out that those atmospheric composition changes created an environment even more suitable to life. Some authorities observe the global equilibrium of abiotic and biotic components and see it as a natural harmony stemming from cooperation, more so than competition. For example, Margulis holds that "Life did not take over the globe by combat, but by networking," that is, for complex and robust ecosystems to have emerged the phenomenon of organisms working together must have overshadowed the phenomenon of organisms "red in tooth and claw" competing. The philosophical concept of dual purposes similarly sees cooperation as the underlying principle between the evident harmony. A purpose for the whole is one whereby the individual contributes to the preservation and development of the whole. These two purposes are seen as working together in harmony, being interdependent, such as the way that a cell in the body produces useful products for the body, while preserving its own self, and being supported in its survival by the body. Beyond the concept of a "self-organizing system," a more radical Gaia hypothesis is that all lifeforms are part of one single living planetary being called Gaia. In this view, the atmosphere, the seas and the terrestrial crust would be results of interventions carried out by Gaia through the coevolving diversity of living organisms. While it is arguable that the Earth as a unit does not match the generally accepted biological criteria for life itself Gaia has not yet reproduced, for instance; it still might spread to other planets through human space colonization and terraforming , many scientists would be comfortable characterizing the earth as a single "system. Scientists contend that there is no evidence at all to support this last point of view, and it has come about because many people do not understand the concept of homeostasis. Many non-scientists instinctively see homeostasis as an activity that requires conscious control, although this is not so. Much more speculative versions of Gaia hypothesis, including all versions in which it is held that the Earth is actually conscious or part of some universe-wide evolution, are currently held to be outside the bounds of science. Also outside the bounds of science is the Gaia Movement, a collection of different organizations operating in different countries, but all sharing a concern for how humans might live more sustainably within the "living system. A few of these are defined as follows: A version of strong Gaia hypothesis called "Optimizing Gaia" asserts that biota manipulate their physical environment for the purpose of creating biologically favorable, or even optimal, conditions for themselves. Rather, energy is expended by the biota to actively maintain these optima. Another strong hypothesis is the one called "Omega Gaia. The weakest form of the Gaia theory has been called "influential Gaia. Weak Gaian hypotheses suggest that Gaia is co-evolutive. Co-evolution in this context has been thus defined: The weak versions are more acceptable from an orthodox science perspective, as they assume non-homeostasis. They state that the evolution of life and its environment may affect each other. However, these theories do not claim the atmosphere modification has been done in coordination and through homeostasis. I have been trying to think of the earth as a kind of organism, but it is no go. I cannot think of it this way. It is too big, too complex, with too many working parts lacking visible connections. The other night, driving through a hilly, wooded part of southern New England, I wondered about this. If not like an organism, what is it like, what is it most like? Then, satisfactorily for that moment, it came to me: Lovelock initial hypothesis Lovelock defined Gaia as: His initial hypothesis was that the biomass modifies the conditions on the planet to make conditions on the planet more hospitableâ€”the Gaia Hypothesis properly defined this "hospitality" as a full homeostasis. Lovelock suggested that life on Earth provides a

cybernetic, homeostatic feedback system operated automatically and unconsciously by the biota, leading to broad stabilization of global temperature and chemical composition. With his initial hypothesis, Lovelock claimed the existence of a global control system of surface temperature, atmosphere composition, and ocean salinity. The global surface temperature of the Earth has remained constant, despite an increase in the energy provided by the Sun Atmospheric composition remains constant, even though it should be unstable Ocean salinity is constant Since life started on Earth, the energy provided by the Sun has increased by 25 percent to 30 percent; however the surface temperature of the planet has remained remarkably constant when measured on a global scale. Furthermore, he argued, the atmospheric composition of the Earth is constant. Traces of methane at an amount of , metric tons produced per annum , should not exist, as methane is combustible in an oxygen atmosphere. This composition should be unstable, and its stability can only have been maintained with removal or production by living organisms. Ocean salinity has been constant at about 3. Ocean salinity constancy was a long-standing mystery, because river salts should have raised the ocean salinity much higher than observed. Only recently have we learned salinity is controlled by seawater circulation through hot basaltic rocks, and emerging as hot water vents on ocean spreading ridges. The only significant natural source of atmospheric carbon dioxide CO2 is volcanic activity, while the only significant removal is through the weathering of some rocks. During weathering, a reaction causes the formation of calcium carbonate. This chemical reaction is enhanced by the bacteria and plant roots in soils, where they improve gaseous circulation. The calcium carbonate can be washed to the sea where it is used by living organisms with carboneous tests and shells. In short, a rock was weathered, the resulting carbon dioxide processed by a living organism, and returned to a rock through sedimentation process. Part of the organisms with carboneous shells are the coccolithophores unicellular planktonic marine algae , which also happen to participate in the formation of clouds. When they die, they release a sulfurous gas DMS , CH3 2S, which act as particles on which water vapor condenses to make clouds. See also carbon cycle. Lovelock sees this as one of the complex processes that maintain conditions suitable for life. The volcanoes make the CO2 enter the atmosphere, CO2 participates in limestone weathering, itself accelerated by temperature and soil life, the dissolved CO2 is then used by the algae and released on the ocean floor. CO2 excess can be compensated by an increase of coccolithophoridae life, increasing the amount of CO2 locked in the ocean floor. Coccolithophoridae increase the cloud cover, hence control the surface temperature, help cool the whole planet and favor precipitation, which is necessary for terrestrial plants. For Lovelock, coccolithophorides are one stage in a regulatory feedback loop. Lately, the atmospheric CO2 concentration has increased and there is some evidence that concentrations of ocean algal blooms are also increasing. Critical analysis Basis The Gaia Hypothesis is based on the simple idea that the biomass self-regulates the conditions on the planet to make its physical environment in particular temperature and chemistry of the atmosphere on the planet more hospitable to the species that constitute its " life. A simple model that is often used to illustrate the original Gaia Hypothesis is the so-called Daisyworld simulation. Whether this sort of system is present on Earth is still open to debate. Some relatively simple homeostatic mechanisms are generally accepted. For example, when atmospheric carbon dioxide levels rise, plants are able to grow better and thus remove more carbon dioxide from the atmosphere. Criticism The initial Gaia Hypothesis was highly criticized by many scientists for being teleological, a belief that all things have a predetermined purpose. It was very critically received, in particular by Richard Dawkins and Ford Doolittle. These latter argue organisms could not act in concert as this would require foresight and planning from them. They rejected the possibility that feedback loops could stabilize the system. In , Dawkins claimed "there was no way for evolution by natural selection to lead to altruism on a Global scale. They argue that, as Gaia cannot reproduce herself, she cannot be alive in any meaningful sense. They also claim that the theory is not scientific because it is impossible to test it by controlled experiment. Lovelock offered the Daisyworld model as mathematical evidence to refute most of these criticisms see below. The initial hypothesis was rather imprecise, and Lovelock later refuted accusation of teleologism by stating: Another of the largest criticisms against the idea that Gaia is a "living" organism is the inability of the planet to reproduce. Certainly one of the hallmarks of living organisms is their ability to replicate and pass on their genetic information to succeeding generations. Others have proposed that humanity itself is the means by which Gaia will reproduce. Human

beings exploration of space, its interest in colonizing other planets, and the large body of science-fiction literature that describes terraforming, lend strong evidence to the idea that Gaia is planning to reproduce. DaisyWorld simulations Lovelock responded to criticisms with the mathematical Daisyworld model , first to prove the existence of feedback mechanisms, second to demonstrate it was possible that control of the global biomass could occur without consciousness being involved. Daisyworld, a computer simulation, is a hypothetical world orbiting a sun whose temperature is slowly increasing in the simulation. Daisyworld was introduced by James Lovelock and Andrew Watson to illustrate the plausibility of the Gaia hypothesis in a paper published in The simulated planet is seeded with two different species of daisy as its only life form: White daisies have white flowers that reflect light , and the other species has black flowers that absorb light. Both species have the same growth curve that is, their reproduction rate is the same function of temperature but the black daisies are themselves warmer than the white daisies and bare earth. A planet with preponderance of white daisies is cooler than one with more black ones. At the beginning of the simulation, Daisyworld is so cold that only a few black daisies, and almost no white daises, can survive. As the planet becomes hotter, white daisies begin to breed as well, and eventually the planet reaches a point of temperature equilibrium. Any increase in temperature is combated by a greater proportion of white daisies; any decrease leads to more black daisies. Such a system is remarkably stable against varying solar input; the entire planet maintains homeostasis. With the daisies, at the beginning of the simulation there is enhanced warming, and at the end of the simulation enhanced cooling, resulting in a close to equilibrium temperature for most of the simulation. In this way the daisies are modifying the climate to make conditions more hospitable for themselves. However, the Daisyworld system exhibits hysteresis: If the external temperature becomes too cold or too hot, it overwhelms the system. Later extensions of the Daisyworld simulation included rabbits, foxes and other species. One of the more surprising findings of these simulations is that the larger the number of species, the greater the improving effects on the entire planet i. These findings lent support to the idea that biodiversity is valuable, and sparked the modern biodiversity debate. Daisyworld has attracted a substantial amount of criticism. However, Daisyworld arguably demonstrates that biologically mediated homeostasis does not require a teleological explanation. This research on the Redfield Ratio of Nitrogen to Phosphorus, shows that local biotic processes can regulate global systems Downing and Zvirinksy The accusations of teleologism were dropped after that meeting. Lovelock presented a new version of the Gaia Hypothesis, which abandoned any attempt to argue that Gaia intentionally or consciously maintained the complex balance in the environment that life needed to survive. This new hypothesis was more acceptable by the scientific community.

THE HISTORY OF GAIA THEORY pdf

7: Gaia Hypothesis | www.enganchecubano.com

The History of Gaia Hypothesis Independent research scientist James Lovelock first scientifically formulated Gaia Hypothesis during the 's when he was working for NASA. At the time he tried to establish new methods for detecting life on Mars.

Before you proceed, take a few moments to review the characteristics of living matter. One useful analogy that has been proposed for understanding Gaia is the California redwood tree, Sequoia gigantea. These trees which stand in great groves along the northern coast of California and elsewhere can stand as high as feet and weigh as much as tons. Some of them are more than years old. The wood of the trunk and the bark of the tree are dead. Only a small rim of cells along the periphery of the trunk is living. The bark, like the atmosphere, protects the living tissues, and allows for the exchange of biologically important gases, such as carbon dioxide and oxygen. There is no doubt in my mind that a redwood tree is a living entity. Would you just call the outer layer the redwood tree and the rest of it dead wood? The same holds true for Gaia. While much of the Earth may be considered "non-living", the fact that all of these non-living parts are involved to some extent in living processes suggests that the whole Earth is alive, just like a redwood tree. All of us know that our body temperatures are maintained pretty close to The maintenance of this body temperature is the result of feedbacks between the brain and various organs and systems of the body. Our bodies have developed different responses to increases or decreases in our core temperature. If it is too cold, our bodies produce heat by shivering; if it is too warm, our bodies sweat and remove heat through evaporation. Of course, humans have extended their ability to survive in extremes of temperatures by inventing clothing that insulates, heats, and even cools our bodies. On Earth, temperature is regulated in a similar, albeit, more complicated fashion. Albedo refers to the color of a planet and its ability to absorb or reflect light. Dark areas, such as mountains in summer, forests, or even the ocean, tend to absorb heat energy from the sun. As you can imagine, the albedo of the Earth is not constant. One possible means by which global temperature is regulated is by clouds. If there are more clouds, more sunlight is reflected away from the earth, and the earth cools. If there are less clouds, more sunlight is able to reach the surface of the Earth and the earth warms. What factors control the abundance of clouds? There are many factors that affect cloud cover over the planet. The interaction of the atmosphere with the ocean is one major factor. Other factors, such as the rain shadow effect and weather fronts contribute to cloud cover over the planet. Coccolithophorids are well-known for their beautiful calcareous skeletons that make up the White Cliffs of Dover in England. Clouds form when water vapor in the atmosphere condenses or freezes. However, for clouds to form, a particle or "nucleus" must be present to "gather up" the water into a droplet. These particles, called cloud-condensation nuclei, are the tiny particles in the atmosphere that lead to the formation of clouds. Water vapor condenses around these particles and clouds are formed. It has been known for quite some time that certain algae or phytoplankton plant plankton that live in the ocean release trace quantities of DMS. Production of DMS by phytoplankton may be sufficient to cause the formation of clouds, and recent research has been directed towards quantifying the amounts of DMS released into the atmosphere by organisms living in the sea. Where this process becomes interesting for Gaia is, the possibility that phytoplankton can control the temperature of the Earth by regulating the amount of cloud cover over the oceans. After a while, the increase in clouds lowers the temperature of the Earth, but it also blocks the sunlight to the phytoplankton. As a result, the phytoplankton grow more slowly, less clouds are formed, and the temperature of the Earth rises. The cycle continues to repeat in a self-regulating and balanced manner. Regardless of whether this mechanism bears the test of time, it does give us pause to think of how living organisms and the Earth itself may interact with each other. It should make us sit and wonder how such a mechanism evolved. For sure, the idea that the whole Earth - the lithosphere, atmosphere, hydrosphere, and biosphere - works together in a harmonious fashion has great intellectual, philosophical, and poetical appeal, if nothing else! What Does Gaia Predict? If indeed the Earth is a living organism and the sum of its biological, geological, chemical, and hydrological processes act in concert, What then might we expect of such an organism? How should such an organism act? We also looked at how organisms such as phytoplankton can

transfer chemicals such as DMS into the atmosphere and thus, participate in the cycling of elements within the planet. Organisms are a vital part of all chemical cycles and I would like to introduce to you here the concept of biogeochemical cycles. Otherwise, the whole system would run down and the Earth would be just like the moon. The most common biogeochemical cycles are the carbon cycle, the nitrogen cycle, and the sulfur cycle. Living organisms are a vital part of these cycles. Tremendous masses of material are consumed, transformed, transported, and recycled by the actions of living organisms. In fact, the deposition of sediments in shallow waters is responsible for the uplifting of coastal shores. Planetary processes governed by living organisms lend credence to the Gaia hypothesis, but they do not prove her existence. If, after a number of decades, a large body of evidence develops that supports the hypothesis that our planet is a living, self-regulating organism, then the Gaia hypothesis may be upgraded to a theory, much like the theory of gravity. Until then, Gaia is an idea that stimulates our thinking and generates scientific research that helps us better understand our planet and how it works. As one last look at what Gaia might predict, I would like to offer an idea of my own. One of the biggest criticisms against the idea that Gaia is a "living" organism is the inability of the planet to reproduce. Certainly one of the hallmarks of living organisms is their ability to replicate and pass on their genetic information to succeeding generations. In the case of Gaia, this does not appear to be true, or does it? I would like to propose that man himself is the means by which Gaia will reproduce. Imagine that man colonizes another planet. No longer will this planet be a static, forbidden place. It will be transformed into a place of beauty - a living, breathing, evolving entity. This indeed is the power of Gaia, and one of the more fascinating and compelling reasons to consider her existence! Finally, beyond the scientific importance of what we have discussed here, we might do well to consider some of the more poetical thoughts of the originator of the theory. At the end of Chapter 1 in his first book, Lovelock writes: The Gaia hypothesis is for those who like to walk or simply stand and stare, to wonder about the Earth and the life it bears, and to speculate about the consequences of our own presence here. It is an alternative to that pessimistic view which sees nature as a primitive force to be subdued and conquered. It is also an alternative to that equally depressing picture of our planet as a demented spaceship, forever traveling, driverless and purposeless, around an inner circle of the sun. Having taken a couple courses in Systems Ecology from Dr. James Kremer, I was more than accepting of the idea that systems have emergent properties that cannot be discerned from their individual components. Within that context, the Gaia Hypothesis made sense to me, perhaps more philosophical scientific, but sense, nonetheless. Since the time of writing these notes in the summer of just before I started teaching at Fullerton College , I have learned a lot more about the Gaia Hypothesis, both from the WWW and from conversations with Tom Morris, who teaches planetary biology at Fullerton College and hosts the Planetary Biology Home Page. It has also become somewhat of a theme of mine throughout all of my oceanography classes, not so much the hypothesis, but the idea that physical, geological, chemical and biological processes are interdependent, something that fits quite well with Gaian Theory. Here then are a few more things that I have learned in the past three years that may further elucidate and validate this important idea. The Many Faces of Gaia One of the more interesting extensions of the Gaia Hypothesis has been its transformation from one hypothesis to multiple hypotheses. This is not uncommon in scientific work and it generally represents a healthy and lively application of the scientific method. Recognition of the many Gaia hypotheses evolved from a symposium on the Gaia Hypothesis held in A group of geophysicists and others came together to discuss the hypothesis, an event in itself that helped fuel its acceptance. While there were and still are many detractors, Gaia did appear to gain a toehold with general acceptance of the idea that life at least influences planetary processes. The resulting oxygen holocaust, which established present-day oxygen concentrations about 2. Rust is one good example of chemical alterations brought about by oxygen. A good biological example is the appearance of oxygen-breathing organisms, or aerobes, and the confinement in a figurative sense of non-oxygen breathing organisms, or anaerobes, to swamps and bogs and places deep in the Earth. The idea that life influences planetary processes i. This hypothesis is generally supported by scientists today and, in fact, is probably most responsible for stimulating continued research on Gaia. Even the most conservative scientists agree that research on the way in which living organisms interact with non-living processes may yield useful information. Much of our modern-day climate research is based, to some degree,

on this idea. As a result of defining a weak Gaia hypothesis, the original Gaia hypothesis i. Few scientists are willing to support this hypothesis. As we learned earlier, the traditional scientific method relies on refuting a hypothesis, proving it wrong, as the means for eliminating possible explanations. Popper passed away in but he is still considered one of the most influential philosophers of the 20th Century. You can learn more about him by visiting the Karl Popper Website. Without going into all the details, suffice it to say that those arguments are valid. The strong Gaia hypothesis states that life creates conditions on Earth to suit itself. Life created the planet Earth, not the other way around. As we explore the solar system and galaxies beyond, it may one day be possible to design an experiment to test whether life indeed manipulates planetary processes for its own purposes or whether life is just an evolutionary processes that occurs in response to changes in the non-living world.

8: Gaia hypothesis - Wikipedia

If, after a number of decades, a large body of evidence develops that supports the hypothesis that our planet is a living, self-regulating organism, then the Gaia hypothesis may be upgraded to a theory, much like the theory of gravity.

Beekes has suggested a Pre-Greek origin. After them was born Cronos Cronus the wily, youngest and most terrible of her children, and he hated his lusty sire. Cottus, Briareos and Gyges, each with a hundred arms and fifty heads. So Gaia devised a plan. She created a grey flint or adamantine sickle. And Cronus used the sickle to castrate his father Uranus as he approached Gaia to have sex with her. From the testicles of Uranus in the sea came forth Aphrodite. But when Rhea was pregnant with her youngest child, Zeus , she sought help from Gaia and Uranus. When Zeus was born, Rhea gave Cronus a stone wrapped in swaddling-clothes in his place, which Cronus swallowed, and Gaia took the child into her care. But afterwards, Gaia, in union with Tartarus, bore the youngest of her sons Typhon , who would be the last challenge to the authority of Zeus. His son by Elara, the giant Tityos , is therefore sometimes said to be a son of Gaia, the earth goddess. Depiction[edit] In classical art Gaia was represented in one of two ways. In Athenian vase painting she was shown as a matronly woman only half risen from the earth, often in the act of handing the baby Erichthonius ,a future king of Athens, to Athena to foster. In mosaic representations, she appears as a woman reclining upon the earth surrounded by a host of Carpi, infant gods of the fruits of the earth. Being a chthonic deity, black animals were sacrificed to her: Chthonic Gaia receives a black animal, heavenly Helios a white one. It was thus said: For they say that in earliest times the oracular seat belonged to Ge Earth , who appointed as prophetess at it Daphnis, one of the Nymphai Nymphs of the mountains. There is extant among the Greeks an hexameter poem, the name of which is Eumolpia, and it is assigned to Musaios Musaeus , son of Antiophemos. In it the poet states that the oracle belonged to Poseidon and Ge Earth in common; that Ge Earth gave her oracles herself, but Poseidon used Pyrkon Pyrcon as his mouthpiece in giving responses. The verses are these: It is said that he to Poseidon Kalaureia Calaurea , that lies off Troizenos Troezen , in exchange for his oracle. There was a temple of Ge Eurusternos on the Crathis near Aegae in Achaia, with "a very ancient statue": The woman who from time to time is priestess henceforth remains chaste, and before her election must not have had intercourse with more than one man. Any woman who may chance not to speak the truth is immediately punished as a result of this test. If several women compete for the priesthood, lots are cast for the honour. Close to the sanctuary of Eileithyia in Tegea was an altar of Ge; [39] Phlya and Myrrhinos had an altar to Ge under the name Thea Megale Great goddess ; [40] , as well as Olympia which additionally, similar to Delphi, also said to have had an oracle to Gaia: In more ancient days they say that there was an oracle also of Ge Earth in this place. On what is called the Stomion Mouth the altar to Themis has been built. In this grove are also two temples of divinities, one of Apollon, the other of Aphrodite. Next to the grove is a sanctuary of Demeter; she and her daughter [Persephone] are standing, but the image of Ge Earth is seated. Here the floor opens to the width of a cubit, and they say that along this bed flowed off the water after the deluge that occurred in the time of Deukalion, and into it they cast every year wheat mixed with honey. The ancient sanctuary of Zeus Olympios the Athenians say was built by Deukalion Deucalion , and they cite as evidence that Deukalion lived at Athens a grave which is not far from the present temple. Her existence is a speculation, and controversial in the academic community. Some modern mythographers, including Karl Kerenyi , Carl A. Ruck and Danny Staples interpret the goddesses Demeter the "mother," Persephone the "daughter" and Hecate the "crone," as aspects of a former Great goddess identified by some[who? The mother-goddess Cybele from Anatolia modern Turkey was partly identified by the Greeks with Gaia, but more so with Rhea and Demeter. Aion and Gaia with four children, perhaps the personified seasons, mosaic from a Roman villa in Sentinum , first half of the third century BC, Munich Glyptothek, Inv. W Neopaganism[edit] Many Neopagans worship Gaia. Beliefs regarding Gaia vary, ranging from the belief that Gaia is the Earth to the belief that she is the spiritual embodiment of the earth, or the Goddess of the Earth. Gaia hypothesis The mythological name was revived in by James Lovelock , in Gaia: In some Gaia theory approaches, the Earth itself is viewed as an organism with self-regulatory functions. Further books by Lovelock and others popularized the Gaia Hypothesis , which was

embraced to some extent by New Age environmentalists as part of the heightened awareness of environmental concerns of the s.

9: Famous theory of the living Earth upgraded to 'Gaia '

Beliefs regarding Gaia vary, ranging from the belief that Gaia is the Earth to the belief that she is the spiritual embodiment of the earth, or the Goddess of the Earth. [46] Modern ecological theory [edit].

From the moment life first appeared on Earth it has worked hard to make Earth a more comfortable place to live. Gaia theory suggests that the Earth and its natural cycles can be thought of like a living organism. When one natural cycle starts to go out of kilter other cycles work to bring it back, continually optimising the conditions for life on Earth. At the time, Lovelock was working for Nasa, looking at methods of detecting life on Mars. Initially, Gaia theory was ignored, and then later ridiculed by scientists such as Richard Dawkins and Stephen J Gould. However, in recent times stronger evidence for the theory has emerged and Gaia has started to gain support. Bacteria produced nitrogen, an inert gas, and photosynthesising plants produced oxygen, a very reactive gas. The nitrogen helps to keep things stable, preventing oxygen levels from climbing too high and fuelling runaway fires. Meanwhile, the oxygen supports complex life. Gaia also helps to explain how the oceans are kept in balance. Rivers dissolve salt from rocks and carry it to the ocean, yet ocean salinity has remained at about 3. It appears that the salt is removed again when water is cycled through cracks on the ocean floor. These processes are not thought to be conscious ones, or to favour any one life form over another. Lovelock argues that humans have now pushed Gaia to her limit. In addition to filling the atmosphere with carbon dioxide, we have hacked our way through the "lungs" of the planet the rainforests and driven many species to extinction. He thinks we are heading for a very warm world, where only polar regions are comfortable for most life forms. Eventually, he suspects, Gaia will pull things back into check, but it may be too late for the human race. Feedback loops Feedback loops often appear to keep the planet in balance. One good example of this is the way in which atmospheric carbon dioxide is kept in check. Carbon dioxide is pumped into the atmosphere by volcanoes, and removed by the weathering of rocks encouraged by bacteria and plant roots in the soil. When it reaches the sea, the dissolved carbon dioxide is used by tiny organisms, known as coccolithophores algae , to make their shells. When coccolithophores die they release a gas - dimethyl sulphate - which encourages the formation of clouds in the atmosphere. When atmospheric carbon dioxide levels become too high, coccolithophores get busy, locking up more carbon dioxide in their shells and pumping dimethyl sulphate into the atmosphere when they die - producing clouds which reflect back sunlight and help the Earth to cool. Conversely, if atmospheric carbon dioxide levels become low, coccolithophores reduce their activity. Over the past years mankind has greatly increased atmospheric carbon dioxide levels, and recently there has been evidence that algal blooms in the ocean are increasing. Could Gaia be trying to correct our mistake?

THE HISTORY OF GAIA THEORY pdf

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