

## **THE FOURTH LAW AND THE PHYSICAL BASIS FOR EVOLUTION**

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### **ABSTRACT**

Over its 4.6GY history the evolution of Earth, from the earliest prokaryotes to the explosive globalization of human cultural systems going on today has been characterized by the progressive (going in a direction) and opportunistic accelerating production of increasingly more highly ordered dynamic states. Given Boltzmann's probabilistic interpretation of the 2nd law of thermodynamics as a "law of disorder" each and every one of these ubiquitous and characteristic transitions, in Boltzmann's own words, would be "infinitely improbable". This view has cast physics as the "river that runs downhill" to disorder and the evolution of life, the "river that flows uphill", in apparent opposition to each other with the life somehow miraculously violating the laws of physics or, in any case, for some unexplained ("miraculous") reason in a constant battle against them. The cost of this antiquated paradigm, in addition to reenforcing an outdated and diminished physical theory, has had decimating effect on evolutionary theory.

Philosophers of science have noted well the irrational persistence of paradigms even in the face of anomalies (errors of fact that falsify its claims), and we are in such a place now with regard to this old paradigm. Studies in autocatakinetics (self-organization, or spontaneous ordering more precisely defined) in simple physical systems falsify Boltzmann's view showing that spontaneous order arises not "infinitely improbably" as he would have had it but with a probability of one, that is opportunistically, every time certain thresholds are crossed and it gets the chance. The identification, demonstration, and articulation of the 4th law of thermodynamics (the law of maximum entropy production, or LMEP), now roughly three and half decades ago provides the physical selection principle that accounts for this universal ordering, the nature of life, and natural selection. Selection is entailed by spontaneous ordering and natural selection is a special case where the components are replicating. This new paradigm easily replaces the old by all comparative methods of theory selection. The problems with orthodox evolutionary theory, the older physical view, and the new paradigm grounded in the 4th law are sketched and outlined showing the physical basis for why rather than collapsing monotonically to disorder, the world is in the order-production business.

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