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Transaction costs and structure formation: an economic approach to biological systems

We harness insights from economics and information theory and apply them to biological systems. Using information theory as a conceptual bridge between biology and economics, biological and economic systems can be analyzed and compared, thereby paving the way towards new models in bioeconomics. Driven by the interplay of replication, variation and selection, systems in biology and economics evolve towards ever more refined information architecture, thus lowering transaction costs in general and information costs in particular. Hence, transaction costs drive structure formation. To illustrate this principle, we present a wide range of examples from biology and economics, and explain the following concepts: First, the role of entropy in biological and economic systems and three applications: the Kelly criterion, which relates the Shannon information entropy to the limits of biological and economic growth; structure formation as local entropy reduction; and the maximum entropy principle. Second, the role of higher-order information and Schelling points in biological and economic systems: the occurrence of Schelling points, or focal points, can transform information of first and second order into information of higher order as well as common knowledge and hence fundamentally change the information architecture of a system. Third, bounded rationality: due to the limitations of computational capacity, biological and economic systems face fundamental tradeoffs when processing information. Fourth, strategic evolution and the adaptive market hypothesis. And fifth, the importance of non-equilibrium: escaping local maxima in biology and economics. Utilizing these concepts and comparing the information architecture of biological systems and economic systems allows to determine the potential of applying economic theory to biology, as well as the limits of such applications.