Pseudoscience: Objective or Subjective?

MICHAEL RUSE

ABSTRACT

What is pseudo–science and when do charges of pseudo–scientific thinking generally arise? These questions are answered by looking at six examples where the charge of pseudo–science has arisen: anti–vaccination and the claims that it causes illnesses, Creationism – the claim that the Bible is literally true –, chiropractic and claims about curing cancer and the like, pre–Darwinian evolution, that is developmental hypotheses before the *Origin of Species* (1859), Immanuel Velikovsky and his book, *Worlds in Collision*, and the Gaia hypothesis that the Earth is an organism. It is agreed that there is an objective foundation to charges of pseudo–science and the author's testimony in a court case in Arkansas in 1981, arguing that Creationism is not genuine science, is used to support this claim. Karl Popper's criterion of demarcation invoking falsifiability is a key notion here. However, it is argued that charges of pseudo–science occur most frequently when conventional practitioners are under threat. Then claims of pseudo–science are used to attack the non–conventional opposition. The examples are used to support this conclusion.

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§1

I WANT IN THIS ESSAY to consider the question of whether ascription of the term "pseudo–science" is objective or subjective. By this I mean: Is pseudo–science something existing out there, like President Donald Trump, or is it something existing in here, like our feelings about President Trump? I will begin by giving three personal vignettes, and these will take me to the heart of my discussion[1].

§1.1 Anti–Vaccination

I was born in 1940. My mother died when I was thirteen and on the bounce my father married a German *au pair*. Her family had been close friends of Dr. Rudolf Steiner, the Croatian–born *clairvoyant* and polymath, noted best today as the founder of the Waldorf system of education, a great success in the United States, especially places like California. Steiner had strong views on individual development —these underlie the Waldorf system— and among them was the belief that childhood illnesses like measles are a necessary part of growing into mature adulthood.

As we know only too well, given the present outbreak of measles, along with schools for Orthodox Jews, Waldorf schools are prime places for the spread of this once–conquered, often–dangerous disease. My father had 25% eyesight in one eye and 50% in the other, thanks to childhood measles. For over thirty years —he became a bursar at a Waldorf school— he swore blind (to use a metaphor) that vaccination was a great danger. He was what is known as an Anti–Vaxer. This, despite the fact that such a position is firmly based on

[1] My most detailed discussion of this topic is in my *The Gaia Hypothesis: Science on a Pagan Planet* (2013).

pseudo–scientifc ideas, such as the discredited belief that vaccination leads to autism.

§1.2. Creationism

In my scholarly career, I became an expert on Charles Darwin and his theory of evolution. In 1981, I was called down from my university in Canada to be a witness (along with such luminaries as the paleontologist Stephen Jay Gould and the theologian Langdon Gilkey) for the American Civil Liberties Union (ACLU) in a trial in Arkansas over whether "Creation Science" so called, should be taught in state–supported public schools (Ruse 1988).

I argued that Creation Science, aka Genesis read literally, is no science; it is a pseudo–science, invented to get religion into state schools. The judge agreed with me, writing:

> More precisely, the essential characteristics of science are:
>
> (1) It is guided by natural law;
>
> (2) It has to be explanatory by reference to natural law;
>
> (3) It is testable against the empirical world;
>
> (4) Its conclusions are tentative, i.e., are not necessarily the final word; and
>
> (5) It is falsifiable. (Ruse and other science witnesses).
>
> Creation science as described in Section 4(a) fails to meet these essential characteristics (Overton 1982).

Interestingly, a point to which I shall return, the judge noted that the Creationists accuse the evolutionists as embracing a pseudo–science!

Creationists view evolution as a source of society's ills, and the writings of Morris and Clark are typical expressions of that view.

> Evolution is thus not only anti–Biblical and anti–Christian, but it is utterly unscientific and impossible as well. But it has served effectively as the pseudo–scientific basis of atheism, agnosticism, socialism, fascism, and numerous other false and dangerous philosophies over the past century. Morris and Clark, *The Bible Has The Answer*, (p. 31 and Pretrial p. 89).

§1.3. Chiropractic

My third example is close to home, and occurred shortly after my family moved (in 2000) to Florida State University (FSU) from my previous base in Canada. In

the early years of the new century, FSU founded a new medical school. On campus, there was much opposition to this, faculty especially arguing that the state did not need another medical school and that one at FSU would drain resources from elsewhere on campus. To counter this, the new school emphasized that its focus would be on producing general practitioners and that these would be directed at needs in rural areas and similar locations. How could a good liberal like me object to this?!

Then a year or two later, disaster struck. A prominent state politician, a chiropractor, secured a considerable sum —ten million dollars was the figure, I think— to found a department of chiropractic within the new medical college. The FSU administration welcomed the funds and the opportunity. The dean and faculty of the medical school went berserk. They knew of the problematic reputation of chiropractic and of its keen desire to be considered legitimate. If it were introduced into a new, already–somewhat–insecure institution, it would spell the end of its reputation. Harvard might get away with it. Florida State could not. Immediately the troops rallied —the cry of "pseudo–science" was on everybody's lips— and with relief the money was refused. And then people went back to normal. In Tallahassee this meant a good working relationship between regular doctors and chiropractors, and that when you have back problems your doc is as likely to refer you to a chiropractor as to a physiotherapist.

§2. Objective or subjective

Now what moral do we draw from these three tales? Obviously, there is an objective side to pseudo–science. Immodestly, in the Arkansas trial I am the chap who defined or characterized pseudo–science, a definition or characterization that has gone all the way up and been accepted by the Supreme Court. My reasoning applies in the other cases too. There is no way that the anti–vaxers are going to accept that the autism story has been refuted. There is no way that chiropractors are going to accept that a lot of what they believe is untrue, starting with the dangers of vaccination. A recent Canadian Broadcasting Corporation investigation of chiropractors, in the province of Manitoba (main city, Winnipeg), found all sorts of fantastic claims. Including: "Offers of treatments for autism, Tourette's syndrome, Alzheimer's disease, colic, infections and cancer"[2].

As importantly, I want to argue that there is a crucial subjective element to these tales. It is not just that people believe or don't believe in claims about

[2] https://sciencebasedmedicine.org/cracking–down–on–chiropractic–pseudoscience/

pseudo–science, but that the term "pseudo–science" tends to get most bandied about at times of tension. This is seen most obviously in the chiropractic case. Everyone was just fine —the medics were oblivious to chiropractic, until it looked like they might be professionally associated with it— and then all hell let loose. And the term of "pseudo–science" came right up. Then after it was all over, pseudo–science was conveniently dropped.

We have the same in the anti–vax case. Until the measles epidemic, no one cared much about Waldorf schools, certainly not as a threat. They have many virtues, being very children–focused and strong on things like art and theatre and the like. I even left two of my children with my father and stepmother for a year so they could go to his Waldorf school in England when I was on sabbatical. Then, people found themselves threatened by Waldorf schools and their philosophy. My kids might get measles because their kids are not yet vaccinated. Remember, you have to be a certain age to be vaccinated so all young kids are threatened as well as those who, for legitimate medical reasons, cannot get vaccinated. And, cries of pseudo–science came loud and clear —and often.

The Creationism story is much the same. Most of the time, regular scientists could not care less about Genesis, certainly not in the context of science education. Then the threats started to occur —apparently much of the attraction of Creationism came from fears of the threat of nuclear Armageddon because of the Cold War— and, before long, the embattled scientists were raising cries of pseudo–science. Even to the extent of winkling out an English–born historian and philosopher of science from his snug home in Ontario and getting him to testify in the American South! What is an interesting twist on the story is that the Creationists likewise felt threatened. By the end of the 1970s, they had been having much success, especially making evolutionists look fools in debates with their stars (above all, Henry M. Morris and Duane T. Gish). And now it was they who were being made to look foolish. Naturally, it was their turn to invoke philosophy and argue that it was Darwinian evolutionary theory that is unfalsifiable. They started with the fact that the central mechanism of natural selection is supposedly a tautology: the survival of the fitness really means that those that survive are those that survive. An interesting side note is that the Creationists were even keener on the Popperian falsifiability, as a criterion of demarcation (of science with non–science), than were the evolutionists. Many philosophers were (and are) very suspicious of Popper. I used it precisely because the Creationists had introduced it into the discussion. Did I ever get negative backlash from my fellow philosophers!

So, I argue that pseudo–science has both an objective and a subjective side. Now let us apply my reasoning to three more cases —two I have investigated and one the work of another— and then I will be ready to draw my conclusions, speaking directly to the theme of this symposium, abut supposed upstarts in the frequency of pseudo–scientific ideas.

§3. Evolution

Evolutionary thought, the claim that organisms are all descended by a process of modification from just a few simple forms, perhaps indeed from inorganic materials, has a history of about three hundred years. August Comte claimed that Western thought has gone through three phases — the Theological or fictitious, the Metaphysical or abstract, and the Scientific or positive — and in respects he is uncannily prescient about the history of evolutionary thought (Ruse 1996).

The first phase dates from the early years of the eighteenth century to 1859, the year that Charles Darwin published his *On the Origin of Species*. Although this was not a term in general use until the end of this period, I argue that this is the time of pseudo–science (theological or fictitious), based on evolutionary thought being a parasite on cultural claims about progress. From savages to Englishmen, from monads to men. Listen to Erasmus Darwin, Charles Darwin's grandfather.

> Organic Life beneath the shoreless waves
> Was born and nurs'd in Ocean's pearly caves;
> First forms minute, unseen by spheric glass,
> Move on the mud, or pierce the watery mass;
> These, as successive generations bloom,
> New powers acquire, and larger limbs assume;
> Whence countless groups of vegetation spring,
> And breathing realms of fin, and feet, and wing.
>
> Thus the tall Oak, the giant of the wood,
> Which bears Britannia's thunders on the flood;
> The Whale, unmeasured monster of the main,
> The lordly Lion, monarch of the plain,
> The Eagle soaring in the realms of air,
> Whose eye undazzled drinks the solar glare,

> Imperious man, who rules the bestial crowd,
> Of language, reason, and reflection proud,
> With brow erect who scorns this earthy sod,
> And styles himself the image of his God;
> Arose from rudiments of form and sense,
> An embryon point, or microscopic ens!
> (Darwin 1803, 1, 11, pp. 295–314)

Notions of biological progress, running up from the blob to the human, make the very backbone (to use an apt metaphor) of this vision, shown as Darwin explicitly tied his biology into his philosophy. The idea of organic progressive evolution "is analogous to the improving excellence observable in every part of the creation; such as the progressive increase of the wisdom and happiness of its inhabitants" (Darwin 1794–1796, 2, p. 247–2).

We get this progress–infiltration again, just before the *Origin*, from the Scottish publisher Robert Chambers, writing anonymously. He published *The Vestiges of the Natural History of Creation* in 1844, and certainly had a progressive axe to grind. Chambers thought that, against the miracle stories of Genesis, natural origins are more in line with the industrialized society that Britain had by then become.

> A progression resembling development may be traced in human nature, both in the individual and in large groups of men… . Now all of this is in conformity with what we have seen of the progress of organic creation. It seems but the minute hand of a watch, of which the hour hand is the transition from species to species. Knowing what we do of that latter transition, the possibility of a decided and general retrogression of the highest species towards a meaner type is scarce admissible, but a forward movement seems anything but unlikely" (Chambers 1846, the fifth edition, pp. 401– 402).

So up to about the middle of the nineteenth century, evolutionary thinking was pseudo–scientific. A point that Darwin's bulldog, Thomas Henry Huxley, writing about *Vestiges* later in the century, noted explicitly. In an article labeled "Science and Pseudo–science" (1887), of "pseudo–scientific philosophy" he wrote: "I was familiar with it in full bloom, more than thirty years ago, in a work which had a great vogue in its day —the 'Vestiges of the Natural History of Creation'— of which the first edition was published in 1844. It is full of apt and forcible illustrations of pseudo–scientific realism".

Then came the *Origin*. Charles Darwin's intention was, at one leap, to raise evolutionary thought from pseudo to professional, what you find in the work of physicists and chemists. In certain limited fields he was successful. The work done, using natural selection, on problems of mimicry in butterflies was thoroughly professional and is still recognized as such today. Generally, however, with respect to professional science, Darwin was not that successful, because the biologists of his day were into physiology, anatomy, and paleontology, none of which disciplines which had much use for natural selection. But at the popular level (metaphysical or abstract) Darwin's thinking, including natural selection (and its subsidiary sexual selection, involving selection for mates) was hugely successful. Look at the poem by a young woman in the 1880s. It is labeled "natural selection", but it is really about sexual selection.

I HAD found out a gift for my fair,
I had found where the cave men were laid:
Skulls, femur and pelvis were there,
And spears that of silex they made.

But he ne'er could be true, she averred,
Who would dig up an ancestor's grave—
And I loved her the more when I heard
Such foolish regard for the cave.

My shelves they are furnished with stones,
All sorted and labelled with care;
And a splendid collection of bones,
Each one of them ancient and rare;

One would think she might like to retire
To my study—she calls it a "hole"!
Not a fossil I heard her admire
But I begged it, or borrowed, or stole.

But there comes an idealess lad,
With a strut and a stare and a smirk;
And I watch, scientific, though sad,

The Law of Selection at work.

Of Science he had not a trace,
He seeks not the How and the Why,
But he sings with an amateur's grace,
And he dances much better than I.

And we know the more dandified males
By dance and by song win their wives—
'Tis a law that with avis prevails,
And ever in Homo survives.

Shall I rage as they whirl in the valse?
Shall I sneer as they carol and coo?
Ah no! for since Chloe is false
I'm certain that Darwin is true.

(Naden 1999)

Then, finally, we had the coming of Mendelian genetics around the turn of the new century, Darwinism and Mendelism were seen to be not rivals but complementary parts of the full picture, and so Neo–Darwinism (English term) or the synthetic theory of evolution (American term) was born (Provine 1971). Great theoreticians like Ronald Fisher and J B S Haldane in England and Sewall Wright in America came first, and then the empiricists E B Ford in England and Theodosius Dobzhansky, Ernst Mayr, George Gaylord Simpson, and G Ledyard Stebbins in America filled out the theoretical skeleton. Professional evolutionary biology (the scientific or positive) had arrived.

Go back to the pseudo–scientific phase. That evolutionary thinking was truly pseudo–scientific in an objective way goes without saying. Nobody had any evidence. Sometimes the claims were truly ludicrous. Chambers, for instance, on the origin of life, wrote of "experiments conducted a few years ago by Mr. Crosse, which seemed to result in the production of a heretofore unknown species of insect in considerable numbers. Various causes have prevented these experiments and their results from receiving candid treatment, but they may perhaps be yet found to have opened up a new and most interesting chapter of nature's mysteries. Mr. Crosse was pursuing some experiments in crystallization, causing a powerful voltaic battery to operate upon a saturated solution of

silicate of potash, when the insects unexpectedly made their appearance. He afterwards tried nitrate of copper, which is a deadly poison, and from that fluid also did live insects emerge" (Chambers 1844, "particular considerations respecting the origin of the animated tribes"). If you believe that, you believe anything. You are certainly not into the falsification business.

But it is the subjective side that is more interesting. The venom of Chambers' critics is overwhelming. My favorite quote is by Adam Sedgwick, Professor of Geology at the University of Cambridge. His response was a fifty–plus rant in the *Edinburgh Review* and then to a mild little (thirty–page) sermon he had given to undergraduates in the early 1830s, he added a five–hundred word preface and a three–hundred word afterpiece. To a friend, Sedgwick wrote:

"The work finds much favour in London, and is now in a fourth edition! Why? Because of the shallowness of the fashionable reading world, and because of the intense dogmatic form of the work itself. He who asserts boldly and without doubt, will be sure of a school of followers. This is true of religious sects from Mahometans to Newmanites, and it is equally true of philosophic schools. I believe the author is a woman" (Sedgwick to Napier, 17 April 1845).

To be fair, having speculated that *Vestiges* could only have been written by a woman, Sedgwick took back this suggestion as too vile to contemplate. It could never have been produced by a member of the fair sex: "the ascent up the hill of science is rugged and thorny, and ill fitted for the drapery of a petticoat". Rather, woman has "a soft and gentle temperament", "quick appreciation of character", and "instinctive knowledge of what is right and good" (Sedgwick 1845, 4). Sir David Brewster, optician, biographer of Newton, and general Scottish man of science, knew the real cause: "Prophetic of infidel times, and indicating the unsoundness of general education, "The Vestiges" has started into public favour with a fair chance of poisoning the fountains of science, and sapping the foundations of religion" (Brewster 1844, 471). He too worried about its popularity with women. "It would auger ill for the rising generation, if the mothers of England were infected with the errors of Phrenology. It would auger worse were they tainted with Materialism". He too saw the problem lies in the nature of our distaff half. "The hold in which Providence has cast the female mind, does not present to us those phases of masculine strength which can sound depths, and grasp syllogisms, and cross examine nature". Stick to water–colors, as Brewster was happy to praise one Lady Cumming Gordon of Altyre for so doing. And so it went. William Whewell, Master of Trinity College Cambridge (of which Sedgwick was a fellow, brought together anti–evolutionary

extracts from earlier works and published them (*Indications of the Creator*) without being able to bring himself to mention the vile work.

What was terrifying Sedgwick and his friends was the threat that *Vestiges* seemed to pose to their own positions. Whewell and Sedgwick were Anglican clergymen in one of the nicest spots in England, a very rich college, that depended entirely on its being taken as beyond question true and safe. And now along comes *Vestiges*, suggesting that their whole fabric is tawdry and their lifestyles are built on falsities. No wonder they were tense!

Huxley is somewhat different but at least as interesting. At the time of writing in the early 1850s he was no evolutionist, but he hated *Vestiges* precisely because he saw it as too religious (Huxley 1854)! Chambers may not have been a theist, believing in the God of Christianity, but he was a deist, believing in God as Unmoved Mover. Just before the passage on the spontaneous generation of insects, he wrote: "The Eternal One has arranged for everything beforehand, and trusted all to the operation of the laws of his appointment, himself being ever present in all things". Anathema to Huxley, who later was to invent for himself the label of "agnostic". An interesting footnote is that, when Huxley wrote his piece on pseudo–science, the row over *Vestiges* was long gone. The object of Huxley's ire now was the Duke of Argyll (1867) who had presumed to write on these matters and who, like Chambers, embraced a fully deistic worldview. Given the Duke's status, naturally he attracted attention and followers, and that was the threat that the science modernizing Huxley felt in full. As always, pseudo–science had its subjective dimensions.

§4. Velikovsky

In this section, I talk of work that is not my own. I rely on Michael Gordin's superb discussion of Immanuel Velikovsky, author of the notorious *Worlds in Collision* (1950)[3]. I take the fact that Gordin independently comes to very similar conclusions to mine about the subjective element in pseudo–science ascription to be strong confirmation of my position.

Gordin's (brilliant) gambit is to start with the theorizing about heredity by the Soviet scientist Trofim Lysenko. It was clear, certainly to American geneticists —above all to Theodosius Dobzhansky, Russian–born and trained and leader of the new evolutionary synthesis (see above)— that Lysenko's ideas,

[3] Gordin first wrote an article "How Lysenkoism Became Pseudoscience: Dobzhansky to Velikovsky" (2012), and then a full–length book, *The Pseudoscience Wars: Immanuel Velikovsky and the Birth of the Modern Fringe* (2012). All the material I need here can be found in the article.

a not–much–updated version of Lamarckism, were false through and through. At first, the effort was to discredit Lysenko as a scientist. Gordin writes:

"I suggest that often when Lysenkoism is classed as a pseudoscience, one usually finds either one or a conflation of four possible reasons for the categorization: (a) that the biological claims of Lysenko were erroneous to the point of being pseudoscientific; (b) that the methods Lysenko used did not belong to the canons of science (especially his rejection of statistics or controls); (c) that the elaboration and justification of scientific findings in terms of philosophy or ideology (and especially dialectical materialism) was a non–scientific practice; and (d) that outside (e.g., state, media, church) intervention on behalf of a particular scientific doctrine automatically contaminates it and renders it pseudoscientific" (Gordin 2012a, p. 445).

In other words, the objective side of things was stressed. If anything, Lysenkoism as a threat was played down. This is from a letter by L. C. Dunn, a geneticist colleague of Dobzhansky, to one of the science editors at the *New York Times*. "The fact that conflicting views and reports continue to come out of the Soviet Union seems to me the best indication that both sides are free to express themselves" (Gordin 2012a, p. 450, written May 22, 1946). Then came the meeting in Moscow in 1948 when, thanks to the endorsement of Stalin, Lysenkoism was given unique state–endorsed status. Immediately, the American geneticists saw Lysenkoism as a different kind of threat. It was political, social, subjective. Another letter from the same writer (L. C. Dunn).

> Discussion on the scientific level is not likely to lead to further understanding but only to widen the gap between Lysenko and geneticists generally, since, Lysenko's views having become officially adopted, he is no longer free to change them.
>
> The better practice to follow in attempting to improve American Soviet understanding would be to attempt to provide an interpretation of Lysenko's victory over his opponents on other than scientific grounds…" (Gordin 2012a, p. 454, written January 1949).

Dobzhansky agreed. This is a letter to Dunn, December 12, 1948:

> It is evident that "the mainsprings of action in this particular case" are frauds backed by political chikanery [sic] – an[d] any attempt to represent it as anything else does not serve the truth...: a contemptible cheat has not only obtained backing for his prescientific and at best 19th century ideas, but has also succe[e]ded in murdering some and bouncing other scientists who were doing first class work and who dared to oppose his charlatanism. This is the core of the situation, and all else is materials for dissertations of future historians.... And as to "the scientific issues involved", the situation is likewise unmistakably clear.... And

> if saying that a political regime under which such things may happen is a crime against humanity, I am in favor of "attacks upon Soviet policy as a whole" —the time when one had to refrain from saying the whole truth because of hopes of saving thereby the lives of Dubinin, Schmalhausen, and others has passed. These people are now martyrs of this political regime, and it is just as well to say so aloud. Yes, I know, saying this will be a help to some people much nearer than Moscow whom I do not like to help. But, Dunn, trying to convince oneself and others that the snow in New York falls black and turns white in a few days is a futile as well as in the last analysis harmful procedures [sic]. Let us say the truth, and let the chips fall where they may" (Gordin 2012, p. 455).

As Gordin concludes, wryly: "Lysenkoism was no longer bad science, or ignorance, it had become *pseudoscience*".

The Velikovsky affair fits right into this. Velikovsky was a Russian–born physician, trained as a psychoanalyst, who ended up in America. He believed that the Old Testament was a good guide to past astronomical events, and, in his *Worlds in Collision* published in 1950, he gave full scope for his imagination. There had been all sorts of catastrophes, perhaps the best–known around 1500 BC when, thanks to a comet from Jupiter, the waters of the Red Sea were parted. This comet later became the planet Venus, which upset Mars, causing another set of catastrophes.

The conventional astronomers went bananas, even to the extent of bullying Velikovsky's publisher to drop him, despite his being a runaway best seller (they threatened the textbook side of the publisher, Macmillan). Why? Why didn't they just ignore this nonsense? The Lysenko affair! Lysenko was obviously Soviet science. This was just the time when the Cold War was getting underway and Senator Joseph McCarthy and his HUAC thugs were going after respectable (liberal) scientists, accusing them of being communists. These people had to fight back, and what better than to make Velikovsky (a Russian!) the astronomical equivalent of the biologist Lysenko? The popular–science writer Martin Gardner spoke of "the work of the Russian geneticist, Lysenko, unimportant in itself, but with a wider significance because it strengthens a cultural paranoia, and dramatically high lights the conflict between a relatively free and a rigidly controlled science". He went straight on to add:

> Although there obviously is no sharp line separating competent from incompetent research, and there are occasions when a scientific 'orthodoxy' may delay the acceptance of novel views, the fact remains that the distance between the work of competent scientists and the speculations of a Voliva [a prominent flat–earther] or Velikovsky is so great that a qualitative difference emerges which justifies the label of 'pseudo–science (Gordin 2012a, 462).

Many years later, a supporter of Velikovsky —Leroy Ellenberger— wrote the appropriate epitaph:

> Thus, having been inadvertently associated with one of the 20th century's greatest scientific frauds, left–wing scientists were sensitized and quick to attack any suspicious–looking idea in order to shore up their reputations as respectable, proper–thinking men of science. To vulnerable astronomers, the advent of *Worlds in Collision* could not have been a more welcome instrument to assist their redemption (Gordin 2012b, 102).

Amen!

§5. Gaia

Third and finally, the Gaia hypothesis, the brainchild of English chemist and inventor James Lovelock and (to a certain extent) Lynn Margulis, American cell biologist (and, as it happens, whose first husband was Carl Sagan). The Gaia hypothesis is that the Earth is an organism and that the mark of the organic is homeostasis, the ability to maintain a constant state. The two advocates offer a serious argument. Start with the atmosphere. Venus has massive amounts of carbon dioxide, comparatively little nitrogen, and no oxygen at all. Mars has little carbon dioxide, virtually no nitrogen or oxygen. Earth, as is well known, has about 20% oxygen, 80% nitrogen, and traces of carbon dioxide. Why the difference?

Using the term "cybernetics" for the study of systems where feedback mechanisms —meaning by "feedback" cases where the end product (the effect) swings around and affects the initial input (the cause) and thus controls or regulates the working of the whole— the Earth is just such a system. We find a number of feedback mechanisms, such as a room's temperature being controlled by a thermostat and, even more pertinently, with the human body's temperature regulation through sweating and shivering and so forth. Indeed: "We suspect that the earth's control systems follow a similar complex pattern more comparable to the temperature control in individual organisms than to man–made models" (Margulis and Lovelock 1974, p. 474). Thus, the Gaia hypothesis! "We conclude from the fact that the temperature and certain other environmental conditions on the earth have not altered very much from what is an optimum for life on the surface, that life must actively maintain these conditions" (ibid., p. 475).

This isn't a stupid argument by any means. Probably essentially true. It cannot be denied that, in subsequent years, Lovelock (1979) did tend to go over the top a little, introducing all sorts of teleological arguments the like of which went out with the Scientific Revolution. The salinity of the sea is about 3.5%. If you work out the salt that is being dumped into the sea yearly by runoffs from the land (via rivers), it is clear it should be a lot higher. In fact, in a mere 80 million years starting from scratch one could get up to the present levels, not much when you consider how long the oceans have been around (about four billion years). Where is all the salt going? And why? Obviously, it is going because organisms cannot handle higher salinity levels. So, the Earth set about fixing things! Lovelock suggested that life constructs lagoons in which sea water can be trapped and evaporated. The salt is removed this way. How does the construction occur? Well, coral reefs are one possibility. "Is it possible that the Great Barrier Reef, off the north–east coast of Australia, is the partly finished project for an evaporation lagoon?" (op. cit., p. 91) And so on and so forth. It is even possible that life manipulates the inorganic world. Volcanic activity and continental drift could be turned to nature's ends.

Some of the reaction was predictable. No one much cared for the teleology, and, after a while, Lovelock himself started to tread carefully. Disciplinary barriers went up. Lovelock is an organic chemist, so homeostasis was meat and drink to him. For evolutionary biologists, life gets defined in a very different way, in terms of natural selection. Expectedly, Richard Dawkins was eloquent on this.

> The fatal flaw in Lovelock's hypothesis would instantly have occurred to him if he had wondered about the level of natural selection process which would be required in order to produce the earth's supposed adaptations. Homeostatic adaptations in individual bodies evolve because individuals with improved homeostatic apparatus pass on their genes more effectively than individuals with inferior homeostatic apparatuses (Dawkins 1982, pp. 235–236).

In any case, in Dawkins's opinion, there is something wrong about the emphasis that Gaia puts on homeostatic self–regulation as the defining characteristic of living things. Dawkins was happy to accept the connection between homeostasis and life, but he wanted to counter the belief that homeostasis alone is enough to deem something as living. Life itself has to be the end product of natural selection. And once you recognize this, you see at once how flawed the Gaia hypothesis has to be.

> For the analogy [of the Earth to an organism] to apply strictly, there would have to have been a set of rival Gaia's, presumably on different planets. Biospheres which did not develop efficient homeostatic regulation of their planetary atmospheres tended to go extinct. The Universe would have to be full of dead planets whose homeostatic regulation systems had failed, with, dotted around, a handful of successful, well–regulated planets of which the Earth is one" (ibid.).

And, so on and so forth. What makes the story interesting and pertinent for our discussion is the fact that Dawkins himself had just brought out a book, *The Extended Phenotype*, where he offered many arguments that seem very similar to those of Lovelock! He had all sorts of stuff about how animal and plant behaviors in one part of the world can have knock–on effects in other parts of the world, as everything is bound up symbiotically to further reproduction and existence.

Dawkins was critical. Others were downright nasty. "Gaia –the Great Earth Mother! The planetary organism! Am I the only biologist to suffer a nasty twitch, a feeling of unreality, when the media invite me yet again to take it seriously?". Thus John Postgate, leading British microbiologist, Fellow of the Royal Society, and colleague of John Maynard Smith. He continued that Gaia "has metamorphosed, in Lovelock's writings and those of others, first into a hypothesis, later into a theory, then into something terribly like a cult". His judgment: "It is pseudoscientific mythmaking". And, so came the warning.

> When Lovelock introduced it in 1972, Gaia was an amusing, fanciful name for a familiar concept; today he would have it be a theory, one which tells us that the Earth is a living organism. Will tomorrow bring hordes of militant Gaia activists enforcing some pseudoscientific idiocy on the community, crying "there is no God but Gaia and Lovelock is her prophet"? All too easily (Postgate 1988, p. 80).

What's going on here? Gaia is a mixed bag. Some of it is good science. Some of it is a bit flaky, pushing to the limits and over to pseudo–scientific status. The North–American biologist W. Ford Doolittle (1981) was clearly bothered by the odor of teleology that hung over the Gaia hypothesis, making semi–joking reference to children's books about a near–namesake, Dr Dolittle, mentioning particularly one story that involved a Council of Life on the Moon that prevented fighting and promoted harmony. Here we clearly have ends (if you like, intended ends) in some way influencing earlier events, a kind of planning. How can we suppose something like this for Planet Earth? "The construction of an evaporation lagoon for sequestration of sea salt may benefit the biosphere as

a whole, in the very long run, but what in particular does it do for the organisms who construct it, especially in the short run?" (Doolittle 1981, p. 61).

Somewhat hurtfully, Doolittle's judgment was that although Jim Lovelock's "engaging little book" gives one "a warm comforting feeling about Nature and man's place in it", it is based on view of natural selection "which is unquestionably false". Even worse, it is potentially dangerous, because it gives the illusion that if things go wrong, the Earth will fix itself, whereas in truth there is absolutely no guarantee. Things work by chance not design. Any sense of design comes about through illusion —if things did not work as they do, we would not be here. That is all. "[O]nly a world which behaved as if Gaia did exist is observable, because only such a world can produce observers" (ibid. p. 62). To assume that there is more could lead us into the false trap of behaving as if there will inevitably be a tomorrow when in truth tomorrow may never come.

Thus, the objective issues. But this does not account for the nastiness. By now we should be hypothesizing that perhaps the critics were under strain. That they saw Gaia threatening because of their own problems. And this was indeed true. By about 1980, the time when Gaia became really well known (Lovelock had just written his popular book on the subject —the object of Doolittle's scorn, yet taken up with delight by the general public), the evolutionary biologists were squabbling like a crowd of hungry, tired kids in kindergarten. In taxonomy, the cladists had battled with the Darwinians. In behavior, Edward O. Wilson's magisterial *Sociobiology: The New Synthesis* had brought down the scorn of the Marxists, some biologists in his own department. "I don't really think we are engaged primarily in an intellectual issue. I do not think that what he has been doing for the last ten years has been primarily motivated by a genuine desire to find out something true about the world, and therefore I don't think it is serious".

This geneticist, Richard Lewontin, one of those colleagues, also wrote a scathing review of a book on biology and culture, co–authored by Wilson.

> "One of the reasons my book review… had a kind of sneering tone is that it is the way I genuinely feel about the project, namely that it is not a serious, intellectual project. Because I have only two possibilities open to me. Either it is a serious intellectual project, and Ed Wilson can't think, or he can think, but it is not a serious project and therefore he is making all the mistakes he can —he does. If it is a really deep serious project, then he simply lowers himself in my opinion as an intellectual..." (Segerstrale 2000, p. 75).

He continued: "I have to say that my chief feeling —I'll be honest about my chief feeling when I consider all this stuff— it's one of disdain. I don't know what to say, I mean, it's cheap!" (ibid.).

Then there was paleontology and Stephen Jay Gould's hypothesis of "punctuated equilibria", evolution by jumps (Eldredge and Gould 1972). The doyen of Darwinian evolutionists, John Maynard Smith, responded bitterly.

> Gould occupies a rather curious position, particularly on his side of the Atlantic. Because of the excellence of his essays, he has come to be seen by non–biologists as the preeminent evolutionary theorist. In contrast, the evolutionary biologists with whom I have discussed his work tend to see him as a man whose ideas are so confused as to be hardly worth bothering with, but as one who should not be publicly criticized because he is at least on our side against the creationists. All this would not matter, were it not that he is giving non–biologists a largely false picture of the state of evolutionary theory" (Maynard Smith 1995, p. 46).

No wonder biologists turned on that audacious pseudo–science interloper, the Gaia hypothesis. They could join forces agreeing how dreadful it is. Here again is John Postgate.

> "As every thinking scientist knows, science has fallen badly into disrepute in the past couple of decades. The reasons, which are multiple and very serious, are not relevant just now. The important thing is the consequence of that disrepute: fringe science, pseudo science, obscurantism, wishful thinking and mysticism today find almost mediaeval favour even among educated people. For example who, a few decades ago, would have expected the surge of astrology, fringe medicine, faith healing, nutritional eccentricities, religious mysticism and a thousand other fads and cults which now plague developed societies?" (Postgate 1988, p. 80).

The professional community turned on Gaia not just for its failings, but because of their own insecurities. John Maynard Smith was blunt about all of this. "Look Jim, all the trouble with Gaia is that we've had such agony with vitalism and group selection, and all these other things, and we thought we had it all worked out, and then you came along. You couldn't have chosen a worse moment"[4].

Lovelock comments: "This, I think, explains a lot of the hostility".

[4] The David Suzuki (filmed) interview of James Lovelock, copyright 2002

§6. And the world said

The theme of our symposium is "the upsurge of irrationality". Is there an upsurge of irrationality? A skeptic like myself is liable to say that there has always been irrationality. To claim that the death of someone on a cross, two–thousand years ago, has any relevance to the fact that I cheat on my taxes seems to me to be the epitome of irrationality. But let us not get diverted into issues of religion and the like. Let us stay with issues where most everyone —religious or not— agrees that there is irrationality at issue. I claim that my studies of pseudo–science fit this demand.

I am still worried about whether there is really an upsurge. Truly, wouldn't one want to say that the enthusiasm for spiritualism in the second half of the nineteenth century showed an upsurge? Or the arguments about Freud and psychoanalysis in the 1920s? What about all the stuff about supply–side economics in the 1980s —cut the taxes on the rich and we will all benefit? Some hope! It is certainly the case that there is some irrationality thriving— if that is the right term —today. I would start with denial of global warming. I find —I am not surprised to find— that the term "pseudo–science" figures high in the discussions. I also find —and again I am not really surprised to find— that both sides of the debate use the epithet "pseudo–science". Of course, you would expect to find the regular scientists using the term, especially given that despite the science, governments —starting with the US government— ignore or deny the science. But the term is used also by the deniers. This from a pamphlet, "Global warming alias climate change [the non–existent, incredibly expensive, threat to us all, including to our grandchildren]" — by one David Kear, 34 West End, Ohope, Whakatane, NZ (former Director–General, NZ DSIR; United Nations consultant; & South Pacific geoscientist).

> Fooling the World: The Global Warmers persisted with their use of pseudo–science and made further predictions. Understandably they too all proved wrong. At conferences I began to hear, regardless of the science involved, when a speaker wished to "rubbish" some scientific idea or research, he/she stated that conclusion firmly, and followed it by "Just like Global Warming". Clearly the Global Warmers heard that too. They didn't change their pseudo–science, but cleverly changed the name to "Climate Change". [One can disprove warming, but the words change of climate can't be proved wrong].

No surprise at this kind of thing, because if anyone is under threat, global warming deniers are (Notice the Popperian influences about ideas that "can't be proved wrong" — in other words, unfalsifiable).

In the end, my answer is that there may or may not be an upsurge. Perhaps there is. My suspicion is that many of the controversies are going to being sparked by cultural, perhaps political, issues as anything happening within science, although not exclusively. Creationism seems to be something that came from without, fears of nuclear war for a start. Gaia seems to be something that came from within, disputes about biology by biologists. Either way, I predict a long —and if not successful then vigorous— future for the concept of a "pseudo–science"! The ebbs and flows of irrationality, at least the ways in which we deal with irrationality, are going to be subjective as much as objective.

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