

Chaos and Endophysics

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Chaos theory takes the behavior of natural systems and reduces it to a spaghetti tangle in phase space. The taffy puller which is placed excentrically on a rotating platform serves as a paradigm in real space. The exact theory of nature introduced by Newton and Laplace is thereby revived as a conceptual tool. At the same time, the impossibility of a Laplacian demon who is part of the world becomes tangible. Thus, even a classical future is unpredictable from the inside if the tangle is chaotic. Only if you have the chaos in your computer does the irreducible unpredictability and irreproducibility disappear. Chaos therefore brings a Janus-facedness into physical theory. An "exo" and an "endo" face can be distinguished in general. Anaximander, Archimedes, Aristarchos, Boscovich and Maxwell have all previously noted the necessity of such a "double approach". The latter can be fully appreciated only today in the age of computergenerated worlds. Still, "explicit" model worlds — in which the governing laws are reversible as in our own world — have yet to be simulated. Continuous and discrete Molecular Dynamics (the "MY and the "MDMD" algorithms of Alder) and Fredkin's reversible cellular automata ("RCA") can be used. Unexpectedly, the theory involves two unfamiliar symmetries — Gibbs' and Wigner's — if observers (e.g., a fluid neuron) are to be part of the world. The dynamics which generates the internal interface is both chaotic and symmetry-constrained. Even in oversimplified, very low dimensional cases, the problem of how to extract the interface is currently unsolved. Thus, the hardest job of a "demiurge" who operates a reversible world is not to run it, but to observe it with the eyes of the inhabitants.

For J.O.R.