

If the spate of new books and articles being spawned by the budding "sciences of complexity" is any indication, a whole new world paradigm is a-borning. The National Park System, and the Service which exercises collective stewardship over it, eventually will be caught up in any new paradigm that emerges, hence the following "review of reviews." The take-off point for each of the books is "complexity," and together they span much of the human condition—from ecology (with strong overtones of philosophy and religion) to "management" (our attempts to cope with the powers our tools have given us).

A new paradigm is one that affects our whole internal picture of reality. It involves general principles whose understanding and acceptance affect the ways we see and deal with our world and ourselves. At the same time, this particular paradigm—the sciences of complexity—has given rise to writings that question the heretofore largely unquestioned applicability of general principles in all instances—across the board.

Three books, all of which can be read as sequels to the book reviewed in the Summer 1993 issue of *Park Science*, (*Complexity: Life at the Edge of Chaos* by Roger Lewin), are:

**Beginning Again: People and Nature in the New Millennium**, by David Ehrenfeld, Oxford University Press, NY, 1993. 194 pp. \$22.00 (ISBN 0-19-507812-8 cloth);

**Leadership and the New Science**, by Margaret J. Wheatley, Berrett-Koehler Publishers, Inc., San Francisco 1993. \$22.95 (ISBN 1-881052-01-X);

**Origins of Order: Self Organization and Selection in Evolution**, by Stuart A. Kauffman, In Press, Oxford University.

All three are available in forms more accessible to the general public in the following manner:

*Beginning Again* as a review by Bryan G. Norton, School of Public Policy, Georgia Institute of Technology, Atlanta 30332, appearing in the January 1994 issue of *BioScience* (pp. 37-9);

*Leadership and the New Science* as a review by Susan Mokolke in *Timeline*, (pp. 4-7), published bi-monthly by the Foundation for Global Community, 222 High St. Palo Alto, CA 94301-1097; and

*Origins of Order* as an article by the author himself, appearing first in *IS Journal* #12, the bi-yearly publication of International Synergy Institute, a global network of vanguard artists, scientists and activists, and appearing next in *Annals of Earth*, Vol. XI No. 3, 1993, pp 19-26.

To begin with the toughest, but still accessible to the layperson, Kauffman's article describes the evidence for the complexity scientists' claim that complex adaptive systems "achieve in a law-like way, the edge of chaos." This "edge of chaos" is described by Kauffman as "the phase transition zone" between two broad regimes that are "chaotic and ordered." It is in the narrow third complex regime—poised at the boundary of chaos—that Kauffman detects "order for free."

Kauffman leads the reader painstakingly through the complex pathway of how spontaneously ordered features of computer simulations parallel a host of ordered features seen in the ontogeny of mouse, human, bracken, fern, fly, bird. A "cell type," he explains, becomes a stable recurrent pattern of gene expression, or to use mathematical jargon, an "attractor"—like a whirlpool—a system toward which all the possible patterns of gene activities tend to flow and remain. Eventually he arrives at the following paragraph:

"Bacteria, yeast, ferns, and humans, members of different phyla, have no common ancestor for the past 600 million years or more. Has selection struggled for 600 million years to achieve a square root relation between genomic complexity and number of cell types? Or is this order for free so deeply bound into the roots of biological organization that selection cannot avoid this order? But if the latter, then selection is not the sole source of order in biology. Then Darwinism must be extended to embrace self-organization and selection."

Kauffman's articles (about his book) extrapolate complexity theory to such societal phenomena as economics. He posits the notion that complexity theory accounts for "why economics has had a difficult time building a theory of the evolution of technological webs."

Here, Kauffman may be illustrating what Ehrenfeld, in *Beginning Again*, warns against—the wholesale extrapolations of cherished "general principles." According to Norton, Ehrenfeld suggests that while physics emphasizes general laws that facilitate predictions and centralized control, biology is inherently a science of the particular. In Ehrenfeld's Part 1, "Taking Bearings," he explores aspects of the idea of place, the local and particular wisdom about, and commitment to, a home in the natural world. The word "chaos" again appears, often. "It is possible to steer through the chaos of modern life in a deteriorating environment, Ehrenfeld believes, if we follow the secret of all navigation: 'the secret... is in paying attention to the fixed landmarks, both celestial and earthly' (p. viii from the book).

The celestial landmarks are described by Norton as "the gems of religious wisdom, introduced on nearly every page." The earthly landmarks (which are of intense interest to National Park System managers) represent the particular knowledge of particular places—the understanding, gained by ecologists and other sharp observers, of the particularities of life in diverse systems and landscapes. Ehrenfeld calls them "the innumerable examples of how to live and endure in the kaleidoscopic environment of our earthly and only home."

Thus, Ehrenfeld enjoins both ecology and religion as partners in the search for a new beginning.

Norton terms Ehrenfeld's book an embodiment of "religion in the best sense—an attitude of respect for cultural wisdom that emerges over many generations—without dogma—simply a search for wisdom as opposed to information, expertise, and technique."

With direct application to the National Park Service, Ehrenfeld states: "Places can be destroyed, that is, they can have their nature and meaning irrevocably changed and their connection with the past severed." And then he states (on p. 33) what Norton calls "the central insight of this insightful book":

"Conservation has to start at home, where we know, or ought to know, the problems, and where we are most likely to understand the opportunities and limitations of our solutions."

But managers do not escape with only guideposts. Ehrenfeld devotes much of his book (again according to Norton) to "the explosion of the managerial class, which he indicts as 'the most destructive force of modern society.'" Norton quotes Ehrenfeld thusly:

"Overmanagement is a by-product of an exploitative age in which the massive extraction and processing of natural resources have been accompanied by the release of huge amounts of surplus wealth." He uses universities as an example of management run amok. He decries these large new "sources of unregulated cash" where a positive feedback loop emerges: the need to control funds, leading to more administrative tasks, even as more administrators choke the system and reduce the productivity of educators who are more and more frozen out of control of their own fates.

For another view of management, Wheatley's *Leadership and the New Science* offers hope that managers of the future will do their jobs within the new paradigm—one

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that abandons the world of predicatability that Newton and Descartes envisioned in favor of a world of potentials and probabilities.

Wheatley is a Harvard-educated organizational consultant who, while trying to address the growing problem of organizational dysfunction, became obsessed with the new sciences of complexity and chaos. Haunted by such questions as "Why does change, which we are supposed to be managing, keep drowning us?" she plunged into a journey of discovery and arrived at her premise:

"I believe that we have only just begun the process of discovering and inventing the new organizational forms that will inhabit the 21st century. To be responsible inventors and discoverers, though, we need the courage to let go of the old world, to relinquish most of what we have cherished, to abandon our interpretations about what does and doesn't work. As Einstein is often quoted as saying, 'No problem can be solved from the same consciousness that created it.' We must learn to see the world anew."

It would seem that Wheatley has gone directly from a layperson's description of new sciences to the management implications they present for dealing with self-organizing systems. Change, stability, and renewal are hallmarks of a self-organizing system, and Wheatley defines the key to such systems (self-reference) this way:

"In response to environmental disturbances that signal the need for change, the system changes in such a way that it remains consistent with itself in that environment." She sees this as an optimistic lesson for despairing humans. Freedom and order are partners in the new paradigm...the more freedom in self-organization, the more order.

And further good news is the new insight that "under certain conditions, when the system is far from equilibrium [at the edge of chaos], creative individuals can have an enormous impact." As she notes, "It is not the law of large numbers, of favorable averages, that creates change, but the presence of a lone fluctuation [the butterfly wing effect] that gets amplified by the system." (*See Editorial, page 2 of this issue, for additional thoughts—Ed.*)

Information, Wheatley concludes, is the creative energy of the universe. Certainly this emerging paradigm suggests it. It was back in the '20s and '30s that astronomer Sir James Jeans observed: "The universe begins to look more like a great thought than a great machine."

Mokelke calls *Leadership and the New Science* an inspiring book, with much to offer any individual or organization walking the edge of chaos on the road to a higher order of being," and offers this quote from Wheatley as a concluding example:

"To live in a quantum world, to weave here and there with ease and grace, we will need to change what we do. We will need to stop describing tasks and instead facilitate process. We will need to become savvy about how to nurture growing, evolving things. All of us will need better skills in listening, communicating, and facilitating groups, because these are the talents that build strong relationships. It is well known that the era of the rugged individual has been replaced by the era of the team player. But this is only the beginning. The quantum world has demolished the concept of the unconnected individual. More and more relationships are in store for us, out there in the vast web of universal connections."

Jean Matthews  
Editor, Park Science