

# FROM HELIX TO HOLOGRAM

## An Ode on the Human Genome

*Life is fundamentally electromagnetic rather than chemical, the DNA blueprint functioning as a biohologram which serves as a guiding matrix for organising physical form.*

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*Form is not other than Void; Void is not other than Form.*

(from the *Heart Sutra*)

### FROM BIOCHEMISTRY TO BIOPHYSICS

**W**hat is DNA? Where did it come from? How does it function to create life, to create us? We have some of the biochemical answers, but we can look deeper into biophysics for our models. We propose that DNA functions in a way that correlates with holographic projection. DNA projects a blueprint for the organism that is translated from the electrodynamic to the molecular level. Furthermore, research strongly suggests DNA functions as a biocomputer. This DNA-wave biocomputer reads and writes genetic code and forms holographic pre-images of biostructures. We are more fundamentally electromagnetic rather than chemical beings.

### BIOCOSMOLOGY

*Where do we come from?* Imagine the possibility that life may have come from the fertile womb of the Universe to Earth as a tiny hitchhiking alien, using a meteor as a spacecraft. Anaxagorus, an ancient Greek, first proposed the theory that the seeds of life are spread throughout the Universe.

A science for discovering the foundations of life needs a theory—a biological Big Bang. One current theory has emerged from astrobiology, the science that searches for life in the Universe. It is a candidate to replace the old concept that life arose on Earth in a "primordial soup".

Panspermia alleges that life exists and is distributed uniformly through the Universe in the form of amino acids, microbes, germs and spores. If life arose extraterrestrially, then our planet is *not* a closed system. The fossil evidence shows that life took root on Earth as soon as possible once the heavy bombardment period subsided, the planet cooled and water formed. Vulcanism and space debris made conditions inhospitable to life for the first half-a-billion years of planetary existence.

This "seed of life" can travel between worlds and arrive by natural means such as ballistic impact, meteorite and comet. Intergalactic space may be permeated with cosmic dust and microbes. Evidence shows they could survive the hard-core radiation and the near-absolute cold of deep space. Some researchers (Hoyle and Wickramasinghe, 2000) believe these "seeds" of life are raining down on us all the time, affirming our cosmic ancestry.

Four billion years ago there was no DNA on planet Earth. It is widely believed that our DNA/protein-based cells are derived from an earlier world based on RNA, which can both replicate information and be a catalyst for chemical or metabolic processes. In the prebiotic era, self-assembling RNA was both the genetic and catalytic basis. The simple genome resided in the RNA—a single circular chromosome. We still don't know how RNA arose in the first place (Poole, 1998). Perhaps it arose from some simpler, self-replicating molecule.

The evolutionary path from the RNA world led to the most primitive organisms: prokaryotes (bacteria and archaea) and eukaryotes (single-celled organisms). Neither variety of primitive organism is a complete cell, but even prokaryotes have some free-floating DNA and ribosomes to make protein. Ribosomes "read" the genetic information and make whatever the cell needs. They possibly existed longer than 3.55 billion years ago, as their fossils and carbon deposits may indicate. Even exponents of competing

theories on the origin of life agree ribosomes are at least 2.7 billion years old (Copley, 2003).

For 500 million years there were only RNA-based organisms. Primitive life could exist in hostile surroundings with extreme heat and acidity or with no oxygen or even light. Latest findings show that this life-form descends deep within the crust of our planet, and perhaps other planets. It seems life is not so fragile after all, but hearty and robust. The womb of our Universe is fertile—not hostile to life.

How life took a quantum leap into the world that eventually manifested human life is still a mystery. To call it life, you need a cell with both a nucleus and a containing membrane. The mystery is written in the cells and molecules of all the life that still surrounds us.

The eukaryotes evolved in complexity, developing cellular characteristics. Arguably, there are fossils 3.8 billion years old that have structural molecules, ribosomes and protein-synthesising machinery. Proteins make possible the molecules for the "blueprint" molecule DNA. The stable DNA molecule became the genome carrier.

### SALT OF THE EARTH

*We wish to suggest a structure for the salt of deoxyribonucleic acid (DNA). This structure has novel features which are of considerable biological interest.*

Thus, Watson and Crick announced their revolutionary discovery with an understatement about their studies on pure, crystallised DNA. But what was the role in the evolution of life for this "salt of the earth"?

A shift to an oxygen-rich atmosphere 2.0 billion years ago allowed the evolution of cells with a nucleus. Eukaryotes keep their DNA structures in a nucleus. They have 10 to 1,000 times more of this genetic substance than prokaryotes.

For a thousand million years there were only prokaryotes (microbes) and single-celled micro-organisms, eukaryotes. Their reign covers half the timeline of life on Earth.

Cells became more and more complex over aeons, and developed into organs and beings evolved to fuel them. Plants, fish, vertebrae, insects, amphibians, reptiles, mammals, birds and flowers appeared. All animals, insects, plants, fungi and algae are eukaryotes, though the volume of prokaryotes far outnumbers cellular life. Prokaryotes are still essential to sustaining life on the planet. RNA still plays a vital role in cellular life, and hasn't relinquished its primal importance.

Perhaps life did not evolve on Earth at all if it is over 3,850 million years old. Maybe it *did* come in the form of intergalactic organic compounds of extremely hardy bacteria, spores and microbes from space, perhaps safely nestled deep in meteors, comets and planetary debris torn loose in collisions. Once they arrived from space, according to the theory, they self-assembled as proteins, then amino acids and life—with the ability to grow and reproduce.

DNA became the active repository of nature's blueprints for life—a library of proteins. Deoxyribonucleic acid is the molecule that programs our genetic potential. It is a virtually immortal thread tying us to all the life that has ever existed.

Decoding life has become a reality, pulling off the veil of

nature's mysterious process. Scientists can now purify, amplify and reproduce DNA in the laboratory. They can also overwrite the genetic code to create wholly new organisms.

### THE GENETIC ODE

The secret of life! How long mankind has yearned to know its essence and how to extend lifespan and improve health. The discovery of the DNA helix in 1953, by Watson and Crick, revealed the *shape* of this magic molecule. The following 50 years of research has led directly to our ability to read the human genome. We can now decipher its creative *meaning* and imitate its creative evolution.

Genetic engineering is no longer a chimera or sci-fi dream, but a stark reality. In terms of genetics, we are moving from the machine age to the gene age. A flood of new genetic information is transforming science and medicine.

A linear string of nucleotides makes up DNA. It specifies "codons", which in turn specify the amino acids that make up all of the different proteins that combine together to make a body. Five decades of tedious work made it possible to identify the 3.3 billion nucleotides that encode the sequence of the human genome.

*Where are we now?* It remains to be seen what sort of balance we strike between using the genome for good or ill, or even if we retain our "humanity" and genetic integrity. Humankind has never attempted such a crucial project before. It has often been said that "the map is not the territory", and the same holds true for the "map" of the human genome. Looking at the map doesn't reveal the natural consequences of real-life experimentation. In complex systems, small changes can quickly pump up into dramatic, often unforeseen and potentially catastrophic consequences.

For the time being, the twisted staircase of DNA is explored in the realms of molecular biology and biochemistry. Based on opening this world of biological organisation, we can conjecture what mysteries an even deeper look at the functional basis of living matter might reveal. This is the domain of biophysics, the realm of both particle and wave interactions—fields.

It has been demonstrated that DNA is electrically conductive; much like copper wire, it can carry a charge. It is believed that this live-wire vital capacity may have provided the charge transfer that gave life a jump-start. DNA's ability to transport charge helps minimise genetic damage from oxidation (Lawton, 2003).

The same fundamental physical laws that govern matter and the Universe also govern living organisms. Even a sound biochemical theory can be replaced by an even better, more fundamental, biophysical theory. It is still important to study properties at their own levels, not just as consequences of more fundamental scientific disciplines.

*Where are we going?* Who knows how future generations of man may be engineered from the 3.3 billion "letters" of the human genome? We have been looking to the genetic *code* for the secret of life. Perhaps we should be listening to the genetic *ode*: the electromagnetic *song* of life that reverberates throughout our being—the audible life-stream.

## THE HOLOGRAPHIC UNIVERSE

We are more fundamentally electromagnetic rather than chemical beings. The driver of evolution is not DNA, but even more fundamental quantum mechanical symmetry-breaking forces (King, 2003).

If we drop down another whole domain of observation from the juicy "wetware" described by chemistry and atomic structure, we enter the subatomic realm of quantum physics. At this level the behaviour of matter, both organic and inorganic, is governed not by classical notions of cause and effect or even complex dynamics, but by those of quantum probability.

"Something" appears to emerge from virtually "nothing"—which physicists have come to describe as a "sea of infinite potential". They call it "quantum foam", "vacuum potential" or "zero-point energy"; we can call it the "vacuum substructure". Subatomic particles wink in and out of existence on a continuous basis, like some subatomic froth. This "something" appears paradoxically in wave/particle form. This world is not transcendent to matter, but underlies it as a coherent unity—much like ecology underlies biology.

Within this context, some physicists have strongly suggested that the nature of reality is fundamentally analogous to that of a holographic projection. The optical process of holography uses interference patterns. Holography describes transformations of light and optical information mathematically in wave mechanics terms. The superposition of a split beam of laser light led to the laboratory development of holograms, or recordable holographic images, demonstrated by Dennis Gabor beginning in 1949. In 1971, Karl Pribram applied this metaphor to neuropsychology, suggesting it was more than analogy and that the brain actually encodes information as holograms. The pattern holds the form.

Holograms contain all the information needed to reconstruct a whole image. They contain many dimensions of information in far less space, like a compressed file. They hold that information in a subtle network of interacting frequencies. Thus, shining a coherent light (reference beam) or laser through the fuzzy-looking overlapping waves of a two-dimensional hologram can create a virtual image of a three-dimensional figure.

The gist of the holographic paradigm is that there is a more fundamental reality. There is an invisible flux not comprised of parts, but an inseparable interconnectedness. The holographic paradigm is one of reciprocal enfolding and unfolding of patterns of information. All potential information about the Universe is holographically encoded in the spectrum of frequency patterns constantly bombarding us.

In this dynamic model there are no "things", just energetic events. This "holoflux" includes the ultimately flowing nature of what is, and all possible forms. All the objects of our world are three-dimensional images formed of standing and moving waves by electromagnetic and nuclear processes. This is the guiding matrix for self-assembly and for manipulating and organising physical reality.

Criss-crossing patterns occur when two or more waves ripple through each other. In the transactional interpretation of quantum physics, waves of probability originate in the past, present and

future. Events manifest when waves from past and future interfere with each other in the present. That pattern creates matter and energy. The Universe emerges from the rippling effects of immense numbers of criss-crossing interference waves. The geometry of the fields is more fundamental than the fields or emergent particles themselves.

Our brains mathematically construct "concrete" reality by interpreting frequencies from another dimension. This information realm of meaningful, patterned, primary reality transcends time and space. Thus, the brain is an embedded hologram, interpreting a holographic Universe. All existence consists of embedded holograms within holograms, and their interrelatedness somehow gives rise to our existence and sensory images.

Interference patterns of waves can be visualised interacting like ripples on a pond. At the quantum level they create matter and energy as we perceive them—lifelike three-dimensional effects. Consciousness and matter share the same essence, differing by degrees of subtlety or density. There is a strong correlation between modulations of the brain's electromagnetic (EM) field and consciousness (Persinger, 1987; McFadden, 2002). The Universe is a continuously evolving, interactively dynamic hologram.

This "Holographic Concept of Reality" was first suggested by Miller, Webb and Dickson in 1973, and later touted by David Bohm (1980), Ken Wilber (1982), Karl Pribram (1991), Michael Talbot (1991) and others. In this holistic theory, the Universe is considered as one dynamic holomovement—a grand Unity.

The part is not only contained within the Whole; the Whole is contained in every part, only in lower resolution. So, following the axiom of "As Above, So Below", we can expect biology to be based on the same physical foundation of creation. Miller and Webb hypothesised precisely this in "Embryonic Holography", also in

1973. At the time, of course, such notions were untestable. But, with continuing revolutions in technology, now we are closer to modelling and demonstrating this creative process.

## DNA AS HOLOGRAPHIC PROJECTOR

In a hologram, wave fields interfere with one another to lay the foundations for the reconstruction of the image of an object. But how are the wave fields produced? The term "holography" comes from the Greek roots meaning "entire" and "to write". In holography, the image is projected by a coherent light source split into both the object wave and the reference wave background.

This dichotomous nature is reflected in the particle/wave nature of the DNA molecule, which can be "read out" with biophotons from chromosomes to set up a holographically produced wave field. This superposition of wave fields (object wave and reference wave) creates a wave guide for the formation of biological structure. The image is constructed according to the reference information contained in the genes. The reconstructed object wave is identical with the object wave field. The reconstructed wave fields reproduce exactly the recorded ones (the DNA with genetic code).

Russian research in genetics led scientists to begin looking experimentally at the helical structure of DNA as a possible holographic "projector" of the DNA code. Thus, the existential

blueprint described by the spiral staircase of DNA is translated into a complex EM field that guides the molecular growth of the organism. Miller et al. suggested as much three decades ago, and outlined possible mechanisms of this quantum biohologram at both the cellular and whole organism level.

This process emerges from a domain more fundamental than the standard genetic code triplet model. Biophysics can now describe how our form emerges directly from the void, the vacuum substructure. In essence, we emerge from the cosmic void—pre-geometrically-structured nothingness. DNA is the projector of that field which sets up the stress gradients in the vacuum substructure to initiate dynamic unfolding. Genes function as holographic memories of the existential blueprint.

At the moment of ovulation there is a definite shift in the electrical fields of the body of a woman. The membrane in the follicle bursts and the egg passes down the Fallopian tube. The sperm is negative with respect to the egg. When the sperm and egg unite, the membrane around the egg becomes hyperpolarised, shutting out other sperm. It is at this moment that the electromagnetic entity is formed. The fertilised egg cell contains all the holistic information necessary to create a complete, operational, human being. The biohologram begins to function at conception and ceases only at death. Our contention is that the DNA at the centre of each cell creates the multi-cellular creature hologram by expressing and projecting the DNA in the centre of the cells.

The biohologram projected by the embryonic nervous system forms a three-dimensional pattern of resonant structures. These structures behave as acoustic waves, acting as field guides for flowing matter and energy. The holograms are "read" by an electromagnetic or acoustic field that carries the gene-wave information beyond the limits of the chromosome structure. In this new understanding, DNA and the chromosome apparatus is the recording, storing, transducing and transmitting system for genetic information at both material and physical field levels.

### DNA-WAVE BIOCOMPUTER

The Gariaev group (1994) proposed a theory of the "DNA-wave Biocomputer". They suggest that: (1) there are genetic "texts", similar to the context-dependent texts in human language; (2) the chromosome apparatus acts simultaneously both as a source and receiver of these genetic texts, respectively decoding and encoding them; (3) the chromosome continuum acts like a dynamic holographic grating, which displays or transduces weak laser light and a solitonic electro-acoustic field. In other words, ***the code is transformed into physical matter, guided by light and sound signals.***

Complex information can be encoded in EM fields, as we all know from coding and decoding of television and radio signals. Even more complex information can be encoded in holographic images. DNA acts as a holographic projector of acoustic and EM information that contains the informational quintessence of the biohologram. Quantum non-locality of genetic information is fundamental.

The nervous system acts as a coordination mechanism that integrates DNA projection of the rest of the cells in the system, aligning these cellular holograms. The biohologram, projected by the

brain, creates standing and moving electromagnetic wave patterns at different frequencies of the spectrum in order to effect different biochemical transformations. There may be specific electrostatic fields, or there may be electrodynamic fields varying at different frequencies, from low (radio waves) all the way up the spectrum into visible light (biophotons) and beyond.

Genes are located on chromosomes in a linear order within the cell nucleus. Chromosomes have the ability to transform their own genetic-sign laser radiation into broadband genetic-sign radio waves (the encoded signal transforms from light to sound). The polarisation of chromosome laser photons is connected non-locally and coherently to polarisations of radio waves.

Through this mechanism, a new field structure is excited from the physical vacuum by an intrinsic creativity that emerges through DNA. The genome's genetic and other regulatory wave information is recorded at the polarisation level of its photons and is non-locally transferred or played out through the entire biosystem by the polarisation code parameter.

Only 3% of the three billion base-pair genome encodes the physical body. The four-letter alphabet of genetic elements—Adenine (A), Cytosine (C), Guanine (G), and Thymine (T) or Uracil (U)—is arranged in three-letter "words" that tell the cell what proteins to manufacture. These genetic characters are distributed in the genetic text in a fractal distribution, i.e., reiterated.

So, the nucleotides of DNA molecules are able to form holographic pre-images of biostructures. This process of "reading and writing" the very matter of our being manifests from the genome's associative holographic aspect in conjunction with its quantum non-locality.

Rapid transmission of genetic information and gene expression unite the organism as an holistic entity embedded in the larger Whole. Gene expression is the mechanism by which new patterns are called into being. The system works as a

biocomputer—a wave biocomputer.

This biogenesis mirrors the cosmic process of creation. The holographic dynamic underlies both processes of cosmological creation and biogenesis. Chemical bonding is a consequence of the non-linear inverse-square law of electromagnetic charge interaction in space-time. Charge interaction precedes quantum chemistry perturbations of bonding energetics. Despite being genetically coded, molecules form fractal structures both in their geometry and dynamics. Generating core biochemical pathways gives rise to the fractal structures of proteins, nucleic acids and tissues.

Theories of biogenesis, such as panspermia, are strongly supported by the fact that organic molecules and amino acids, as well as the nucleotides A, U, G and C, have been detected in meteorites. It is a fecund Universe at both the cosmic and human scale.

### QUANTUM BIOHOLOGRAPHY

**Hypothesis:** *The organisation of any biological system is established by a complex electrodynamical field that is, in part, determined by its atomic physiochemical components. These, in part, determine the behaviour and orientation of these components. This dynamic is mediated through wave-based genomes wherein DNA functions as the holographic projector of the psychophysical system—a quantum biohologram.*

In the mid-1980s, physicist Peter Gariaev first noted a DNA phantom effect in his experiments. DNA was bombarded with laser light. When removed physically from the scattering chamber, its electromagnetic signature—a ghostly holographic after-image—apparently remained. What is measured is light scattering from the DNA phantom fields. As long as the chamber is not disturbed, the effect is measurable for long periods of time. No other substance has been found to emulate the effects of the DNA molecule.

Evidence suggests a relationship to the phenomena of endogenous bioluminescence, liquid crystals and superconductivity. Bioluminescence is the emission of photons of light produced when certain energised electrons drop into a lower or ground state. Humans emit a variety of electromagnetic radiations across the emission spectrum, indicative of the energy state of the organism.

In the nuclei of each cell of the human body, the DNA (deoxyribonucleic acid) carries the structure of our whole body. It is the blueprint not only of our physical form, but also of the processes that our form undergoes in terms of survival. The primal vacuum is the matrix of our existence and, proportionately, our most fundamental reality. In essence, we emerge from pre-geometrically-structured nothingness. DNA is the projector of that field which sets up the stress gradients in the vacuum or quantum foam to initiate the process of embryonic holography.

### THE DNA PHANTOM EFFECT

The Gariaev group has discovered a wave-based genome and DNA phantom effect that strongly supports the holographic concept of reality. This main information channel of DNA is the same for both photons and radio waves. Superposed coherent waves of different types in the cells interact to form diffraction patterns. They emerge firstly in the acoustic domain, and secondly in the electromagnetic domain.

DNA seems to embody the capacity to produce a field experienced by other DNA in the body, linking all holistically together. This dynamic is linked to the cellular level via mechanisms of RNA transfer and enzymatic action in the cell. DNA and RNA are likely to be in non-local communication, possible because DNA molecules in chromosomes are in a state of substance-wave duality. So, DNA codes an organism both through DNA matter and by DNA wave sign functions at the laser radiation level. Wave information is recorded at the polarisation level of photons and is non-local. It is transferred throughout the biosystem by the polarisation code parameter, eliciting holistic response patterns.

Gariaev claims to have demonstrated subtle fields emerging from the quantum foam or vacuum potential, making the effect quantifiable, measurable and objective. He found the phantom effect by irradiating DNA with a target UV wavelength of 338 nm. Poponin (1995) went on to suggest that some new field structure is being excited from the physical vacuum by an intrinsic ability that emerges through DNA.

Gariaev discovered the DNA phantom effect in 1985 when he worked in correlation spectroscopy of DNA, ribosomes and collagen at the Institute of Physics in the Academy of Sciences of the USSR. He was first able to publish his results in 1991, leading to a book, *Wave-Based Genome*, published in 1994. He

demonstrated a dynamic new field in the vacuum substructure by bombarding it with coherent laser light and coupling it to conventional electromagnetic fields. The experimental protocols for this procedure have been reproduced in Moscow from ideas developed at Stanford, and are currently in another replication by physicist Louis Malklaka.

### YOU TURN ME ON – I'M A RADIO

In analysing any complex adaptive system, we follow what happens to the information; in this case, the genetic information. The quantum hologram is a dynamical translation process between acoustical and optical holograms. DNA and the genome have been identified as active "laser-like" environments. Roughly speaking, DNA can be considered a liquid crystal gel-like state that acts on the incoming light in the manner of a solitonic lattice. A soliton is an ultra-stable wave train that arises in the context of non-linear wave oscillation. Oscillations are set up when DNA acts as a rotary pendulum, kindling other oscillations.

Chromosomes can transform their own genetic-sign laser radiations into broadband genetic-sign radio waves. This is the main information channel of DNA, the same for both photons and radio waves. Superposed coherent waves of different types in the cells interact to form diffraction patterns, first in the acoustic domain and then in the electromagnetic domain. The quantum hologram is the matrix of the translations between acoustical and optical holograms. The human biocomputer can be modelled through the marriage of quantum mechanical and complex dynamics.

*Other researchers soon obtained similar results, and not only based on photons. Multi-frequency physical fields are now teleported. Based on this data, it's possible to suppose that photon fields, emitted by chromosomes as sign fields, can be teleported within or even outside the*

*organism's space. The same is true for wave photon fronts, which were read from the chromosome continuum similar to reading from a multiplex hologram. If photons are transformed into radio waves through the EPR-mechanism, then this phenomenon is vital. In fact, the importance of quantum non-locality existence for a genome is hard to overestimate. (Gariaev et al., 2001)*

Basic assumptions of Gariaev et al. included the following:

1. The genome has a capacity for quasi-consciousness so that DNA "words" produce and help in the recognition of "semantically meaningful phrases";
2. The DNA of chromosomes controls fundamental programs of life in a dual way: as chemical matrixes and as a source of wave function and holographic memory;
3. Processes in the substance-wave structures of the genome can be observed and registered through the dispersion and absorption of a bipolar laser beam.

### QUANTUM TELEPORTATION

The polarisations of chromosome laser photons are connected non-locally and coherently to polarisations of radio waves. The signal can be "read out" without any loss of the essential information in the form of polarised radio waves. The genome is a quasi-

hologram of light and radio waves that create the background necessary for the appropriate expression of genetic material. Gariaev argues that the genome emits light and radio waves whose delocalised interference patterns create calibration fields or "blueprints" for a system or organism's space-time organisation, in a coordinated response typical of living systems. Gariaev asserts that quantum non-locality and holography are indispensable to explaining such real-time dynamics properly.

Other research suggests the fundamental interaction of internal and external fields is the right track. Joseph Jacobson (2002) at MIT found a way to switch cells off and on with radio waves. His team also "unzipped" and manipulated DNA with a radio-frequency pulse. The same approach worked on proteins as well, and proteins orchestrate nearly all cellular chemical processes.

Thus, genes can act as quantum objects exhibiting the phenomenon of quantum non-locality/teleportation. This robust dynamic assures information super-redundancy, cohesion and the organism's integrity and thus viability. Gariaev's experiments suggest that DNA does indeed behave like a single quantum, which induces a "hole" temporarily in the vacuum when the DNA sample is physically removed from the vacuum chamber.

Quantum bioholography says that DNA satisfies the principle of computer construction. It carries a copy of itself, its own blueprint, while the mechanism engineering the DNA replication is the biophotonic electromagnetic field. The "letters" of the genetic texts A, G, C, U are held invariant. The existence of the genetic text constitutes the classical signal process of quantum teleportation. It facilitates the quantum mechanical signal processes of both the copying of the DNA as its own blueprint and the construction and homeostasis of the organism in a massively parallel way by means of quantum teleportation.

So, the marriage of the 50-year-old study of DNA with the 30-year-old science of holography has given birth to the model we call the quantum biohologram. Gariaev's discovery of the phantom DNA and the DNA-wave biocomputer strongly suggests that this is more than a model but actually the physical mechanism for our appearance from virtually nothing. In one way, you could say we "came out of nowhere".

But here we are, nevertheless. It is solely because of our DNA's ability to transform its genetic blueprint into a physical reality, embodying simultaneously our inherited past and our future. Sure, we can now create *ersatz* life, but we cannot create the fundamental elements from which it arises, which are the gift of the Universe, cooked in giant supernovae aeons ago. It's like that old joke where the scientist says to God, "We can now make an Adam out of clay", and God says, "No; first you have to make your own *dirt!*"

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