Article

Cosmic Being as the Meaning of Evolution (Part I)

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Abstract

A careful review of the natural record up to levels of sentient awareness from protozoa to humans reveals a new perspective of the evolutionary process related to knowledge of processes extended in space and time. There is an apparent progressive delegation of knowledge drawing on experience learned across parallel evolving streams that is integrated in levels of progressive refinement. The process requires that objective experience must have a subjective quantum equivalent that is timeless and boundless such that the whole of history is embraced by a spatially indeterminate Void. This is consistent with the empirical fact that all we can ever know is active interface processes between a common Inside and Outside. They are mutually reconciled in the boundless Void that exhibits no distinction between subject and object. Since it spans and integrates the whole of space and time it is associated with mind. This indicates that there is a Universal Active Interface that subsumes an open ended hierarchy of active interface processes nested within it that constitutes the whole cosmic order. In other words, there is a Universal Source that embraces all possible structural varieties of Being in phenomenal experience. This is a necessary condition of Universal Wholeness from which universal values and truth derive. Direction is apparent in the evolutionary process that has ascended levels of sentient awareness delegating to human beings a capacity to intuitively recognize our eternal cosmic destiny transcending the whole of space and time. The evidence indicates that this is the only possible condition for bringing our three brains to a sustainable timeless balance. Our personal spiritual destiny as well as our collective future in the biosphere depends upon it.

Part I of this two-part article includes: Introduction; Modern Science; Einstein's Continuum & the Big Bang; Max Planck & Quantum Mechanics; The Void; Louis de Broglie & Quantum Mechanics; The Betrayal of Truth; The Origin of Biological Life; Evolution from Single Cells; The Plants; The Invertebrates; The Vertebrates; The Reptiles; and The Lower Mammals.

Keywords: Evolution, cosmic order, void, universal source, active interface, space, time.

Introduction

There has been much debate about how we human beings came to be where we are, conscious of our mortal condition that urges us to ask probing questions about our origin, our destiny, and what it all means. Nearly all cultures going back to antiquity have had creation myths, from Grandfather Fire to the Garden of Eden, together with some concept of an afterlife. There is a transcending Universal Truth assumed to be implicit in them all. Exceptions are extremely rare. Perhaps the most unusual is the Pirahã tribal people of the Amazon who are concerned solely

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with matters that fall within direct personal experience. They have no history beyond living memory, no interest in what another tells them unless it is from personal experience and they are incapable of the simplest mathematics and counting. They have no names for numbers. They seem unusually happy living in the present without speculations on past or future. They believe in spirits but they actually see them and they mutually agree on their actual presence, even though others outside their culture cannot see them.[1]

Modern Science

With the development of modern science in the last few centuries the human quest has taken a new twist. Science was given great impetus with the publication of Isaac Newton's Principia in 1687. He gave mathematical rigor to laws of motion and gravity, developed the calculus and made other important contributions to science that established a solid foundation for everything that has followed. It was a mechanistic approach that in the current idiom seems inconsistent with Newton's deep concern with theological matters, the nature of the Trinity, alchemy, and the ancient Hermetic tradition that influenced and inspired his scientific work.

Newton conceived of space and time as a kind of infinite vessel in which physical things and events occur. He recognized gravity as a universal force of attraction between all bodies irrespective of their separation in space. He made no hypothesis about this action-at-a-distance which he accepted as an apparent fact. His work on infinitesimals in the Principia which he later formalized as his calculus of fluxions assumed that both space and time are infinitely divisible, a contention debated by Bishop Berkeley.[2] Indeed Zeno's arrow would never reach the target were it so, but that inconsistency did not affect the success of the mathematical formalism, which was also developed independently by Leibnitz. Meanwhile Descartes, who spent much time looking out a window from his sick bed, came up with Cartesian coordinates, perhaps influenced by four panes framed by the horizontal and vertical cross in his window. He was also busy trying to specify the exact location of a fly on his square ceiling by its distance from two walls. Events in space and time could be graphically represented using the x and y axis. Together with the calculus this provided an enormous boon to mathematics.

When Charles Darwin sought a rational explanation for his observations on the voyage of the Beagle around the world it was thus natural for him to think of physical interactions in the externalized context of space and time. The Biblical account of creation could hardly account for the detailed comparisons he made of the natural record. In conjunction with other factors he was led to postulate that some variations in the propagation of species offered a natural advantage over others. He called the process natural selection. He conceived of it accounting for the origin of the diversification of species, like emerging branches of a tree from a common trunk. Our modern knowledge of genetics in keeping with the externalization of events in a vessel of space and time thus interprets biological evolution as rare random mutations some of which exhibit a natural selection pressure in their favor.

Einstein's Continuum & the Big Bang

Einstein compounded the physical picture when he realized that a man falling from a roof did not feel gravity. This kernel of an idea led him to postulate a marriage between space and time so that physical events transpire in a spacetime continuum in which gravitational mass is embedded. Concentrations of mass curve the continuum such that gravitating bodies freely fall "downhill" toward one another, thus accounting for the spooky action-at-a-distance that was so distasteful to Einstein. Gravity and acceleration were assumed to be equivalent.

Galaxies beyond our own had not yet been discovered in 1915 so Einstein introduced a cosmological constant to prevent the known universe from gravitational collapse on itself. Then in 1924 along came Edwin Hubble operating a large new telescope. He established many galaxies beyond our own with an apparent direct relationship between their distance from us and the shift in their light spectra toward the red end of the spectrum. This became interpreted as an expanding universe based on Einstein's field equations. In 1931 Georges Lemaître, a catholic priest, proposed that the universe had begun as an infinitely small and infinitely dense primordial atom from which the whole fabric of space and time began. This was later developed by George Gamow.

The whole universe burst into being from nothing, an origin that became dubbed the Big Bang. It was an expression first used by Sir Fred Hoyle, the inventor of astrophysics, who opposed the idea to the end of his life, proposing steady state alternatives. The discovery of a background radiation is taken by mainstream physicists as verification of the Big Bang Hypothesis. In fact no one really knows what the background radiation is and there remain major dissenters to the theory. There are obvious philosophical contradictions in the hypothesis that space and time can have a beginning in space and time.

An international team of astronomers making deep field observations with Hubble Space Telescope found tentative evidence of three galaxies with redshifts [z] of around 10, indicating they existed just 500 million years after the Big Bang.[3,4] On 6 January 2010 Garth Illingworth, team leader at University of California, Santa Cruz commented:

> *Closer looks at the farthest stars, as often as not, furnish data that do not neatly fit with the standard big bang theory. Therefore we think that cosmology still lacks the authority to place boundaries around the rest of science. That authority has been the basis for assuming that everything must "originate". We think it may be fruitful to question that assumption.*

Unfortunately Big Bang cosmology monopolizes funding. There is evidence that galaxies may be eternally regenerating their stellar populations. Some starburst galaxies have star formation rates as high as 1000 stars or more a year[5] in a process that is periodic. There is also evidence of old heavy stars being recycled through black hole galactic centers with periodic emissions of hydrogen feedstock for new generations of stars.[6] More properly focused research is needed.

Max Planck & Quantum Mechanics

Earlier in 1901, in trying to reconcile electromagnetic radiation from a perfectly emitting black body in thermal equilibrium Max Planck had to assume that the energy radiated was quantized to avoid ultraviolet energy increasing to infinity, which does not happen. Energy emits in integer multiples of a quantity he called *the universal quantum of action*. This necessity disturbed him greatly.[7] Einstein built on his idea and proposed the quantization of *all* electromagnetic radiation, (not just from a black body), in 1905 to explain the photoelectric effect. This basic equation states that electromagnetic energy *E* is equivalent to Planck's constant *h* times the light's frequency *f*. (*E=hf)*

This is one of two primary equations of Quantum Mechanics. It disturbed Max Planck because space and time were believed to be continuous at the time. It was not recognized that light travels in discrete pulses because the whole physical universe is a discontinuous linear series of still space frames associated with each atom since all atoms are synchronously projected in a cosmic movie. Light is the only activity in each still frame. Since it derives from atomic processes light has a universal relationship to each atom consistent with $E=mc^2$ as Einstein showed in Special Relativity while still not recognizing that the whole universe is discontinuous. Between each still atomic space frame is a timeless and boundless quantum energy equivalent such that successive space frames close ranks to provide the illusion of continuity.

The Void

All relative motion occurs in discrete quantum jumps between successive still frames through the agency of the boundless quantum energy equivalents collectively called the Void. Since the Void is timeless it spans and integrates history, the whole of space and time. Since the quantum energy equivalents of atoms are also boundless they collectively constitute the Void as a unified quantum energy field that is spatially indeterminate. It is sandwiched between successive synchronous projections of atoms that constitute still frames in which light is the only action. This boundless and timeless Void is thus orthogonal to the integrated fabric of space and time. Since it spans and integrates history it is associated with mind. Understanding that the Void formlessly mirrors the physical universe is basic to understanding Physics.

It will be seen in what follows later that successive developments in biological evolution display a progressive knowledge of processes extended in space and time. This implicit knowledge embracing space and time through the agency of the Void becomes progressively delegated in the higher invertebrates with a developing nervous system that provides them with a species limited mental capacity to move purposefully through space and time. This capacity of a developing mind takes a leap forward with the quadruped vertebrates especially the higher vertebrates as the brain develops in three distinct stages. Just as the Void is subjective to the objective world so is the evolutionary development of mind.

Louis de Broglie & Quantum Mechanics

By the time Big Bang cosmology was making a debut quantum mechanics was underway following Louis de Broglie's matter wave hypothesis based on Special Relativity and Planck's Universal Quantum of Action. In his doctoral thesis in 1924 he provided the second primary equation of quantum mechanics by assuming that a massive particle such as an electron can also behave as a wave. The moving particle's wavelength $\boldsymbol{\lambda}$ is equal to Planck's constant $\boldsymbol{h}$ divided by its momentum p. ($\lambda=h/p$).[8]

The wave nature of the electron explained the orbits of the Bohr Theory of the Atom[9] since there had to be whole number of wavelengths around each orbit. But the wavelength corresponds to relative quantum jumps in position in successive space frames so there can be no such a thing as part of a jump and there is no actual movement through space and time. There is thus no energy radiated away by the electron through its quantum jumps in successive still frames around each orbit. There is no other explanation consistent with the evidence.

With Heisenberg's uncertainty principle based on discrete matrix algebra Quantum Mechanics became based on probability theory. Atomic particles in relative motion behaved as particles and waves at the same time in a presumed spacetime continuum. The more exact a particle's position was known the less exact its momentum could be known and vice versa. The statistical methods of the Copenhagen Interpretation championed by Neils Bohr, Werner Heisenberg and Max Born became the favored interpretation despite Schrodinger's efforts to preserve a conceptual model of the atom.

But in a discontinuous universe it is obvious that exact position can only be known in one still frame. Exact momentum requires successive relative jumps in position through a succession of still space frames. So it is obvious that they cannot both be known exactly at the same time. It was obviously hard to conceive in those days that the whole universe is synchronously appearing and disappearing with and before our eyes. The discontinuous quantum phenomena could not denied and the continuum of General Relativity was firmly established and yet the two are not mutually compatible. No one thought that space and time themselves are quantized.

The Betrayal of Truth

Einstein refused to believe that God plays dice with the universe and other important physicists were unhappy also, including Planck, de Broglie, Schrodinger and Bohm. This led to a split between the experimental practice of physics and its theoretical interpretation. Multiple interpretations have been advanced for the same experimental results, including Consistent Histories, Many Worlds, Stochastic Evolution, Decoherent Histories, the Bohm-de Broglie Interpretation and many others. This dichotomous split between experiment and interpretation means that empirical science has no direct relationship to truth. The language of science relates only to how it has come to be used. It need not relate directly to reality.

Nevertheless the statistical Copenhagen Interpretation remains the default interpretation of physics. Random order fits nicely with Big Bang Cosmology and Darwinian evolution. Science

seeks a universal framework of understanding that is self-consistent. Even though a Grand Unified Theory remains elusive, mainstream Science wants to write a new Bible that must be accepted by all people for all time.

Our intuitive right brain seeks an eternal or timeless framework of understanding that is a boundless and all-embracing Unity. This is a requirement of mind associated with the Void. There must be some transcending basis to the nature of Universal Truth that does not change from one person or culture to another, or from one historical period to another, or from one galaxy to another. The universe must be One with one basis of Universal Truth, otherwise truth cannot be verified in phenomenal experience. Given the various conflicting opinions of Quantum Mechanics one can sympathize with the direct no nonsense view of the Pirahã tribal people.

Einstein sensed something of this direct confirmation of truth in phenomenal experience in his Autobiographical Notes, written at age 67[10]. *"I see on the one hand the totality of sense-experiences, and, on the other, the totality of the concepts and propositions which are laid down in books. The relations between concepts and propositions among themselves and each other are of a logical nature, and the business of logical thinking is strictly limited to the achievement of the connection between concepts and propositions among each other according to firmly laid down rules, which are the concern of logic. The concepts and propositions get "meaning," viz., "content," only through their connection with sense-experiences. The connection of the latter with the former is purely intuitive, not itself of a logical nature. The degree of certainty with which this relation, viz., intuitive connection, can be undertaken, and nothing else, differentiates empty fantasy from scientific 'truth.'"* Presently we shall see that this is more than just one man's opinion.

Human civilization has become inextricably dependent on science so this places us in a peculiar situation. Many lay people as well as many scientists find efforts to close the book on the evolutionary process disquieting. Yet we need an integrating framework to make coherent sense of experience and science and the global cultural meltdown is seriously eroding traditional value systems. A common basis to human values is essential to our mutual coexistence on a finite planet with limited space and resources. Major adjustments are needed but where are we to find guidance that universally applies?

Science is amoral. It gives us technology to cope with physical reality but it does not advise us how to use it wisely. Something very fundamental is missing. Are there moral issues implicit in the natural order of things or are they just arbitrary aberrations of the human mind? Is there some basis of right and wrong associated with Universal Truth implicit in the cosmic order?

The Origin of Biological Life

When we look at the evolutionary evidence in the natural and fossil record we do not know how the first living cell came into being or even if there was a first living cell. A single living cell is an immense interdependent complexity that is an all or none phenomenon, like pregnancy. It is dependent upon a host of protein enzymes to catalyze its essential chemistry including the chemical synthesis of the enzymes themselves. The protein enzymes fold in intricate patterns that

fit the chemical reactants bringing them together at active sites for their chemical combination while the enzymes themselves remain chemically unchanged. Living cells whether bacterial prokaryotes or eukaryotes as in plants, animals and humans are recursively closed. They employ the exchange of phosphate ions for needed energy, a process employing more protein enzymes. Molecular biology has made great strides in establishing this.

Cells thus have an extremely complex recursively closed archetypal energy pattern that is not itself a physical "thing" and that *subjectively* orchestrates their *objective* biochemical molecular processes. There is no credible series of chemical accidents that can account for the gradual appearance of living cells over a long span of time. Indeed the recursively closed energy patterns are not consistent with random order. It would require a huge and highly complex host of concerted events to happen simultaneously in a hierarchically nested interdependent manner. That simply does not happen randomly in nature. Living cells do not spontaneously appear.

Moreover the oldest meteorite fragments together with the dating of ancient lead deposits indicate that the planet accreted about 4.5 billion years ago. The fossil evidence suggests the presence of prokaryotes as early as 3.8 to 4.0 billion years ago just as the planet cooled to the point where it could support life and the first eukaryotes may have occurred about the same time according to some investigators. No sooner had the planet formed than it was pregnant.

How did these cells originate? A probable answer is provided in the Panspermia Theory suggested by several early investigators, that life is seeded from interstellar space by several possible mechanisms including inside asteroids, meteor showers, and solar radiation pressure from the tail of comets near the sun. It was taken up by the late Fred Hoyle and his colleague Chandra Wickramasinghe who continued to be active at the forefront of related research. In 2001 he reported the presence of clumps of cells in air samples captured by balloon instruments at altitudes of 41 kilometers, too high for them to have been transported from below.[11] A couple weeks later the Italian molecular biologist Giuseppe Geraci announced the finding of extraterrestrial bacteria inside a meteorite estimated to be over 4.5 billion years old that was cultured and found to have DNA unlike any found on Earth.[12] In 2013 Milton Wainwright, of the University of Sheffield in the UK captured collections of cells in balloon instruments at 27 kilometer altitude including a diatom shell (algae) that must have come from space.[13]

For many years Fred Hoyle and various colleagues championed a steady state universe and together with the seeding of planets from an interstellar gene pool it is not necessary to explain an origin for biological life anywhere in the universe. Small eukaryotic cells such as yeast and algae can be seeded by similar mechanisms. There is evidence of diseases from space. Virus genomes inserted into the human genome indicate a degree of direct cosmic regulation in the evolutionary process. Organic life is clearly not an emergent property of physics on the planet.

Biological life is nested within the physical universe. Star formation rates in many starburst galaxies are sufficient to replenish their stellar populations in a billion years, or less in some if sustained. Although the process is not well understood it is periodic. There is solid evidence that galaxies are cells recycling their stellar populations. In this scenario organic life seeded from space embraces the whole of space and time. It is an eternally regenerating process.

Evolution from Single Cells

While panspermia is a credible origin for single cells, it does not explain how multi-cellular plants and animals came on the scene. They did not rain from space. Single cells once seeded might evolve and adapt and form collective communities. For example microbial mats consist of colonies of various bacteria, the top layer often being cyanobacteria that generated the early oxygen in the atmosphere that paved the way for the evolution of eukaryotic cells that employ oxygen. There is a theory that green plants originated about 1.6 billion years ago when a tiny algae swallowed a cyanobacteria and integrated it into its genetic makeup, a process that would have also required a genetic contribution from a parasitic bacteria, a cooperative event so improbable that it only happened once, making the theory improbable. There is also evidence that fungi played a crucial role in the early evolution of the biosphere. Although their soft tissue is not well preserved in the fossil record there is evidence of yeast cells from space.

Mechanisms that demonstrate how complex multi-celled creatures have emerged on the scene remain elusive. Despite the fossil evidence of a seemingly natural evolutionary progression up a ladder of sentient awareness from plants and fungi to invertebrates to vertebrates to human beings with language and creative abilities, the mechanisms that explain the jumps from single cells to complex plants and animals remain absent. They are absent from the fossil record despite the best efforts at speculative conjecture. For example whole new body plans suddenly appear as if by magic as the evolutionary process settles into a steady mode of exploring variations on a common theme then another sudden advance is apparent, and so on. Stephen Jay Gould called it punctuated equilibrium.[14]

Nor is there convincing evidence of divergence from a common ancestral single cell. A variety of single protozoa cells exhibit no common traits that would be expected to lead to plants or animals or fungi while some could fall into more than one classification. For example a single celled species called the Euglenida photosynthesize energy from the sun, just as plants do, but they also swim with a tiny tail and have a mouth and gullet to ingest food. These tiny one-celled creatures cannot survive by photosynthesis alone like plants. They also eat like animals. Some ciliates are amazingly complex for single cells. One called *"Diplodinium dentatum"* has complex mouth parts leading to a gut, with a contractile esophagus and anus. It also has a skeleton, like a tiny backbone within the cell. They live in the digestive tracts of cows and other hoofed mammals, and may be examples of resonant developments between lower and higher levels in the evolutionary hierarchy, as the mammals evolved.

In general the natural and fossil record indicates that evolution appears to explore a variety of options before setting off in one direction or another. There is clear evidence throughout the historical record that successive stages draw on the experience of prior stages across the apparent diverging limbs of the evolutionary tree, without linear causal connections. Moreover divergence begins early in the evolutionary history of the predecessor. Resonant influences are also apparent from higher levels on lower levels as in the case of complex ciliates above. We know from human experience that this is essential to the learning process and to meaningful selection from several possible alternatives. This indicates an agent at work that spans and integrates separate linear chains of events in space and time thus implicating the timeless Void. This is more than a random linear process of survival by "natural selection".

Some species of amoeba that proliferate by cell division attained a kind of eternal life without benefit of either ancestors or offspring. Essentially they divide and spread as a single multifaceted creature across many environments. So the quest for survival was resolved before complex life got underway. Perversely as more advanced higher mammals and we humans evolved we became aware of our own inescapable mortal condition. What possible selection pressure can the knowledge of certain death bestow? If it is all a random process what is the survival advantage of marching mindlessly down a one way corridor to our doom?

The slime mold Physarum polycephalum, can solve mazes, mimic the layout of man-made transportation networks and choose the healthiest food from a diverse menu—and all this without a brain or nervous system. It spreads as a large mass consuming decaying material and it knows where it has been. [15] This is obviously not random.

The *Dictyosteliida*, cellular slime molds, have a very different lifestyle. Although their amoebae remain individual, they live in similar habitats feeding on microorganisms. When food runs out they communicate by signal molecules to find each other and create swarms. These amoeba then self-assemble into a tiny multicellular slug-like coordinated creature, which crawls to an open lit place and grows into a fruiting body with a trunk and top. Some of the amoebae become spores to begin the next generation. Some sacrifice themselves to become a dead stalk, lifting the spores into the air for wider dispersal. There is an archetypal pattern that embraces the collective behavior of individual cells that integrates them into a single creature with specialized parts for the purpose of spore dispersal. This clearly involves knowledge extended in space and time beyond the survival needs of individual cells.

The Plants

The plants, especially higher plants, likewise exhibit a knowledge extended in space and time beyond their immediate location. Early small land plants developed vessels to transport water from the soil to above ground structures where photosynthesis occurs. This allowed plants up to a couple centimeters high until the vascular plants, horse tails and club moss reached for the sky in wetland forests during the Carboniferous Period that began about 354 million years ago and that left us with extensive coal beds. By this time plants had developed separate sporophyte and gametophyte generations. The sexual gametophyte generation of early plants requires a sperm to swim to an egg, so they need moist habitats to produce the sporophyte generation that has a diploid (double) set of chromosomes. Haploid spores are then released from elevated stalks to promote dispersal in the wind. This requires knowledge by a transcending agency of processes extended in space and time that is implicitly directing major structural features of evolution.

This alternation of two generations is a common feature of all terrestrial plants. During the mid to late Carboniferous Period as the supercontinent Pangea began to form there was an uplifting of the land and some mountain building that left areas of desert devoid of vegetation in various places together with areas of alluvial deposits left by erosion. This was aggravated by ice ages in the southern hemisphere that lowered sea levels, anticipating a need and a place for seed bearing plants that could thrive in dry terrain.

Primitive seed ferns from early in the Carboniferous Period diversified and spread to liberate plants from a wetland environment late in the period. It was a task extended by the gymnosperms such as the conifers of today that began at the end of the Period about 300 million years ago and diversified during the Permian period. First came the production of separate male and female spores, as in the club moss *Selaginella.* However the separate male and female gametophytes had to be protected from drying up to survive in drier terrain. While the conifers have male and female gametophyte cones on the same sporophyte tree, the female gametophyte is securely wrapped in tissue, which the male gamete has to penetrate to fertilize the female egg cells after it reaches them. The male pollen grain thus has to be small enough to be carried on the wind, and likewise encased in a waterproof covering. These modifications required knowledge of weather processes and how to exploit them by methods extended in space and time beyond the plant and its current environment. It cannot be explained by random mutations since parallel mutations acting in concert are needed to meet many parallel needs. No process of selection pressure to promote gradual rare random changes can be demonstrated to work in parallel lock-step. At the end of the Permian period 252 million years ago there was extensive loss of woodland forest species during the great Permian extinction. It took the conifers several million years to recover.

In in the angiosperms or flowering plants the gametophyte generation completes its short life within the floral tissues of the sporophyte generation which constitutes the main plant. The male parts of the flower that produce pollen are called stamens. The female parts of a flower are called carpels that are often fused into a pistil with the ovary at its base where the ovules or female eggs are produced. The process of fertilization is quite complex. Plants may be male, female, bisexual, self-pollinating, have male and female flowers on the same tree or plant, or even change sexes with successive generations, all of which are processes with implications extended in space and time. All future variation in the reproductive routines of terrestrial plants became confined within these general constraints, allowing also for vegetative reproduction from new shoots in many cases.

With the appearance of the flowering plants, came an implicit knowledge of more complex events extended in space and time. Most require an insect pollinating vector, often a specific insect so that they must evolve in concert. Many flowers have developed fused floral parts, for instance tubular sheaths around nectar bearing organs that target only certain pollinators, such as humming birds with long curved beaks, and exclude others. Honeysuckle and sweet tobacco flowers are adapted to the long proboscis of a pollinating moth, but excludes bees and flies. This is vital to the moth but it is hard to see any advantage to the plant. The fig is completely dependent on a certain wasp for pollination, and in winter produces sterile fruit solely to ensure the survival of its wasp pollen vector.

Coryanthes orchids[16] have a reservoir of fluid in the bottom of a deep chamber in the bloom that drugs bees, making them groggy and fall in. There is only one exit from the chamber at the fluid level, directly beneath the stigma and stamens. On its first encounter two pollen sacs are glued to the bee's back as it crawls out through this single long passageway to a higher exit, giving it time to regain its senses. On the next encounter another orchid's stigma picks up the pollen from the bee. This is an extraordinary idea that could hardly have evolved by chance. Of the millions of organic compounds possible, the flower must hit on a drug that is strong enough but not too

strong, and yet not discourage the bee from trying again. Its fluid consistency must allow the bee to swim for the exit, the dimensions of which must be precisely positioned with respect to stamens and stigma. Many factors involving complex events in space and time must be just right and evolve in concert to produce an anticipated result. This is compelling evidence of a transcending agent at work integrating diverse events in space and time.

There was obvious mutual dependence between insect diversification and the diversification of the flowering plants. This required coherent parallel mutations in lock step between plant and animal species if selection pressure is to be demonstrated, a process that is not random. Nevertheless this freed flowering plants from uncertainties of the wind and ensured fertilization over a broader range. As plants evolved at this level they also provided nutrients for animals higher up the ladder of sentience which allowed them to evolve in tandem. In the junipers, the cone scales swell into an edible covering attractive to animals and birds which transport the seeds. The higher sentient levels, especially the higher mammals and birds, needed more concentrated food provided by flowering plants in the leaves, flowers, fruit, stems and roots.

Many plants produce large fruits as plentiful food supply for birds and animals unrelated to their own propagation needs. The fruit rarely falls far from the plant or tree so that the plant is largely dependent on animal dispersal. Dry fruits such as the dandelion and thistle have a parachute to carry them on the wind. The sycamore and maple have wings attached. Burrs hitch a ride on animals. These are inventions displaying a knowledge of events extended in space and time.

Although a few flowering plants such as magnolias appeared about 140 million years ago, it is significant that the flowering plants began to diversify in concert with the insects coincident with the extinction of the dinosaurs 66 million years ago. The Indian subcontinent was plowing into Asia at a few inches a year pushing up the Tibetan Plateau. The Earth's crust was under compression with extensive mountain building in Europe and the Americas. Broad savannas appeared as the wetland habitat of dinosaurs rose and dried out, making way for the extensive diversification of mammals and birds that need an enriched food supply. The convergence of these diverse factors is further evidence of comprehensive knowledge of processes extended in space and time across species, genera, families and kingdoms, as well as embracing tectonic events in the bowels of the planet.

The Invertebrates

While a few plants such as the Venus Fly Trap and Mimosa Pudica can move quickly in response to touch, they were not ancestral to the invertebrate animals that explored an immense variety of sensory motor systems of movement. Fossil evidence of the earliest invertebrate sponges dates back at least 665 million years with indications of worm-like creatures dating back perhaps a billion years. About 450 million years ago they began to diversify in a bewildering host of body forms, from sessile sponges to jellyfish, flatworms, roundworms, starfish, urchins, centipedes, beetles, spiders, flying insects, crustaceans, molluscs, and so on from microscopic bugs to colossal squid. The invertebrates represented a complete departure from plants which synthesize the food from the energy of the sun that all higher life forms need. They began to diverge from protist or protozoa unicellular origins early in the unicellular history of plants so

there is no random linear explanation for why they should have evolved at all, much less into such a diverse and elaborate array.

It is noteworthy that the early transformation of the atmosphere was assisted by single-celled marine creatures, called *foraminiferans,* that make shells of calcium carbonate that are discarded when they divide. These discarded shells accumulated to make up extensive limestone deposits thousands of feet thick covering millions of square miles in various parts of the world. The process began about 200 million years ago when the supercontinent Pangea was breaking up. While processes such as these were reducing carbon dioxide levels in the atmosphere by building the continental shelves, plants were elevating oxygen levels and preparing the atmosphere in apparent anticipation of a distant future fit for more sophisticated creatures to come.

Independent movement of complex invertebrates offered no survival advantage or selection pressure over plants. They have to forage for food and for the most part they are comparatively short lived, especially the many millions of species of insects. The chiton group of mollusks are especially curious, since their shells are divided into eight articulated segments which allow them to curl up in a ball for protection, unlike other mollusks. This is evidence that the segmented experience of the annelid worms is available to adaptation by the non-segmented mollusks, even though they do not share the same lineage. The same is true of inhalent and exhalent siphons common to both mollusks and sea squirts even though they are of separate lineage. In fact the whole arthropod group is considered by some to have evolved independently in three separate lineages that for some unexplained reason share many features in common.[17] These instances argue compellingly in favor of cross-lineage communication at work in the evolutionary process. Experience gained in one lineage may be intelligently integrated into another in a self-similar way. There is an overriding balance or resonance at work between diverging evolutionary branches in the biosphere that transcends linear events in space and time.

The early cephalopods appeared about five hundred million years ago, the nautilus being the only surviving genus. In this remarkable creature the foot has moved forward to surround the mouth with thirty-eight prehensile tentacles. The digestive tract is U-shaped so the viscera form a hump in a fleshy mantle with gills, all fitted into a many-chambered shell that is used to adjust buoyancy so they can float at any depth at will. Some long extinct nautilus species reached lengths of four meters and were the first large animals. This remarkable design required a knowledge of how to exploit buoyancy on a large scale in a protective shell while forcibly ejecting water to move and capture prey. This requires an explicit knowledge of complex events extended in space and time, another example of a transcending agency involved.

Flight is a remarkable achievement that takes more than the development of wings and the muscles to move them correctly. It requires the rapid integration and processing of much improved sensory input, especially vision, and equally rapid and appropriate patterns of motor responses. Flight requires focus on direction and an ability to steer. The proper size shape and movement of the wings is essential for directed flight through space and time. This also requires the simultaneous nervous integration of discrete visual images. Remote sensing in space and time must be interpreted accurately and fast. Complex parallel mutations had to simultaneously converge on directed flight to exhibit selection pressure, contrary to the thesis of rare random mutations. It had to be directed toward this specific result and not move off in other infinitely

more probable random directions. Moreover the flowers simultaneously exhibited a knowledge of complex events far extended in space and time in order to use flying insects as a pollinating vector in precise ways. They produced attractive blossoms and nectar unrelated to their needs apart from attracting insects or humming birds to spread their pollen to other distant flowers.

Examples of invertebrate knowledge of events extended in space and time are legion. Monarch butterflies come out of hibernation in February or March to find a mate in Mexico or California. They then migrate north and east some three thousand miles or so to lay their eggs on milkweed plants about April to start a new generation. The eggs hatch in four days into caterpillars. After growing for a couple of weeks the caterpillar attaches itself to the plant and spins a silken chrysalis wherein it undergoes metamorphosis and emerges as a new butterfly that lays eggs and lives for a few short weeks. The second generation of monarch butterflies is born in May or June, and then the third generation is born in July or August. They go through exactly the same four stage life cycle as the first generation did, dying after two to six weeks as a butterfly. The fourth generation is born in September or October. It goes through exactly the same process as the first, second and third generations except it does not die after two to six weeks. Instead it migrates back to warmer climates in Mexico and California and lives for six to eight months until it is time to mate, fly back north, and start the process over again.[18] This whole process exhibits an extraordinary knowledge of complex processes extended in space and time.

There are many curious variants among the invertebrates. For example the diving bell spider creates a silk aqualung that allows both sexes to live, mate and raise young underwater.[19] Why would a spider begin to consider such a risky adventure? Another spider that lives underwater makes a snorkel tube to breathe. The freshwater lampsilis clam modifies its mantle to mimic a swimming minnow complete with an eye spot. When a bass attacks the minnow the clam automatically ejects a host of clam larvae into the mouth of the fish. They are tiny clams that clamp onto the gills of the fish where they feed on blood from the gills until mature enough to drop to the lake bottom.[20] How did a blind sedentary clam work this magic by accident? How did it know there was a fish with gills? Why would it begin to extend and modify its mantle at all, much less the shape of a swimming minnow? There was no gradual selection pressure to make it converge on a minnow with an eye, fins and swimming movements that would make a bass strike until the process was nearly complete. Bass will not strike if the fake minnow is not accurate. A separate set of mutations is essential to eject larvae when triggered to clamp onto the gills of a bass to feed and then release at the right time in their development. These events require parallel mutations in concert that indicate a knowledge of complex events extended in space and time.

The Vertebrates

One thing is certain. The knowledge of how to relate to events extended in space and time is essential to the evolution of the vertebrate animals that swim, walk and fly. This knowledge did not come easily. It began with the fungi and plants and was further explored in more refined detail by the higher plants and then at an increasingly complex and accelerated pace with the invertebrate animals. As the invertebrates evolved in parallel with the plants there were obvious mutually interdependent developments. Together they explored space and time in every corner of

the biosphere as it hummed with life resonating ever faster around the girth of the planet. This learning process, although modest at first, gained enormously in complexity and extent, building on previous gains with influence also from some higher vertebrate developments as in the lampsilis clam. It was not a linear random process governed solely by natural selection. Selection is a factor in adaptation but not in unique species origination. Learning was happening on many levels at once, with communication between parallel evolving streams.

Divergence between fungi, plants and animals was apparent in the initial appearance of unicellular protozoan cells, so that all complex multicellular creatures must have mutually benefitted across diverging lines through an unidentified process or agency that facilitates communication and balance in the evolution of the biosphere as a living resonant whole. Otherwise the diverging evolutionary streams would be drying up in a multiplicity of dead ends. The branches of the evolutionary tree are also roots that supply a common evolving trunk that embraces the biosphere. This becomes more pronounced in the evolution of the vertebrates. It began with fish that move freely in three dimensions through space and time to actively pursue their needs, drives and private exploratory interests in their extensive environment.

The vertebrate animals are another radical departure from the immense variety of invertebrate body plans. They came on the scene in much less variety leaving a major gap in the record. Studies indicate that the vertebrates emerged from the phylum chordata early in the invertebrate lineage possibly from the lancelets which resemble a minnow although they lack a back bone, fins, and other features, or perhaps from the sessile tunicates which have a swimming larva stage. Although there are some similarities to the primitive hagfish and lampreys they is no agreement on a common vertebrate ancestor.

As lobe finned fish made the transition to land, the amphibians morphed into successive episodes of reptiles, then mammals and birds that culminated in a single human species. The vertebrate body plan converged on a common quadruped skeletal format. There was no re-exploration of multiple legs or compound eyes, no six legged lizards or four winged birds, no eight legged eight eyed spider men. And yet all that learning of the plants and invertebrates was somehow available to vertebrate evolution. It was essential to intelligent vertebrate movement through space and time that began with fish exploring movement in three dimensions.

The extinct Labyrinthodontia amphibians evolved from the lobe finned fish about 390 million years ago and are believed to be ancestral to all vertebrate animals.[21] They were moderately large, some species being up to four meters in length. The largest amphibian of all time was the 30 foot long *temnospondyli Prionosuchus* which appeared about 270 million years ago resembling a crocodile with a long snout. Over time, amphibians shrank in size and decreased in diversity. The number of known living amphibian species today is approximately 7,000, of which nearly 90% are frogs. The smallest amphibian (and vertebrate) in the world is a New Guinea frog with a length of just 7.7 mm (0.30 in). The largest living amphibian is the 1.8 m long Chinese giant salamander. Later we shall see that all species explored the limits to size and related mobility through space and time in diverse environments.

A common feature of vertebrates is cerebral hemispheres that reflect emotional patterns drawn from memory in conscious awareness, beginning modestly in fish. Fish can remember the best

location to feed, or where to spawn. In the extraordinary case of salmon they return from several years at sea to return as far as a thousand miles up rivers while climbing several thousand feet to spawn at their original spawning location. This represents an extraordinary knowledge of processes extended a couple thousand miles from extensive sea travel to spawning grounds over periods of up to seven or eight years.[22] This is associated with implicitly programmed emotional patterns of the parasympathetic nervous system concerned with the long term interests of the salmon species. For example the transient cardiac arrest that occurs in chum salmon when spawning has been attributed to the parasympathetic system.[23] Salmon also go through major physiological changes for their return journey upstream.

In the Pacific Northwest and Alaska, salmon death after the spawn supports wildlife from birds to bears and otters. The bodies of salmon represent a spatial transfer of nutrients from the ocean, rich in nitrogen, sulfur, carbon and phosphorus, to the forest ecosystem. Bears carry salmon into wooded areas where they leave nutrient-rich excrement and partially eaten carcasses. They leave up to half the salmon they harvest on the forest floor in densities that can reach 4,000 kilograms per hectare, providing as much as 24% of the total nitrogen available to the woodlands.[24]

With the amphibian vertebrates the cerebral hemispheres of their brain exhibit three undeveloped bulges that later blossomed sequentially in three distinct historical stages, namely during the age of the reptiles, the age of the lower mammals, and the later development of the higher mammals, especially humans. This cerebral development was accompanied by resonant developments of the autonomic nervous system that reflects historically conditioned emotional patterns in conscious cerebral awareness.[25] This sequential development of the cerebral and autonomic nervous systems was implicitly prescribed by the three brain bulges of the amphibians. It was harnessed to a fixed quadruped limb structure, with a similar skeletal arrangement and visceral organs, spanning global changes in space and time over a period of approximately 390 million years from the appearance of the first amphibians to humans. This patterned development of all vertebrates was evident in the nervous system organization of the ancestral amphibians from the beginning. This represents an overriding plan spanning space and time on a colossal scale.

The Reptiles

The first reptiles were small creatures that emerged from the amphibians. The *casineria* was a small animal about six inches long with both amphibian and reptile features that lived about 340 million years ago during the carboniferous period.[26] It lived and reproduced on land and was probably one of the first animals to lay hard shelled eggs with an amniotic membrane that allows living in dry environments, a feature that displays knowledge of processes extended in space and time. Two distinct lineages of amniotes, the synapsids and sauropsids, emerged in the late Carboniferous Period.

The first undisputed reptile was the small lizard-like sauropod named *Hylonomous lyelli* which lived about 315 million years ago from which the lizards, snakes, crocodilians, dinosaurs, and birds descended. About the same time the first lizard-like synapsid ancestors of the mammals appeared during the late Carboniferous period when an uplifting of dry land occurred. The supercontinent Pangea was forming which allowed the diversification of the reptiles to colonize

the entire common land mass of the planet together with the diversification of the gymnosperm plants, especially the conifers. A common land mass was essential to the common evolution of the vertebrate quadruped format that followed with the mammals and birds and that was foretold in the three brain bulges of the amphibians. It is another compelling example of a transcending agency at work with extensive knowledge of processes extended in space and time linking plate tectonics essential to vertebrate evolution far into the future.

The emerging supercontinent of Pangaea presented severe extremes of climate and environment due to its vast size. The south was cold and arid, with much of the region frozen under ice caps. Northern areas suffered increasingly from intense heat and great seasonal fluctuations between wet and dry conditions. The lush swamp forests of the Carboniferous were gradually replaced by conifers, seed ferns, and other drought-resistant plants.

Shielded by their thicker, moisture-retaining skins, reptiles moved in where amphibians had previously held sway and became well suited to the desert-type habitats in which they thrive today. Being cold-blooded, they had to find ways to deal with big daily variations in temperature, from below freezing at night to over 100 degrees Fahrenheit (38 degrees Celsius) during the day. Some primitive pelycosaurs were up to ten feet long and had sail-like structures on their backs that are thought to have acted as heat exchangers, catching the sun in the morning to help warm the sluggish creatures, features involving knowledge of processes extended in space and time.

Later mammal-like reptiles known as therapsids conserved heat generated through the breakdown of food. These more metabolically active reptiles could survive the harsh interior regions of Pangaea and became the dominant land animals of the late Permian. They rapidly evolved many different forms, ranging from fanged flesh-eaters to herbivores. Some species became large at over a ton. In the latter part of the Permian, smaller probably warm blooded varieties emerged that looked like mammals, some covered in insulating hair. The cynodonts of the late Permian include the ancestors of all mammals.[27] They had mammal-like features, larger brains, and some were capable of complex social behaviors.

The catastrophic Permian-Triassic extinction 252 million years ago killed off 70 percent of terrestrial vertebrate species, the majority of land plants, 95% of marine species and it was the only known mass extinction of the insects, that then consisted mostly of cockroaches, beetles, bugs and dragonflies. Some of the latter had wing spans of thirty inches and were capable of feeding on small invertebrates. Ecosystems and food chains collapsed. New ones took 30 million years to evolve. The Permian extinction may be attributed to huge volcanic activity that produced the Siberian traps[28] covering an area larger than Western Europe.

A pig-sized herbivorous therapsid constituted as much as 90% of earliest Triassic land vertebrates. Smaller carnivorous therapsids also survived, including the ancestors of mammals. *Adelobasileus cromptoni* was a very small shrew-like species from the late Triassic about 225 million years ago traditionally considered a mammal and a common ancestor of all mammals, although a clear division of the first mammals is difficult. Typically the mammals diverged early in the reptilian period long before the dinosaurs became prevalent.

A previously obscure sauropsid group, the archosaurs, which includes the ancestors of crocodilians and dinosaurs, became the dominant carnivores during the Triassic Period. There was a major rearrangement of ecological balances and resonances that anticipated essential events far in the future.

Just before Pangea began to break up, about two hundred million years ago, toward the end of the Triassic Period, there was a mass extinction which included most reptiles that had evolved a variety of mammalian features. The first mammals that had appeared during the late Triassic survived the Triassic extinction as tiny shrew-like creatures a couple inches long. The crocodiles and dinosaurs, later emerged as dominant. The dinosaurs began as small and medium sized creatures, however their legs moved underneath the body allowing them to later support enormous weights as they explored the upper limits to size. The 130ft-long Argentinosaurus was 65ft tall and weighed about 77 tons. One flying pterosaur reached a wing spread of forty-nine feet, exploring the behavioral limits of space and time.

They all became extinct at the end of the Cretaceous, about sixty-six million years ago. By then the flowers had begun to arrive in abundance as if for the funeral, along with a confluence of related events mentioned above. The only reptiles to survive were crocodiles, turtles, lizards and snakes. This was another reordering event with far reaching implications indicating a knowledge of processes extended in space and time. The reptiles never regained their dominance. It was time for a refinement of higher species to take the stage.

Throughout the reptilian epoch spanning approximately 250 million years, the first bulge in the amphibian brain bloomed as the reptiles diversified and explored a huge variety of behaviors in changing environments as Pangaea consolidated then broke up. The second bulge associated with the lower mammals also bloomed to a lesser extent as reptiles with mammalian features appeared in the late Permian and diversified later in the Triassic along with the appearance of the first small rodent-like mammals from therapsid ancestry. Although this brain development allowed for little diversity in the behavior of individual reptiles such as a crocodile or a turtle the range of behaviors over a huge range of species with mammalian features over a long period of time in spatially evolving habitats, as Pangaea formed and later fractured, made for a wealth of experience that could be exploited by the later diversification of mammals. There was now explicit knowledge in evolutionary history that covered a global expanse of space and time.

The Lower Mammals

It is apparent that the first mammals diverged in the late Triassic Period early in the evolutionary development of the reptiles. They survived the late Triassic extinction as tiny shrew-like creatures only a couple inches long. Being closely related to primates they are included in the primate lineage. They were carnivorous and active with a very large brain to body size ratio, modern tree shrews having the highest ratio of any mammal including humans. The pen-tailed tree shrew in Malaysia consumes large amounts of naturally fermented nectar up to 3.8% alcohol content the entire year without having any effects on behavior.[29] The Etruscan shrew has a very fast heartbeat, up to 1511 beats/min (25 beats/s) and a relatively large heart muscle mass, 1.2% of body weight. It is about 3.5 cm long and 2 grams, the smallest living terrestrial mammal.

Eurasian shrews need to consume two or three times their body weight each day to survive and will attack creatures larger that itself. A shrew may starve if it finds no food for as little as 5 hours. Life expectancy is about 15 months. Some species in SE Asia are larger up to 8" or more.

The shrew-like mammals diversified but remained small and largely nocturnal throughout the Jurassic and Cretaceous Periods, from 200 million to 66 million years ago. *Agilodocodon scansorius*, an omnivore that lived roughly 165 million years ago, possessed paws with curved claws for climbing and spade-like teeth for eating tree sap and bark. It also had limb proportions characteristic of tree-dwelling mammals and flexible elbow, wrist and ankle joints that made them expert climbers. *Docofossor brachydactylus*, is the earliest-known subterranean mammal, living around 160 million years ago. It had a skeletal structure similar to the modern day African golden mole, as well as shovel-like fingers good for digging. *Agilodocodon* was discovered in 2011 in lake bed deposits in Inner Mongolia. A year later, the fossil of *Docofossor* was unearthed in lake deposits of the Ganggou Fossil Site in China's Hebei province. Both were shrew size belonging to the long-extinct mammalian order called Docodonta. *Agilodocodon* weighed about 40 grams. *Docofossor* was smaller. It stood 3.5 inches tall and weighed up to 17 grams. Despite their small size, these shrew-like creatures survived during the dinosaur period developing striking mammalian diversity while swarming over the planet.

The first mammals were probably ancestors of egg laying monotremes. Marsupials emerged before the placental mammals about 160 million years ago just as Pangea was breaking up into the Southern and Northern hemispheres of Gondwanaland and Laurasia with the continents later moving into their current positions. The small mammals experienced relatively rapid evolution during the mid-Jurassic when dinosaurs were maturing. Some gliding mammals appeared later in the Cretaceous when dinosaurs were reaching their maximum size. The diverse activities of these small creatures exploited a large brain relative to their body size. This implicated considerable variation in the autonomic emotional apparatus compared to their larger reptilian counterparts. This allowed then to be much more emotively animated requiring a significant blossoming of the second brain bulge with some small expansion of the third brain bulge. Individuals could exhibit much more flexibility of movement and agility through space and time in small body formats prior to the demise of the dinosaurs.

The Cretaceous extinction completely wiped out the dinosaurs, many plants and some mammals. The reptiles did not recover while the mammals, flowering plants and insects began to diversify to fill the vacancy. Plate tectonics continued to reshape the continents with the rising of land masses and mountain building. Ten million years after the death of the dinosaurs, the world was filled with rodent-like mammals, some medium-sized scavenging in forests, and larger herbivorous and carnivorous mammals hunting other mammals, birds, and reptiles. For example Titanoides lived 60 million years ago in the Americas. It was bear-like and up to two meters long with claws. It weighed up to 200 kilograms. These larger mammals had a low brain to body size ratio. The lower mammals had to consolidate development of the second brain bulge with enormous increases in body size and behavior in space and time.

Later the early dog-sized rhinoceros of the Eocene period, 56 to 34 million years ago, grew into a twenty ton Indricotherium or "giraffe-rhinoceros" that was 18 feet tall at the shoulder with a long neck allowing it to graze from thirty foot trees. They lived during the following Oligocene epoch

among lesser giants, about thirty million years ago. In those early days there were some fearsome carnivores, such as the one ton wolf-like Andrewsarchus that was sixteen feet long with a head three feet long. About 20 to 30 million years ago during the Miocene *Daeodon shoshonensis* was a "hell-pig" six feet tall at the shoulder with a head 3 feet long. Moropus related to the horse was 8 feet tall at the shoulder with claws. There were successive waves of large mammals such as the one ton rat Josephoartigasia that lived about 2 million years ago. Giant building continued in successive waves into the Pleistocene epoch of the ice ages, with Daedicurus, an armadillo over ten feet long, and the six meter tall Giant Ground Sloth. The marsupials also produced giants during this time, including the Diprotodon, a wombat as big as a grizzly.

It is clear that the evolutionary process has been required to explore limits to size from small to large throughout the history of the biosphere in every lineage. Microscopic single cells reached a maximum size of up to 12 inches, although nerve cell axons of giant squid can reach 39 feet. Giant dragonflies had a wingspan of 30 inches. A sea scorpion 8 feet long perished in the Permian extinction. A land scorpion over 2 feet long lived 400 million years ago. Cameroceras, an ancient relative of the Nautilus, could reach 30 feet. Arthropleura was an ancestor to centipedes and millipedes that could reach more than eight feet (2.4 m) in length. Platyceramus was an ancient bivalve clam 3 meters in diameter. It has been a recurring pattern in the evolutionary process essential to the exploration of processes extended in space and time. This knowledge is essential to the evolutionary climb up the ladder of sentient awareness with intelligent responsiveness, from plants to invertebrates to vertebrates to lower mammals and finally to higher mammals and humans.

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