Introduction

Let me venture a "modest" prediction: This book, the first volume of an audacious series, will eventually enter the history of biology, physics, and chemistry, as one of the most important integrative scientific works of all time. I confess that I am humbled by the invitation from its authors to introduce this revolutionary work, the first volume of what is to be a series of texts, *Foundations of Aetherometric Biophysics*. This Volume I is the distillation of several lifetimes of scientific work on the frontiers of biology, physics, and chemistry by the remarkable husband and wife team, Dr. Paulo and Alexandra Correa, who have worked in the Toronto, Canada area for the past few decades. They have confronted all of nature by asking at every turn this dramatic question: Is the commonly accepted dogma about this or that aspect of scientific knowledge on secure ground? In this, they have returned to the true spirit of science — in contrast to much of what passes for "science" these days, which is to say a rigorous refusal to question *fundamental* principles, while adding ever more complex, often baroque structures on top of what may well be a teetering house of cards.

If you have been troubled by some of the glib, prevailing umbrella "explanations" and assumptions of modern biology and biochemistry, it is essential that you explore what the Correas have set forth here. On the other hand, if you believe that *fundamental* physics, *fundamental* biology, and *fundamental* chemistry, as taught in our universities circa 2004 is approximately 100 percent correct and that mainstream research (as published for example in *Science* and *Nature* magazines) is producing an ever more complete and useful picture of Nature, i.e. is asymptotically approaching Truth, then this book is most surely *not* for you. But if you are curious about asking the fundamental question posed by the Correas — *Are present fundamental scientific paradigms secure?* — then this book is absolutely essential to read. It opens a gigantic window into an entirely new way of looking at and investigating all life processes in a continuum with other natural processes. If the Correas are correct in the essentials and most of the particulars that they begin to describe here, then it could be said fairly that further progress in biology will be severely hampered without serious attention to these insights.

But that, dear reader, is for you to judge yourself, if you are so bold as to go beyond this introduction and test the waters to see whether my assessment is on target.

There are three major categories of the profound implications of the Correa work:

1. A radical revision of fundamental physical and chemical models that are said to underlie biology – as carried out from what one might most aptly describe as an energetic perspective;
2. A much needed revision of developmental biology, in particular, with regard to cellular diversification processes and morphogenesis, but as well in what concerns the grand processes involved in the terrestrial "evolution" of life; and
3. Critical insights and explanations about how otherwise totally mysterious— if not completely "impossible"— modalities of healing, such are often described in the alternative or complementary medicine fields, operate in cases where no presently accepted physiological models can describe the therapy's function (such as acupuncture, in particular, where very concrete physical proof of its efficacy already exists[1]).

This first volume, of course, does not provide all the proposed answers to these questions, many of which I believe are already in hand by the Correas, but it does lay down the fundamental foundations for these novel understandings.

Let me right away distinguish this work from so many other tomes that may aspire to a drastic revision of fundamentals: *Nanometric Functions of Bioenergy* does not pull from thin air a speculative, beautiful-seeming "Theory of Everything" for biology and its support sciences, physics and chemistry. Rather, it confronts precisely defined experimental and logical anomalies in biology and shows how dramatic new *experimental* evidence - which the Correas have obtained with their own difficult pioneering work in new energy systems - can explain these anomalies in the framework of an enlarged theory of biological systems.

First, some background about the two authors and their pioneering scientific work, both experimental and theoretical. Paulo Correa has a PhD in Cellular and Molecular Biology (Hematology and Oncology) from the University of Toronto (1991); also from the same University an MSc in Biophysics applied to the field of Virology and Oncology (1987) and a BSc in Physics, Chemistry and Biology (1984). He has other degrees in Political Science and Sociology (HBA, 1979, York University, Glendon College), in Law (Bachelor), and piano and music composition. Alexandra Correa, his wife, scientific partner and co-author, holds an HBA degree in Psychology and Sociology from York University, Glendon College (1979). She is also an expert scientific glassblower, a brilliant visual artist, and a musician.

Dr. Correa's doctoral dissertation constitutes perhaps the first formally recognized contribution he has made to the field of Medical Hematology. Together with Prof. Arthur Axelrad, MD, and at the Faculty of Medicine of the University of Toronto, he developed a serum-free assay that subsequently permitted the identification of a specific hypersensitivity to Insulin-like Growth Factor I on the part of the blood-forming cells of patients with *Polycythemia vera* - a precancerous, proliferative disease that results in excess growth of red blood cells and platelets[2]. This finding - which resulted in two patents - broke away from nearly thirty years of erroneous assumptions about the molecular nature of the disease - assumed variously to be caused by hypersensitivity to, or independence from, Erythropoietin (the hormone responsible for the normal differentiation of red blood cells). This ground-breaking work resulted in a collaborative effort with Prof. Axelrad and his group, which has lasted to this day and has permitted entirely new analytical approaches to other myeloproliferative disorders, and the purification and isolation of blood-forming stem cells.

I first met Dr. Paulo Correa at the Third International Symposium on New Energy held in Denver, Colorado in April 1996, where he gave a keynote lecture about his and Alexandra Correa's autogenously Pulsed Abnormal Glow Discharge (PAGD^{TM}) reactor. This invention, developed out of a serendipitous discovery in plasma physics, is comprised of an evacuated glass tube with aluminum electrode plates, which is set into auto-electronic discharge emission by associated circuitry (this invention was awarded three US patents in 1995-1996, as well as patents in Israel, England and Canada). It produces reported substantial "excess electrical energy", as validated by copious and varied testing. The fact that many others, earlier in the 20th Century, had seen (but casually dismissed) gas discharge anomalies and anomalous cathode reaction forces which form the basis of the PAGD^{TM} technology, illustrates a quality characteristic of all the Correa work, experimental and theoretical, with which I have since come into contact: that its accomplishments come from the Correas' ability to *see differently into* 'things' - processes and events - that others have *looked at* many times before. Another quality I have come to know and appreciate, is readiness to acknowledge their intellectual debt to others. In that same Denver lecture, the Correas offered specific praise for Dr. Harold Aspden's work on electromagnetic theory, and - in particular - for his Law of Electrodynamics whose predictions were substantially confirmed by their PAGD work. I should note, in passing, that Dr. Aspden - previously Professor at Southampton University and head of IBM's patent operations in Europe (1963 through 1983) - is the author of a compendious body of work on the physical nature of the dynamic

non-relativistic Aether (see, for example, his recent *Aether Science Papers*). He has repeatedly written about the work of the Correas[3]. At the conference in Denver, he delivered a lecture on "Vacuum Spin as a New Energy Source." I was greatly impressed by that first encounter, in Denver, with the Correa research, and began, soon after, to publish their work in *Infinite Energy* magazine, whose editor-in-chief I have been for almost a decade.

The Correas' work has been entirely self-financed since the early 1980s, of necessity due to its pioneering nature. The PAGD work and technology originated from extra-academic studies of low-voltage X-ray production in the mid-1980s, but their joint interest in the work of the controversial and commonly disparaged and ignored Nikola Tesla (1856-1943) and Wilhelm Reich, MD (1897-1957), was of even earlier vintage. Over the years, the Correas were able to repeat, and substantially improve upon, some of the most baffling experiments of Tesla and Reich, and the practical and theoretical understandings they have achieved in the frontier areas of physics, biology, and other sciences, permitted them to develop a number of innovative, forefront energy technologies, as well as a foundation-setting theory of the massfree Aether - which also represents, in part, a critical evolution of the work and findings of prior researchers such as L. de Broglie and H. Aspden. The theoretical and experimental work of the Correas, as witnessed by their publications [4-6], is a truly extraordinary achievement, almost unparalleled by any previous research to-date, and amounting to the beginning of a scientific revolution. With the present book, the scientific vision they have developed turns to the fundamental problems of biology.

If a vote were taken among scientists, high on the list of enduring scientific mysteries would be *life* itself — in particular how it functions, how it originates, how it changes form on many time scales, how it is so brilliantly varied and fills every ecological niche. In short, scientists remain in awe of the many phenomena of life. But despite many enduring acknowledged mysteries, there is a creeping tendency in science today to imagine that in some sense we have already captured the essential outlines of what life is all about. We have known since the early 1950s about the genetic apparatus of cells. Within only half of one century, knowledge of the function of DNA, RNA, enzymes, other elaborately folded proteins, viruses, and a plethora of microbial forms — not to forget the astonishing prion replicants of more recent vintage — seems to have reached a high order of refinement. "A huge number of details are being filled in with an accelerating pace" might be an apt description of the prevailing scientific view about life, with the exception perhaps of life's mysterious origins in the dark mists of ancient time.

This belief in an asymptotically approached completeness is similar to the opinion about the physical sciences that was famously expressed by physicist Albert Michelson in 1894: "While it is never safe to say that the future of Physical Science has no marvels even more astonishing than those of the past, it seems probable that most of the grand underlying principles have been firmly established and that further advances are to be sought chiefly in the rigorous application of these principles to all the phenomena which come under our notice." Physicists and chemists circa 2004 have unfortunately assimilated a view that is not very different from Michelson's opinion of over a century earlier, an idea that was to be shattered by developments that began the very year after Michelson's bold utterance — starting with the discovery of x-rays. Early 21st Century physicists and chemists, by and large, are on ice at least as thin as that on which Michelson stood — as is amply demonstrated, for example, by the previously published experimental findings of the Correas [4-6]. The life scientists of today, resting as they do on the supposed sacrosanct pillars of physical and chemical wisdom, are seen to be basing their scientific worldview on even more incomplete and shaky grounds than the physicists and chemists.

High on the list of accepted "certainties" about life are these:

1. All biology can be reduced ultimately to a complex biochemistry of molecules, atoms, electrons, and protons, *sans any intra- or intermolecular interstitial energy medium*. (What could that be, in any case, other than the empty space vacuum?) These constituents, in turn, are to be grasped within the framework of a physics of basic atomic, molecular, and electronic phenomena that are *claimed* to be fundamentally understood with such governing theories as modern quantum mechanics and the theory of Special Relativity (SRT) — even though it is acknowledged at the same moment that quantum mechanics and SRT's complement, General Relativity, have stubbornly refused all attempts at theoretical unification! There can be no fundamental alteration of these theories — certainly none that would radically alter a conception of the biochemical foundation of life. Massbound life is based on massbound physics and chemistry, period: Any conception of a *massfree* component to life (which the Correas explore in great detail, beginning with the misunderstood experiments of Luigi Galvani on frogs' legs two centuries ago [7,8]), other than ancillary electromagnetic radiation, must surely be some kind of "new age" fiction.
2. The processes of life — life itself — rigorously obey the tyranny of the Second Law of Thermodynamics, which also mandates an ultimate decay and degeneration of the entire cosmos. There can be no such process as an "entropy-reversing" *draw of energy* into themselves by organisms, *up the hill* of a temperature gradient.
3. Signals within organisms are of a purely chemical nature, with an overlay of well-understood massbound electrical phenomena, such as in the transmission of electrical nerve impulses. There can be no such entity anywhere as the flow of *massfree electrical energy*, perhaps with an ambipolar (non-polar) conveyance of charge.
4. Life on Earth had a single, exceptionally difficult and obscure origin. There can be no such thing as a continuing biopoiesis that might affect extant life. Any experiment that hints — or *more* than hints! — at a contrary view must be, *a priori*, flawed. Included in that rubric would be the experiments performed in the 20th Century by Wilhelm Reich on so called "SAPA bions" — seemingly microbiological forms obtained from high temperature silicon-dioxide particles plunged into sterile growth medium. These nonetheless bear some conceptual kinship with the later famous Urey-Miller experiments of the 1950s — which produced all the essential amino acids from energized gas mixtures — and even more so with Stanley Fox´s self-assembling "proteinoid microspheres".
5. Life changed its form over the eons in a process that was dominated almost exclusively by natural selection of random genetic mutations. That is, neo-Darwinism reigns supreme and is unchallengeable.
6. The form-shaping and cellular differentiation within multicellular organisms follows a complex genetically influenced and controlled regime. Morphogenetic "fields" of any kind are, at best, analytical constructs, at worst, mystical notions.

As it happens, the Correas argue pointedly and with force against *all* of these biologically "essential" certainties, which is a very tall order, indeed. This makes them very intractable heretics in what concerns a broad spectrum of life's manifest properties. Their line of argument proceeds along a well-documented pathway, that is often challenging to follow, to be sure, because so many myths must be uprooted along the way. Furthermore, it would be very unfair to their opus to attempt any kind of detailed summary here, but let me mention some of the counterpoints that it makes to the above tenets, so as to invite you to take up the challenge of reading this book in depth.

It begins with the notion that (1) the foundations of physical theory must be reformulated within the framework of an *energy continuum*, under which the subsidiary phenomena of

space and time naturally and mathematically emerge. This leads to the experimental finding that a space-pervading non-electromagnetic, *massfree* aether (not the *luminiferous ether* that *was* unwittingly done away with by the Michelson-Morley experiment of 1887) is the substrate that affects and explains all *massbound* (inertial) particles — their genesis, their motion, interactions and structure. Moreover, (2) this massfree plenum provides, in part, a more generalized latent heat characteristic that is "affected to" molecules. Not only does this latent heat manifestation explain numerous experiments in which anomalous energy is observed, but it goes right to the heart of the non-covalent bond structures in biochemical systems, structures that are so incompletely understood. One can see where this is going: a better understanding of biochemical reactions, for one thing, and of the protein folding problem and the correlated characteristics of the water molecule for another.

As this relates to the problem of entropy, we are confronted with one of the most challenging parts of the present book — the treatment of order and entropy proposed by the authors. They set out to demonstrate how entropy is not a concept or a function that may differentiate between order and disorder, or measure the degree of either one. The same applies to the inverse concept of negentropy. Without getting lost in the systematic subtleties of their argument, the Correas propose that "order, entropy and internal energy vary in parallel, though not isomorphically", and that "it is always the growth in the internal energy [of a system] that is correlated to the increase in actual entropy", but that "entropy can only be maximal when the total energy function of a system is minimized and most or all of the enthalpy of a system is mobilized into exhalpy [or discharge]"; now, this only happens upon the death of a living system — the characteristic of living systems being precisely the accumulation of a greater quantity of internal energy at the expense of that "exhalpy". It follows that, in their words, "since actual entropy can only be a measure of the proportion of the total energy of a system to the energy it outputs back to a thermal state, and which alone produces the temperature of the system, no system can increase its enthalpy without increasing its entropy, and all the more so if it is to also increase its internal energy over time". Hence, they argue that what characterizes living processes is that they "are marked by a greater disproportionation of the energy of a system to the energy portion that is found, at any one time, in mechanical or sensible thermal forms", thus making the problem of entropy secondary to the functions they define for the coefficients of order describing the states of the internal energy of a system. Accordingly, this leads to a very new viewpoint that holds that "what characterizes living systems is the growth of their internal energy with time and over time", which requires — in their argument — that entropy also increase, but under conditions that minimize the discharge of energy (the "exhalpy") from the system. It is only with respect to their "exhalpy" that the entropy of living systems can be said to decrease ("phenomenological negentropy", they call it); not so with respect to their enthalpy, precisely because living systems are not exclusively thermal machines, but systems that deploy other energy forms to increase their internal energy. The concept of entropy thus reduces to being simply a "measure - albeit indirect - of the proportion of energy in a flux, or a system, which is in the sensible caloric form".

This complex demonstration leads the Correas to a novel definition of living systems, they write:

"Living systems are not the analogue of mechanical machines; they are [self-assembling] systems or assemblages of nonlinear, nanometric-scale micro-machines. These [pre-cellular and intra-cellular] machines have finite scale and energy limits, barely known at present, and their articulation involves not simply quantic interactions but also, and most importantly, subquantum ones that have resisted the analytical tools of modern physics."

Let me mention, in this context, the resonances between the present book and some of

the points in the recent controversy between Richard E. Smalley (Professor of chemistry, physics, and astronomy at Rice University, Houston, who won the 1996 Nobel Prize in Chemistry for the discovery of fullerenes) and K. Eric Drexler (Ph.D. in molecular nanotechnology from MIT in 1991 and author of the 1986 book, "Engines of Creation: The Coming Era of Nanotechnology"). Drexler argued in his book that nanomachines capable of precise atomic-level "mechanosynthesis" will one day be able to replicate autonomously and chain-make other nanomachines, thus posing "basic threats to people and to life on Earth". Subsequently, in an open letter to Smalley, Drexler states - "I have from the beginning argued that the potential for abuse of advanced nanotechnologies makes vigorous research by the U.S. and its allies imperative." Smalley counteracted this 'alarmist perception of an imaginary danger' in a September 2001 article in *Scientific American*, where he argues that the precision required for the realization of Drexler's vision can only come from biological molecules capable of directed catalysis - specifically one that employs water as the medium - and not from mechanical nanobots. Smalley suggests that only a biosynthetic water-based process can turn and twist the molecules, lending and taking energy out of the interactions, to permit the most adequate fit and allow for the emergence of *nanomachines of a biological nature*. Without taking sides on this controversy - though I suspect the Correas would agree with Smalley's politics of science and his anti-obscurantist stance ("there will be no such monster as the self-replicating mechanical nanobot of your dreams", he wrote in response to Drexler) - the contribution which the present work of the Correas might bring to the present state of nanotechnology and nanobiology might be summarized by saying that it elucidates the role - functional and structural - of water in biological nanomachines, and permits a new and more exact understanding of the specificity of structure and energy interactions that underlie the operation of these machines. Perfect mechanical nanobots may not be possible, but there is an unsurmised higher degree of exactitude, structure and morphogenesis that a better physics enables one to discern as being at work behind all biosynthetic processes. I am not a biochemist, but it seems to me that in pursuit of this effort to achieve a greater precision in analysis and practical understanding of "nanometric" interactions, the Correas also introduce an entirely new integrated theory of the electrical values and functions of the pH scale and redox potentials - presenting, in fact, a new scale based on the log function of electron concentration. Lastly, along lines not entirely foreign to Smalley's criticism of Drexler, the Correas also contend - through their particular concept of living systems as autopoietic machines (upon which they engage in controversy with F. Varela's concept of the same) - that one should, indeed, distinguish between mechanical systems (mechanisms), no matter how miniaturized, and biological machines as the only actual nanomachines.

The Correas propose that a functional understanding of these non-mechanical self-assembling machines is not possible without taking into account the physics of massfree energy — whether in the form of latent heat or in the form of massfree charge, or what they refer to as "ambipolar electricity". This approach therefore leads them to assert that "the concept of entropy is glaringly insufficient to account for 'the variations in development' of the *energy content* of a living system."

Many illustrious authors, such as Stuart Kauffman, have made valiant attempts to explain the seeming paradoxes of life and the Second Law but have failed to achieve a convincing synthesis of the facts[9]. Kauffman, for example, advertises his explanation as follows: "… [it] supplies a novel answer that goes beyond traditional scientific thinking by defining and explaining autonomous agents and work in the contexts of thermodynamics and information theory." But nothing that Kauffman or others put forth, can explain the experimentally determined autonomous draw of energy that the Correas experimentally and analytically

establish, precisely because the Kauffmans of this world are utterly blind to the gaps in chemico-physical theory that everywhere gloss over the presence of energy draws —above and beyond the intake of massbound energy source material.

The Correas write, "A mechanism is essentially a transmission relay. It has no capacity to acquire energy - withdraw energy from its environment or increase its internal energy content - other than that which is mechanically discharged to it. But machines, such as those one studies at the nanometric scale in cellular environments, in their quality of micromachines, are self-assembling (auto-poietic) molecular aggregates that constantly borrow massfree energy from their surrounding media to function through pathways that are inseparable from their formation." Indeed, this is the heart of their argument, which can be traced back to the original Galvani-Volta controversy—the point at which biology may have taken a very wrong turn.

The book also offers a devastating scientific and philosophical critique of Darwinism and the dogma of "natural selection". This critique does not proceed from a "creationist" perspective, a mystical interpretation of life's origins, or from teleological or finalistic arguments that border on what some have called "intelligent design." Rather, what it argues in favor of is a "neo-Lamarckism in the speciation process and its application to the double systems of genes and proteins, including the novel physical functions of molecular substrates in the capture and the emission of massfree energy."

For those who may not fully appreciate the appropriate attack under which dogmatic Darwinism and neo-Darwinism have increasingly come from non-mystical sources, it suffices to quote the accomplished biologist Lynn Margulis (the discoverer of the likely symbiotic bacterial origin of cellular organs — or organelles — such as mitochondria), who with her son Dorion Sagan recently wrote[10]: "The entire panoply of neodarwinist terminology reflects a philosophical error, a twentieth century example of a phenomenon aptly named by Alfred North Whitehead: 'the fallacy of misplaced concreteness.' The terminology of most modern evolutionists is not only fallacious but dangerously so, because it leads people to think they know about the evolution of life when in fact they are confused and baffled. The 'selfish gene' provides a fine example. What is Richard Dawkins's selfish gene? A gene is never a self to begin with. A gene alone is only a piece of DNA long enough to have a function. The gene by itself can be flushed down the sink; even if preserved in a freezer or a salt solution the isolated gene has no activity whatsoever. There is no life in a gene. There is no self. A gene never fits the minimum criterion of self, of a living system. The time has come in serious biology to abandon words like competition, cooperation, and selfish genes and replace them with meaningful terms such as metabolic modes (chemoautotrophy, photosynthesis), ecological relations (epibiont, pollinator), and measurable quantities (light, heat, mechanical force). So many current evolutionary metaphors are superficial dichotomizations that come from false clarities of language. They do not beget, but preclude scientific understanding." At another point in this text Margulis and Sagan summarize their alternative: "We suggest that at least some of Jean Baptiste de Lamarck's 'acquired characteristics' that sensitively respond to the exigencies of the environment are foreign genomes. Tiny masters of metabolism and movement are often ready and willing to associate with larger forms when environmental pressures encourage togetherness. Evolution's menagerie is far more responsive to immediate environmental forces than the 'random mutation' contingent would have us believe."

This is clear evidence that even "mainstream" biologists are beginning to emerge from under one of the greatest and most irrational dogmas ever erected about life! It is very interesting to note that the Margulis-Sagan book has begun to generate tentative, but significant, praise from relatively conservative quarters. There is hope, therefore, that the

present Correa work on fundamental bioenergies will find some appreciation among this new emerging community, and will eventually spur on a systematic re-evaluation of physics and biochemistry, whose absolutely fundamental flaws the Correas so precisely and elegantly catalog here. This Correa work is amenable, I repeat, to testing and experiment. Science, if it is to progress beyond the ossified dogmas of today, must return to its roots as a truly questioning enterprise based on the absolute primacy of experiment, and the fashioning from that of pioneering new theories.

In 1987, I was the author of what I then thought was a novel synthesis of cosmic knowledge, *The Quickening Universe*[11]. It told of a universe "coming to life" — quickening. I then accepted the glib, self-satisfied assurances of the "Scientific Establishment" whose experts surely "knew what they were talking about." I had assimilated the "asymptotically approaching Truth" theory of accepted scientific knowledge, which I now understand to be catastrophically wrong. I am very thankful that I was given the opportunity to explore just how these alleged scientific "facts" about cosmic evolution have been assembled. Via independent means — other than the Correa synthesis, I have concluded that the accepted modern scientific edifice has significant foundational flaws. This took me on a journey that led to the provocative insights of Paulo and Alexandra Correa. They themselves were standing on the shoulders of giants about whose scientific work I was blissfully ignorant. It is my hope that this limited introduction to what I believe to be a critical and eloquent work of scientific synthesis will encourage others to assess its many messages and analyses, and above all to accept or reject them on their own merits, without preconceptions.

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