

GAIA AND THE SEVENTH PRINCIPLE
Including Part I of the Nuclear Energy discussion
By Tom Kinney
May 10, 2009

Bulletin quotes:

“Nature is a unity in diversity of phenomena; a harmony, blending together all created things, however dissimilar in form and attributes; one great whole animated by the breath of life.” *Kosmos* Alexander von Humboldt (1769—1859)

Intergenerational Piece:

Some people think Gaia is a sort of spirit out there controlling the balance of what happens on our planet. Now I don't happen to believe the spirit part but...I wrote this talk about Gaia and the UU 7th Principle when I was in Texas this January, a talk that also opens an ongoing discussion toward learning more about nuclear power. And a few months later, I got an e-mail in our tiny village library down there from our vice president of Sunday services, Pam, saying she had been able to schedule Dr. Reed Johnson on nuclear power generation for a few weeks ago and ask me to do the introduction. Then, a few weeks after I heard from Pam, I got an e-mail from Jane asking me to play the music for her program on Gaia. Soo-o-o-o-o. It's a bit of a woo-woo that maybe there is someone or something out there pointing us all in a direction of importance.

But then I remembered a movie about a primitive guy in Africa that is sitting under a tree and gets hit on the head with a coke bottle. He has never seen a coke bottle, doesn't understand how it happened to hit him on the head, and ends up building a religion around what was just an unusual coincidence. By the

way, the coke bottle got tossed out of an airplane flying overhead. I think the name of the movie was *The Gods Must be Crazy*.

Well, crazy gods or not, Gaia and our interdependent web is what I'll be talking about today. Let's start with our Seventh Principle which states: We, the members of the Unitarian Universalist Association, covenant to affirm and promote respect for the interdependent web of existence of which we are a part.

On this Mother's day, a day founded by the author of the "Battle Hymn of the Republic," our Unitarian Julia Ward, we need to remember it's origin was as a day of peace. We sometimes forget the true theme of this day. Although today's talk does not focus on that specific, peace permeates much of what we study and learn about. So, let's open with a mother story.

Those of us who grew up in modest means know the principle of minimizing waste. If a morsel of food dropped on the floor, you picked it up, dusted it off, and ate it. Our Mom's had the philosophy toward dropped food that "You eat a peck of dirt before you die." And with Shirley's Mom, a strong proponent and practitioner of this philosophy, it seems to not have done much harm as she lived less than four years short of 100 years. Our in-house expert on living organisms of the smallest scale, Dr. I.L. Graves, is a proponent of caution in that we don't over-immunize or over sanitize lest when those inevitable few bad little rascals do show up in us, the appropriate antibodies are there inside us to protect.

While we don't expect our next potluck to include a few tasty courses of dirt, we need to understand that we ourselves are an interdependent web of existence as we sit here this very morning. Just like the big tree out back, we have thousands of creatures living in us and on us. We are a walking, or sitting in your case, interdependent web of existence. Most of our co-travelers help us or, at least, don't hurt us. Some we can't live without. So we shouldn't panic or go crazy with fear over what we might touch or what touches us, what might be in our food, water, or air. But think of the Gaia concept, nature works to keep things in balance, and keeps all those creatures on us and inside us in relative peace with each other and with us. It's our own personal interdependent web.

Now, don't be claiming the Gaia concept means you can skip your baths, not brush your teeth, or don't need to stay strong. Nature is there but isn't about to carry the whole load.

Main Talk:

Yes, your mother might have as mine did say, "We eat a peck of dirt before we die."

Contrast this with various product claims to "Use this product regularly, and you will rid yourself and your house completely of germs and pests." The term

“pests” is sometimes poorly defined such that it could apply equally to door-to-door religious salespersons or that shirttail relative you see too much for too long at a time.

More quickly, our mind relates such protective measures that keep our homes free of micro-organisms that cause cholera, malaria, bubonic plague, and other less dramatic diseases. But there is a broad range of invaders of our homes and our bodies.

In a sidebar, maybe there is an applicable perspective here on life as well. “You eat a peck of dirt before you die.” Going negative on Mary Engelbright’s twisting of the common saying, “Life is not always just a chair of bowlies.” To expect life to be always just a bowl of cherries is recipe for disappointment. However, back to step one of our theme this morning -- thinking of our interdependent web of existence in its smallest unit, our physical selves, the colony that is our body.

Biologists set up a hierarchy of three types of relationship between living organisms. When one organism does nothing but harm to its host, that’s called parasitism. Think of that live-in Cousin Billy that breaks the china and wrecked your car. In our body’s case, this means ringworm, pinworms, athlete’s foot, ticks, and fleas. Everything from influenza virus, far too small to see, to the

tapeworm that can grow to twenty feet and more inside your small intestine.

Parasites we can do without.

Much more common, however, are the creatures that live on and in us and do neither harm nor good—the niece Alice in your spare bedroom that you hardly know is there. This type of relationship is known to biologist as commensalisms. We provide a comfortable home for tiny mites that live in our eyelashes, to others that dine upon castoff skin fragments, and a wide variety of bacteria. We are unaware of their presence, and we would have great difficulty ridding ourselves of them. It might even be a bad idea, since we can't be sure that they do not serve some useful function.

And then there is symbiosis, where we and our fellow-traveling organisms are positively good for each other—Uncle Saul buys the groceries every week and does the dishes. What would happen if you could rid yourself of all organisms that do not possess the human genetic code?

The answer is simple. You would die, instantly. In every cell of your body are tiny objects called mitochondria. They are responsible for all energy generation, and they are absolutely essential to your continued existence. But they have their own genetic material and they reproduce independently of normal cell reproduction. They are believed to be bacteria, once separate organisms that

long ago entered a symbiotic relationship with humans (and also with every other animal on earth).

“We are not alone.” More and more, we realize the truth of that statement. We are covered on the outside and riddled on the inside with hundreds of different kinds of living organisms, and we do not yet understand the way that we all relate to each other. For each, we have to ask, is this parasitism, commensalism, or symbiosis.

Sometimes, the answers are surprising. Twenty-five years ago, gastric ulcers were blamed on diet or stress. Today, we know that the main cause is the presence in the stomach of a particular bacterium known as *Helicobacter pylori*. Another organism, *Chlamydia*, is a suspect for coronary disease and hardening of the arteries. A variety of auto-immune diseases may be related to bacterial action.

All these facts encourage a new approach to biologists and physicians: The best way to study humans is not as some pure and isolated life form; rather, each of us should be regarded as a “super-organism”. The life-cycles and reproductive patterns of us and all our fellow travelers should be regarded as a big interacting system.

Disgusting, to be lumped in with fleas and mites and digestive bacteria, as a single composite object? I don't think so. In a way it's a comforting thought. We are not alone, and we never will be.

And no expert understands all these interactions so we invent fictions that put us at ease and that seem to work. "You'll ingest a peck of dirt in your lifetime...and probably more."

Now, broadening the definition of the interdependent web of existence of which we are a part.

I would like to read you a bit from *Ulysses Found* by Ernle Bradford:

It is sometimes difficult when trying to equate geographical fact with poetic fiction to realize how, 3,000 years and more ago, people had no conception of those limits which we accept as dividing the world of actuality from the world of imagination. "The limits of human and superhuman, material and immaterial were but dimly realized. There was something in common between gods and humans and the beasts of the field and all growing things, and a pathway between the living and the dead...Every stream and oak and mountain was the habitation of a spiritual being whose nature was on the borderland between the human and the divine and partook of both. And so weak was the sense of identity, that with a touch of magic it was felt the barrier might be passed, and a

person might become a wolf or a serpent or a hoopoe or a purple lily. He might renew his youth; he might be raised from the dead. With the waving of a branch and sprinkled waterdrops the wizard might bring a rain-shower down the side of Lykaios. He might understand the language of all living creatures, even the woodworms in the decaying rafters, and say "I know the songs of all the birds'."

In childhood we all know these feelings, but in the childhood of mankind it is possible that we still felt them even when we were an adult. It is a faculty which some poets, artists, and men of genius have managed to preserve throughout the ages. William Blake, the "most practically sane, steady, frugal and industrious man" as Samuel Palmer described him, was quite capable of seeing angels singing in the trees—and that was in the 'rational' 18th Century. A pantheist like Van Gogh could find God as easily in a cane chair or a pair of old shoes as in the clouds and sky. It may be that artists are those who have retained into maturity the innocent eye of childhood. Scylla may be a cave in a limestone rock to a geologist, and Charybdis a whirlpool of moderate dimensions to a hydrographer, but these definitions do not necessarily disqualify the poet's view. Stromboli has been described by one volcanologist as "an interesting example of a volcano in almost continuous activity," but the child or the poet is equally entitled to see it as the home of a god. The poetic words of William James describes this perspective: We may be in the Universe as dogs and cats are in our libraries, seeing the books and hearing the conversation, but having no inkling of the meaning of it all." These are the borderlands of science and, in the words of Charles Sheffield from a book of that name: Gaia, the whole earth

mother, is the representation of that more spiritual perspective that comes closest to scientific respectability, although scientists as well-known as Stephen Jay Gould and Richard Dawkins have dismissed it as pseudoscience.

It began in the late 1970's, when James Lovelock published a controversial book, *Gaia: a New Look at Life on Earth* (Lovelock, 1979). In it he set forth his idea...that the whole of Earth's biosphere should be thought of as a single, giant, self-regulating organism, which keeps the general global environment close to constant and in a state appropriate to sustain life. In Lovelock's own words, Gaia is "the model, in which the Earth's living matter, air, oceans and land surface form a complex system which can be seen as a single organism and which has the capacity to keep our planet a fit place for life."

Lovelock says that the notion is an old one, dating back at least to a lecture by James Hutton delivered in 1785. However, modern incarnation of that idea is all Lovelock's, although the name Gaia as a descriptive for such an interdependent global entity was provided by the late William Golding (a Nobel laureate for literature, Lovelock's neighbor in England, and author of the classic *Lord of the Flies*). Both of these interconnected webs of which we are a part, our personal super-organism of which your consciousness is sitting in the midst of at the moment and our world-wide one are complex and interrelated beyond our imagination. So we humans focus upon individual issues in bite-size chunks in

which the interests and concerns wax and wane from decade to decade, from century to century.

Interest is currently peaking in energy as one of those bite-sized issues in our interconnected web of existence. Something like Gaia thinking seems to be needed to apply to the two sources of energy that are part of the earth's environment, one source external to earth and the other source internal. The external source, of course, is the sun, solar energy. Solar energy includes our day-to-day sunshine and its resultant, wind, plus the products of photosynthesis like wood, coal, oil, natural gas, and the recently popular bio-fuels, all of which are actually stored sunshine, a kind of battery of solar energy that we tap. Nearly all creatures of the earth including man exploit this energy source. The second source is our planet's internal energy, both that which is mixed in the dirt in your backyard all the way down through our intensely hot molten core, hotter than the surface of the sun, to our earth's recently found highly compressed solid center. Newly discovered bacteria-sized creatures are dependent upon this ancient energy source. More on this terrestrial energy later.

Solar energy, although from outside the planet, outside our interdependent web, illustrates the Gaia concept. Life has existed on Earth for about three and a half billion years, initiated when the carbon dioxide in the atmosphere was three times that of today. Since that time, the sun's energy output has increased by at least thirty percent. If earth's temperature simply responded directly to the Sun's

output, based on today's global situation we would expect that two billion years ago the whole Earth would have been frozen over. Conversely, if Earth was habitable then it should today be too hot to support life.

But in fact, the response of Earth's biosphere to temperature changes is complex, apparently adapting to minimize the effects of change. For example, as the amount of solar energy delivered to Earth increases, the rate of transpiration of plants increases, so the amount of atmospheric water vapor goes up. That means more clouds – and clouds reflect sunlight, and shield the surface, which tends to bring surface temperatures down. In addition, increased amounts of vegetation reduce the amount of carbon dioxide in the air, and that in turn reduces the greenhouse effect by which solar radiation is trapped within the atmosphere. Again, the surface temperature goes down. There are many other processes, involving other atmospheric gases, and the net effect is to hold the status quo which benefits living organisms. According to Lovelock, it is more than a matter of convenience. Only the presence of life has enabled Earth to remain habitable. If life had not appeared on this planet when it did, over three billion years ago, then by this time the surface of Earth would be beyond the range of temperatures at which the life we know could exist.

Why, then, does the Gaia idea qualify as a scientific heresy? It sounds eminently reasonable, and something like it seems to explain the long continuity of life on the planet. At the least, it is an entertaining exploration.

Part of the problem is that at first thought it seems as though the whole Earth must be engaged in some sort of activist role. Many have assumed that intention is a necessary part of the Gaia idea, a reversion to the times of Ulysses, that the biosphere itself somehow knows what it is doing, and acts deliberately to preserve life. A number of non-scientific writers have embraced this “Earth as Ur-mother” thought in a way and with an enthusiasm that Lovelock neither intended nor agrees with. At the other extreme, two biologists, Dolittle and Dawkins, have offered the rational scientific criticism that the Gaia idea seems to call for global altruism, i.e. some organisms must be sacrificing themselves for the general good. This runs contrary to everything we believe to be true about genetics and the process of evolution.

Lovelock seemed at first to encourage such a viewpoint when he wrote, “But if Gaia does exist, then we may find ourselves and all other living things to be parts and partners of a vast being who in her entirety has the power to maintain our planet as a fit and comfortable habitat for life.” There is more than a suggestion here of a being which acts by design. However, Lovelock has later shown through simplified models that neither global intention nor global altruism is needed. The standard theory of evolution, in which each species responds in such a way as to assure its own survival and increase its own numbers, is sufficient to create a self-stabilizing total system.

Today the Gaia hypothesis, that the whole Earth biosphere forms a single, self-regulating organism, is still outside the scientific mainstream. However, over the past decades it has gained some formidable supporters, notably the biologist Lynn Margulis, who has championed Gaia more actively than Lovelock ever did. The Theory also provides a useful predictive framework for studying the way in which different parts of the biosphere interact, and particular chemicals propagate among them. Nonetheless, if it is not today outright heresy, to many scientist Gaia remains close to it.

Lovelock ironically comments that we may have come (quoting) "...the full circle from Galileo's famous struggle with the theological establishment. It is the scientific establishment that now forbids heresy. I had a faint hope that Gaia might be denounced from the pulpit; instead I was invited to deliver a sermon on Gaia at the Cathedral of St. John the Devine in New York."

The Gaia concept sometimes permits Lovelock to take an unusually detached attitude to other global events. Some years ago, Sheffield was driving him from suburban Maryland to the Museum of Natural History in Washington, D.C. On the way, they somehow got on the subject of all-out nuclear war. Lovelock surprised Sheffield very much by remarking that it would have very little effect. Sheffield said, "But it would kill off every human!"

Lovelock replied, “Well, yes, it might do that; but I was thinking of the effects on the general biosphere.”

Lovelock’s statement leads us back to that bite-sized chunk of the interdependent web, energy, in relation to our covenant to affirm and promote respect for the interdependent web of existence of which we are a part and the effects on the general biosphere. Scientists know the earth was not created wholly as a spin-off of our sun. The sun has the capability of creating only the first half of the periodic table of elements of which our earth and we are made. An ancient exploding star contributed the rest. Dava Sobel, simplifying the science in *The Planets*, gives us the essentials,

At later stages in their lives, stars forged nitrogen, oxygen, and even iron. Then, literally exhausted, they expired and exploded, spewing their bounty of [other] new elements into space. The largest and brightest stars bequeathed to the universe the heaviest of elements, including gold, lead, and uranium. Thus the stars carried on the work of Creation, hammering out a wide range of materials for future use.

This is our terrestrial energy or we might call it Gaia energy as it is part of our earth package. Lovelock, as originator of the “Gaia” hypothesis, puts it: *Perhaps the strangest thing about the Earth is that it formed from lumps of fall-out from a star-sized nuclear explosion. This is why even today there is still enough*

uranium left in the Earth's crust to reconstitute a minute scale of the original event. (end quote) This Gaia energy is enough to provide humanity with ample energy for ages and ages to come. The most passionate Gaia believers probably think it is part of the plan.

It helps to get a sense of the amount of Gaia energy, the nuclear energy, available—this stuff that is found in each shovelful of dirt in your back yard. Explosively, the Hiroshima bomb transformed only ONE GRAM from matter into energy. A gallon of gas propels a 3000 lbs car about 30 miles. The binding energy stored in the nuclei of that gasoline is enough to propel that vehicle 60 million miles, almost all the way to Mars. Fission taps only a small percentage of that binding energy. The North Omaha power plant produces 500 mw of electricity fueled by a 110 rail car train every three days, 125 tons of coal per rail car. The plant occupies two square miles, mostly to handle the coal. The Cooper Nuclear Station, 30 miles south of Omaha, receives two tractor-trailers every 3 years carrying several bundles of 12-foot long nuclear fuel rods. These mildly radioactive rods are handled safely with gloves. And Cooper Nuclear produces 150% of the power of the North Omaha coal plant with no sulfur, no soot, no mercury, no particulate matter, no ash, no slag and no greenhouse gases. At 750 mw, that's a relatively small facility. I recently visited South Carolina's Oconee nuclear power plant with a capacity of 2600 mw and the South Texas project at 2700 mw—both relieving the need for multiple coal plants. These facilities produce five times the power as North Omaha and use only 5% of North Omaha's land. This energy is so different from energy from the sun which has

fueled human and other creatures' needs for millions of years that it is no surprise that there has been such a lag in public understanding. More to follow on this important challenge later this year.

In the poetic words of William James, "We may be in the Universe as dogs and cats are in our libraries, seeing the books and hearing the conversation, but having no inkling of the meaning of it all." Perhaps, over the next few months, we can open a few more of those books and dissolve some energy myths to get an inkling of the meaning of it all.

I leave the subject of Gaia for now with this Science Fiction story idea: suppose that the biosphere did know what it was doing, and acted deliberately to preserve and enhance life. How do you think it would deal with humans?

Closing Circle:

Whether we believe we can
Or whether we believe we can't,
We are absolutely right!

--Henry Ford