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The Organic Revolution in Science and Implications for Science and Spirituality

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1. The machine metaphor has dominated the west for at least two thousand years before it was officially toppled by relativity theory and quantum physics at the turn of the 20th century. Einstein's relativity theory shattered the Newtonian universe of absolute space and time into a profusion of space-time frames in which space and time are no longer neatly separable. Furthermore, each space-time is tied to a particular observer, who therefore, not only has a different clock, but also a different map. Stranger still -- for western science, that is, as it comes as little surprise to other knowledge systems, or to the artists in all cultures -- quantum theory demanded that we stop seeing things as separate solid objects with definite (simple) locations in space and time. Instead, they are de-localised, indefinite, mutually entangled entities that change and evolve like organisms.

2. Leading thinkers of the age such as Henri Bergson, Alfred North Whitehead, J.S. Haldane and Joseph Needham were inspired to develop a science of the organism appropriate to the new understanding of nature, that would transform the entire knowledge system of the west. Whitehead, in particular, declared that we cannot understand nature except as an organism that participates fully in knowing. For me, that was perhaps the most significant turning point. It was to re-affirm what we all knew in our heart of hearts: that we are inextricably within nature; and that we participate in shaping and creating nature, for better or for worse.
3. To participate fully is to do so with all of oneself: intellect and feeling, body and spirit. That is the real meaning of the mutual entanglement of 'observer' and the 'observed' in quantum theory. It matters how we know or 'observe', not only because it changes the entire character of our knowledge, but because the act of knowing transforms both the knower and the known. That is why we must never know with violence, but always with sensitivity and compassion.
4. The project to develop a science of the organism was interrupted and eclipsed, however, by the rise of molecular biology since the 1950s. Biology was taken back down the road of mechanical reductionism, to culminate, today, in a genetic engineering technology that has the potential to destroy all life on earth and to undermine every spiritual and social value that makes us human. We need to reject reductionist biology not just because of its inherent dangers, but because there are positive, rational, life-enhancing, fulfilling and aesthetic reasons for embracing the organic alternative.
5. Fortunately for us, the 'organic revolution' has survived. It has been gathering momentum across the disciplines within the past 20 years, from the study of nonlocal phenomena in quantum physics and nonlinear dynamics in mathematics to complexity in ecosystems, the fluid genome in the new genetics and consciousness in brain science. The message everywhere is the same: nature is nonlinear, dynamic, interconnected and interdependent. The linear, static paradigm of mechanistic science based on interactions between separate, independent parts is a travesty of organic reality.
6. All the elements for a science of the organism are there between the disciplines, precisely as envisaged by the pioneer thinkers. I have put some of the key elements together in my book, *The Rainbow and The Worm, The Physics of Organisms*, first published in 1993 and in 2nd edition in 1998, which is patterned after Erwin Schrödinger's *What is Life?* It attempts to explain organic wholeness and complexity based on contemporary quantum physics and non-equilibrium thermodynamics. It gives new insights into physiological regulation, bioenergetics and cell biology, many of which were predicted by the pioneers. Also consistent with their vision, the new science of the organism promises to restore all the qualities that have been exorcised from life and nature, to reaffirm and extend our intuitive, poetic, and even romantic notions of nature's unity.

7. From the organic perspective, there is no separation between science and spirituality. This stems from the participatory knowing that it entails, in which the knower places her undivided being within the known, which is ultimately all of nature. And, like all participatory knowledge common to indigenous traditions worldwide, it is an unfragmented whole, at once intensely practical, aesthetic and spiritual. It is a coherent and comprehensive knowledge system whereby one lives and whereby one participates in co-creating reality along with all other beings.
8. There is a two-way connection between science and society. Science is shaped by the politics of society and in turn reinforces it, unless we consciously choose otherwise. The mechanistic paradigm projects a Hobbesian-Darwinian view of nature as isolated atoms jostling and competing in the struggle for survival of the fittest. And through the self-fulfilling prophecy, it has created a dysfunctional social milieu and a laissez-faire globalized economy which is destroying our planet and failing to serve the physical and spiritual needs of the vast majority of humanity. That was why fifty thousand took to the streets at the World Trade Organization conference in Seattle in November, 1999.
9. Science shapes society not just through the technologies it creates, but through values and assumptions that motivate human beings, define social norms and inform the policies of nations. That is where I believe the science of the organism may hold the key to a more sustainable and spiritual world.
10. I take science, in the most general terms, to be any active knowledge system shared by a society of human beings that gives both meaning to their way of life and the means whereby to live sustainably with nature. Science, therefore, has an overriding obligation to be socially responsive and responsible. It is inseparable from the entire culture of society and its highest moral values, which define the public good. Sustainability is a moral imperative to achieve and safeguard the manifold conditions of a healthy and fulfilling life for present and future generations.
11. What does it mean to be an organism? To be an organism is to be possessed of the irrepressible tendency towards being whole; towards being part of a larger whole. One of the key concepts in understanding organic wholeness is coherence, the ideal of which is quantum coherence. Quantum coherence aptly describes the perfect coordination of living activities in our body, and there is growing empirical evidence that it may indeed underlie living organization, as described in my book.

12. To get a feeling for the organism, imagine an immense super-orchestra, with instruments spanning the widest spectrum of dimensions from molecular piccolos of 10⁻⁹ meter up to a bassoon or a bass viol of a meter or more, performing over a musical range of seventy-two octaves. Incredible as it may seem, this super-orchestra never ceases to play out our individual lifelines, with a certain recurring rhythm and beat, but in endless variations that never repeat exactly. Always, there is something new, something made up as it goes along. It can change key, change tempo, change tune perfectly, as it feels like, or as the situation demands, spontaneously and without hesitation. What this super-orchestra plays is the most exquisite jazz, jazz being to classical music what quantum is to classical physics. One might call it quantum jazz. There is a certain structure, but the real art is in the endless improvisations, where each and every player, however small, enjoys maximum freedom of expression, while maintaining perfectly in step and in tune with the whole. There is no leader or conductor, and the music is written as it is played.
13. What I have given is an accurate description of the totality of molecular, cellular and physiological reality of the ideal, healthy organism, which serves to illustrate the radical, paradoxical nature of the organic whole. It is thick with activity over all scales, and both local freedom and global cohesion are maximized, which is generally thought to be impossible within the mechanistic paradigm. In the coherent organism, global and local, part and whole, are mutually implicated and mutually entangled from moment to moment. Each is as much in control as it is sensitive and responsive.
14. When we extend this notion of mutual entanglement of part and whole, as Whitehead did, to societies, ecosystems and ultimately to all of nature, we begin to recover the profoundly holistic ecological traditions of indigenous cultures worldwide. The coherence of organisms is quintessentially pluralistic and diverse, and at every level. It is so, from the tens of thousands of proteins and other macromolecules that make up a cell to the many kinds of cells that constitute tissues and organs; from the variations that characterize natural populations to the profusion of species that make a thriving ecological community. And most of all, the kaleidoscopic, multicultural earth that makes life enchanting and exciting for us all.
15. Part and whole, individual and global are mutually entangled and mutually sustaining. That is the basis of the universal moral imperative that we do unto others what we would have others do unto us. It marks the beginning of a genuinely new world order that celebrates and nurtures individual diversity and freedom with universal love.

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