Journey to the Origin: Biological Integrity and Agriculture

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At the outset, it is important for me to describe myself as a layperson in this gathering. My background is in art. I have no formal education in science or agriculture. But I am here with a point of view completely opposed to biotechnology in general and to its place within agriculture in particular.

I say this out of my own experience. I left teaching art in the early 1970's, having been deeply moved by the specter of world hunger as it was looming on the global horizon. After the oil embargo of the same period, and in order to meet its balance of payments, the United States quadrupled the price of its export agricultural commodities. It was a response to the lawlessness of the global market system, whereby unilateral decisions on oil and food commodities wreaked havoc on the desperate economies of the non-industrial world. I remember the vivid realization of learning that the cattle of the feedlots of the United States were daily consuming grain adequate to feed the hungry peoples of the world. That fact determined the direction of my life, and I have been involved with the analysis of hunger and agriculture ever since.

In 1977, I heard a paper delivered by Thomas Berry. The context he outlined also set a direction in my life that has helped me to probe ever deeper the root causes of the kind of dysfunction that plays itself out in the global crises of our times.

Thomas Berry is a renowned historian of world cultures and in his two seminal books, *The Dream of the Earth* and *The Universe Story* , which he co-authored with Brian Swimme, he suggests that the root of our crises is contained with the cosmology that has shaped the total context of western thought. I suggest in this presentation that this cosmology also underpins the world of biotechnology and that it is both flawed and dangerous. I also suggest that a contemporary scientific understanding of the origin, nature, and functions of the cosmos would indicate that biotechnology is itself an extension

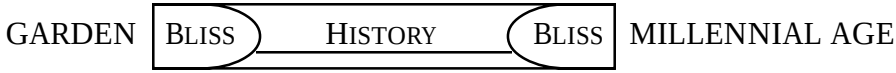
of the same inadequate worldview and that it is taking us in a direction that is counter to the natural progression of the universe, the earth, and life.

The following chart is my simple attempt to model some of the assumptions that are inherent in our traditional western cosmology. Our origin story, rising several thousand years ago out of the Mediterranean world, provided a context of meaning that attempted to answer the ultimate question of the mystery of existence. In short, it provided a coherent set of meanings upon which the various structures of culture were formed. Some of them are:

- That the divine is totally transcendent to the universe, hence perfect and unchanging.
- The human has a transcendent destiny to be brought into union with the divine, but this union depends on the human transcending the cosmos.
- The cosmos itself does not have this spiritual transcendent destiny. It is a physical, material plane of existence and possesses no inherent spiritual substance.
- The human is free to explore the physical world, analyze its physical energies, and redesign them to bring about some of its original perfection lost after the fall.

Hence, this world view might be described by this simple model:

In this worldview, the ordinary conditions of life are perceived as temporary and abnormal. Thomas Berry suggests that this perception sets the stage for



a growing pathological rage within the western psyche. This rage is directed towards the conditions in which life is actually granted to us. Historically, it has made it nearly impossible to develop the inner capacity to live creatively or graciously within the whole fabric of life. Instead, we have resisted all limitations imposed on us as abnormal, as a punishment from which we will one day be liberated. Our inner capacities have been stunted and our total intrusion into the fabric of life, as it has brilliantly evolved, is nearly total.

So it is the scientific story of evolution itself that suggests that our obsession with genetic engineering may well bring about a total undermining of the very life we commit to re-designing. I would like to suggest that as we review the process of evolution, seen now as a total evolution of the inner as well as outer dimensions of the universe, that this context provides an essential correction to the direction that agri-biotechnology is pursuing.

The following overview of the evolution of DNA was prepared by Dr. Lawrence Edwards, PhD, of Genesis Farm.

EVOLUTION OF DNA

About 15 billion years ago

The universe flared into existence. At first all was symmetric. Within much less than a millionth of a second the symmetry is broken as the primal four forces emerge. All subsequent relationships will be governed by these four. In particular, the nature of the electromagnetic force is now set. Even though there were no molecules in existence, the laws of chemistry are now in place. So even though no DNA was present, limits were in place on the strength of the hydrogen bonding and therefore on the diameter of the helix.

A billion years later

The universe coalesces into galaxies and stars. The stars live by consuming primal hydrogen and helium and fusing them into new entities — lithium, beryllium, oxygen — all the chemical elements up to iron in weight. The larger stars exhaust their supplies of hydrogen and helium and can no longer sustain their existence as stars. They become supernova and, in that cataclysmic process, fuse to become the heavier chemical elements. Their bodies, rich in chemical elements, are strewn throughout the cosmos.

For billions of years after

Subsequent generations of stars form by gathering the chemically enriched gaseous clouds of hydrogen into themselves, fusing, become supernova, and again distributing more elements into the cosmos.

About 4.6 billion years ago

A large star in our galactic neighborhood became a supernova.

About one hundred million years later

Our sun and solar system formed from the body of this supernova. For several hundred years the planets grew in size by accruing smaller asteroids in often violent collisions. The earth was often molten during this period. During this process the chemical elements born in the star and supernova combine to form simple molecules (e.g., water) and minerals (rocks, stones, etc.).

About 4.1 billion years ago

The great bombardment was over. The solar system reached its present configuration of nine planets. The earth now cooled for the last time, eventually enough so that steam could condense. It rained violently for eons creating the oceans.

About 4 billion years ago

Probably during one or many of those thunderstorms, the first complex molecules were synthesized from the simple molecules and minerals. (No one knows; there are many theories.) Once created, those molecules self-organized themselves and others into creative possibilities. At least one of those possibilities worked. Over the eons those organizational capabilities resulted in the first living organisms. Probably the first genetic capability was through RNA (ribonucleic acid). Later, apparently, DNA (deoxy-ribonucleic acid) proved to be more effective and RNA was then used not for the storage of the genetic information, but only as a "messenger" between DNA and the enzyme production capability. (Again no one is certain of the process in those early years.)

DNA is a chain of four specific nucleic acids. A "word" in the language of DNA consists of a particular sequence of three of these acids. Thus, there are 4x4x4 or 64 possible words in the DNA language. Each word "speaks" of a particular amino acid. So a sentence of words specifies a sequence of amino acids, which is a protein (enzymes are proteins). In all life forms, the same correspondence exists between the DNA words and the particular amino acid. (In many cases there is more than one word possibility for a specific amino acid.)

This was all worked out 4 billion years ago!

Some hundred million years later

Simple bacteria emerge. A bacterium consists of a cell wall surrounding and containing protoplasm, a complex mixture of organic molecules including naked strands of DNA directing the maintenance of the bacterium. The protoplasm connects with the outside environment through the cell wall. Occasionally, the cell clones itself, a process directed by its DNA. Thus, DNA not only remembers how to create a new cell and how to maintain its existence, but also directs the processes.

About 2 billion years ago

In response to the menace of oxygen, a new form emerges, the eukaryote cell, the cell with a nucleus. (Of course, the bacteria live on and prosper without a nucleus.) The cellular DNA is collected and stored in the nucleus as a double helix. This helix unzips during the reproduction process and then each strand duplicates itself in the daughter cells. During this unzipping the DNA is very susceptible to damage. Mutations occur primarily during this time. Apparently this susceptibility to damage is just right: more would result in higher death rates of the daughter cells, less would result in less ability to adapt. (Later, cells developed molecules to "walk" along the DNA helix strand to find and correct errors.)

For the last 2 billion years

DNA has learned, memorized, and directed the processes of life. Changes in the DNA of a particular species have been slow, in earth time. There have been periods of accelerated change, but these periods have still been long — hundreds or thousands of years when compared to human time. All changes were rigorously tested for compatibility with the organism's ecosystem.

15,000 years ago

Humans started consciously changing the DNA of other organisms through horticulture and domestication of animals. Those changes were made much more quickly than normal evolution, but still over many generations. There was not such rigorous testing of the changed organisms and this led to problems in some cases, e.g., exotics taking over an ecosystem. Often the changed organisms are not even independently viable and must be supported by human activities. But, overall, the changes were not large. For example, there was never the mixing of genes between species.

Today

Humans have learned many words and sentences in the DNA language, the means to change sequences within a gene, and the ability to move sequences from one organism to another organism of a different species. Now the time scale of radical evolutionary changes is instantaneous. There is not the time nor the incentive to thoroughly test the new organisms.

There is not even the knowledge of how to test such unknown creatures. While the goal of many of these manipulations is laudable, e.g., the curing of various inherited, debilitating diseases, most are driven by commercial goals. One can imagine taking a certain risk in order to improve the health of a certain segment of the population. We have done this before, e.g., fluoridation of drinking water and vaccinations. But often there have been unforeseen disadvantages to such activities. In any case, much of the genetic manipulation today is for profit. There are few, if any, redeeming qualities except a more efficient product, e.g., a longer lasting tomato.

We do not understand the consequences of genetic manipulations. We are launching yet another massive experiment on ourselves with little understanding of the long-term consequences.

In conclusion

I would suggest that our refusal to live within the limitations of the unity of the whole, which has enabled the elegant miracles of life to unfold, is a dark extension of our mythology. Biotechnology is a commitment to myth. By refusing to acknowledge the superstition implied in our blind adherence to our vision of a world of bliss, we move deeper into a chaos from which life itself may be unable to recover.

MacGillis

That a university would commit itself to direct its young research capacities and its young scientists to such a distorted view of reality is a tragedy, made less understandable with the evidence that science itself holds forth.

REFERENCES

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