

Book Reviews

Grasping for Wholeness

A review of Stuart Pivar's book *Lifecode: The Theory of Biological Self Organization*

by Richard Gordon

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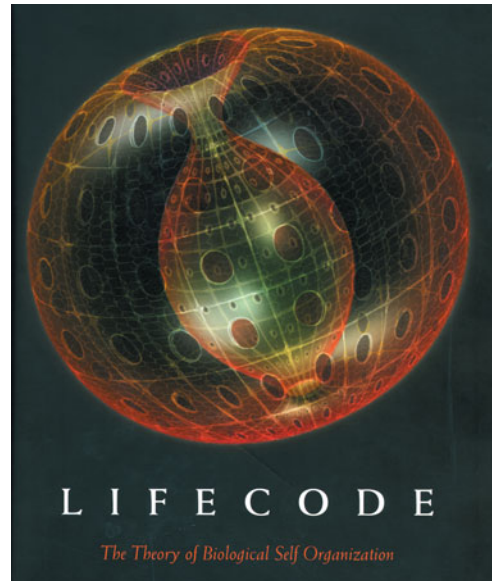
The beauty of the form of organisms has captured our imagination ever since our ancestors created cave paintings, petroglyphs and petroforms. The capture of nature in art, in pressed flowers and in stuffed animals in museums, sometimes to the point of extinction, accelerated as Europeans colonized the world and collected all manner of beasts, usually dead. The preserved, fixed points in the life cycle of organisms would sometimes be arranged in presumed sequences, but the dynamic, four dimensional nature of life was effectively collapsed by pressing or dessication into two or three dimensions. Only a few of us have had the privilege of studying the unfolding of embryos *in vivo*, via time-lapse microscopy. This viewpoint reveals the pulsing explosion of an organism from the humble, simple-looking one celled egg.

Until the advent of Internet, scientific publication precluded time-lapse movies. Now, short Quicktime movies are sometimes buried online as supplements to scientific literature. But the linear word and flat photo prevail, and four dimensional understanding of biological reality is a rarity amongst researchers. Where a picture is worth a thousand words, time-lapse is worth a thousand pictures.

Stuart Pivar, we learn from Internet, is a high bidder for rare fossils, an art collector, "one of the co-founders of the New York Academy of Art & friend of Andy Warhol and Stephen J. Gould", a businessman, aficionado of classical music, and Advisory Board member of the Asian Elephant Art & Conservation Project. Only a latter day Renaissance figure could have conceived and written *Lifecode*. Out in the sticks of the Province of Manitoba, Canada, far from our shared Brooklyn origins, where I can wander 152 acres of my own wilderness with rare tall grass prairie, the biological rampage time-lapsed by our short, intense summers yields a different perspective on life. Yet Stuart Pivar and I have partly converged.

Speak with Stuart Pivar about his book as I have (he found me and brought it to my attention) and you will be faced with a degree of certainty that the problem of morphogenesis has been solved in a manner that is pure and totally lacking in the measured doubt and humility attributed to the stereotypical (if not always real life) scientist. Pivar has earned his platform in other ways, and has no patience for the games we scientists play with one another and with nature. Confronted with this "in your face" enthusiasm for the subject, his lack of formal research credentials, and his blatant disregard of the sacred cows of today's biology and the rules of evidence, apparently only one of scores of scientists plied with this book, yours truly, is trying to see past the spitting words. Each generation of scientists demarks itself from its pseudoscientists, and, along with the chafe, gems such as tectonic plate movement, colliding worlds, particles of inheritance and jumping genes are laughed or brushed away to oblivion until a later generation rediscovers these quaint notions. The perpetrators often die with the agony of isolation and rejection.

Of the 25 chapters (averaging 4 pages each) in *Lifecode*, the following headings catch my eye: Toroidal Membranes, The Crisis in Biology, Form without Inheritance, Mechanical Engineering, and Scientific Dissent from Darwinism. The



Lifecode: The Theory of Biological Self Organization.

(Cover illustrates Stuart Pivar's toroidal sphere).

by **Stuart Pivar**

Ryland Press (2004), 164 pages, ISBN 0-9764060-0-4
60 US\$ (hardback)

common theme is that “[Johann Wolfgang von] Goethe (1790) was guided by an obsessive mission [continued here] to discover the universal factor that generates all organic form”. Toroidal membranes are the answer to the crisis in biology, which is that despite sequencing of the human genome, form occurs independently without inheritance via mechanical engineering without cells or the help of Darwin. That’s the argument in a nutshell, obviously an easy target for any modern biologist who knows better.

At least in Pivar’s book we are not dealing with the supernatural morphogenetic fields that have been foisted upon an unsuspecting lay public and physicists naïve about biology. There are no creationist ideas about unexplainable gaps. No, this is pure Newtonian continuum mechanics, at least as shown through the beautiful models and drawings, lavishly created and photographed by a staff of five in full page color to create a coffee table book. Pivar restores the wholeness of the organism, a concept that he attributes to the organicists of the early 1900s, but which actually goes back to those who in the early 1800s fought (unsuccessfully) against the cell theory that regards our bodies as a cooperative venture between cells engrossed in a division of labor.

Unfortunately, the depictions of the step by step unfolding of a simple toroidal sphere (just a donut rounded up to a ball with a hole through it that expands to a hollow sphere inside) to a human, a plant, or a spider is accompanied by vague language and no side by side comparison with the real thing. Like certain proofs of the Pythagorean Theorem, the inevitability of these transformations is supposed to jump right off the page, without words, leaving us speechless. Our deep knowledge of the 4D anatomy of diverse phyla, which each reader is presumed to have indulged in and memorized, will make these pictures obvious and compelling. It’s a bad tactic. *Lifecode* should have been self-contained to be convincing. It needs Wilhelm His’ 1870 microtoming and serial reconstruction, and today’s confocal microscopy with digital deconvolution, to show real anatomy versus time. It lacks the quantitative compellingness of finite element analysis, the computer tool of engineers that can show in detail how the mechanics of a system does or does not produce a given shape. Intellectually, the problem that Pivar smashes with one mighty blow is this. Ever since we conceived of the separation of the genotype from the phenotype, we have been trying to discover how genes do it. This led to a century of genetic determinism, in which genes “do” everything. Thus when the supposed blueprint for *Homo sapiens* did not crawl off its CD and self-assemble itself into one of us from its DNA nucleotide sequence in the year 2000, we knew we were in trouble. Something else must be going on. Pivar throws the genome baby out with the bathwater, leaving us with the contortions of a toroidal membrane to explain all of biodiversity, not genes. The only concession he makes in this hyperbole is that genes might cause different parts to grow at different rates in different organisms. But that very concession shows that he has not solved the problem, for nowhere in this book will one learn, beyond some vague notion of self-assembly, how growth rates come to differ over the purported surface of the toroidal sphere, and in a species specific manner. How does the homunculus get painted onto that geometry, what is it that differs from one region to the other, and what is the relationship between that spatial differentiation and the uniformity of the genomes in an embryo’s cells? We have to ignore the lability of regulating embryos (like us), the fact that polyclonal wasps will form 1700 individuals from one egg, the correlation between defective chromosomes and birth defects, and cloning, to swallow the notion that we are merely blown up, painted rubber balloons. We have to reject the innumerable DNA sequence homologies between genomes to believe that evolution of the genome did not occur.

So where do we stand? Basically, Pivar makes a long overdue argument that mechanics is a major component of embryogenesis. As I’ve argued myself, all those bends and grooves and contortions mean something. To me they mean that mechanics of a developing embryo alters gene expression, which in turn alters the mechanics. The laws of mechanics are indeed timeless (at least since life started), but the genome does change and evolve. Pivar tells half the story, the half that has been ignored since Wilhelm His wrote in 1888: «To think that heredity will build organic beings without mechanical means is a piece of unscientific mysticism.» But His did not toss out heredity. So *Lifecode*, flawed, jarring but thought provoking as it is, is worth reading and worth the price, even if it is just half and not whole.

*Richard Gordon is author of *The Hierarchical Genome & Differentiation Waves: Novel Unification of Development, Genetics & Evolution*, World Scientific (1999) and co-editor of *Developmental Morphodynamics - Bridging the Gap between the Genome and Embryo Physics*, Int. J. Dev. Biol. in this issue (Vol. 50, Nos. 2/3).