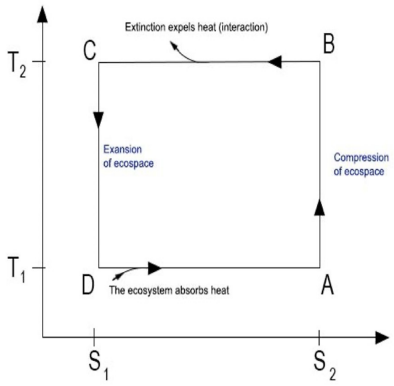
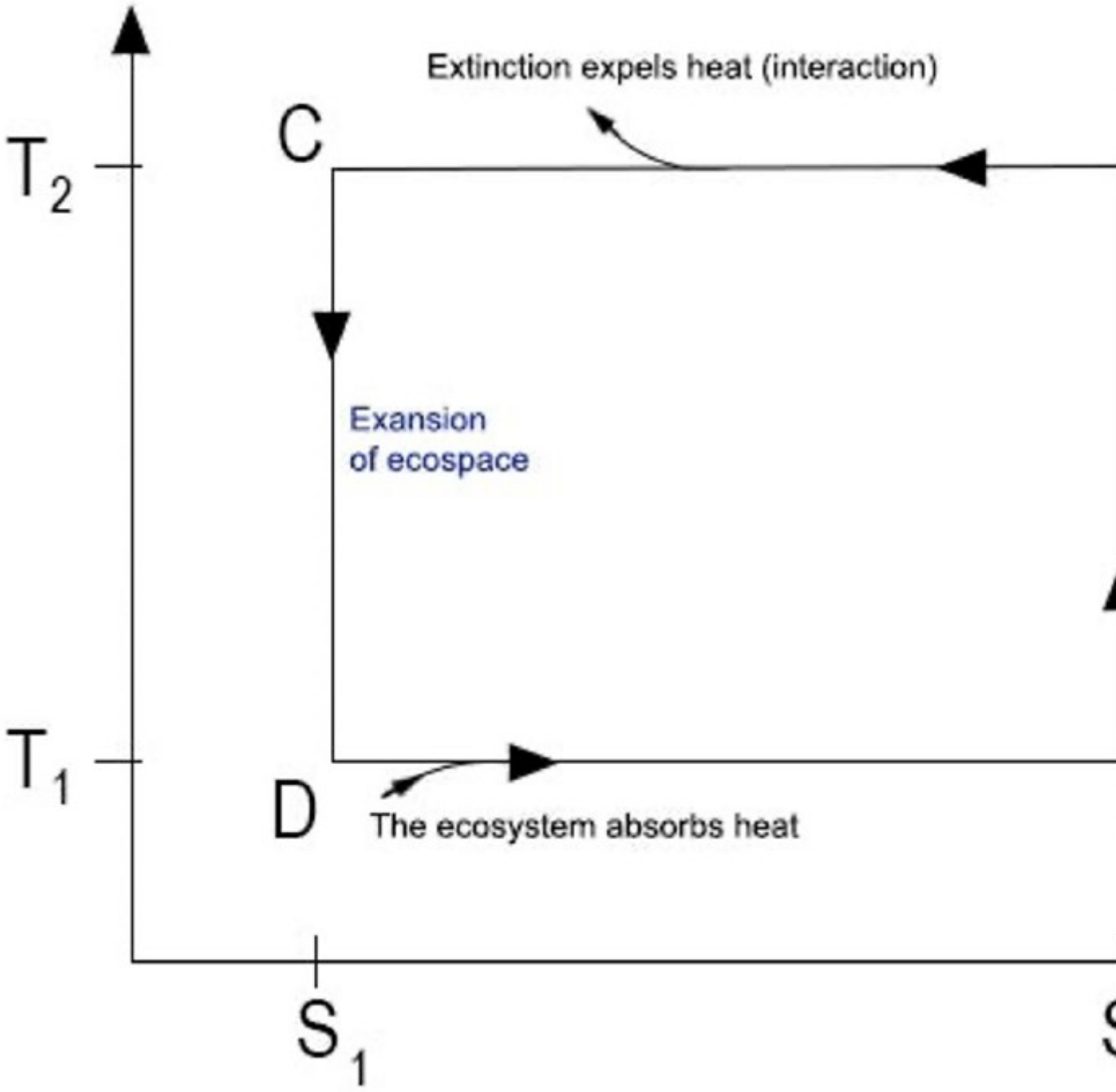


The Thermodynamic Considerations of Biological Evolution; the Role of Entropy

Description

Although Darwinâ??s theory of biological evolution is the cornerstone of modern biology, it lacks proper physical foundations. The author considers ecosystems as closed systems that only exchange energy and information, not matter with the outside. In generalizing, the Darwinian Thermodynamic principles to distinguish order-increasing (low entropy) and disordered (high entropy) evolutionary processes are used. Extinctions divide evolution into well-distinguishable periods, which can be further separated into four phases. The evolutionary cycle starts with a small number of species (microstate). The uprooted environmentâ??s limited degrees of freedom are cooling down onto a â??liquid phase.â• Considering organisms as particles, the liquid phaseâ?? negligible kinetic energy mutes collisions (competition) and inspires generosity and altruism. Resource-richness boosts social coherence, allowing genotype and morpho space adaptation to exploit the possibilities provided by the environment. Increasing population numbers degrade resources, making competition prevalent, whereas mutations find optimal genotypes (Phase Three). In Phase Four, extinction weeds out the failed evolutionary experiments while leaving the genetic and morphological innovations part of the â??survivorâ• genomes. Genetic information preserves the organismâ??s evolutionary history, yet its evolvable organization provides adaptability. Therefore, the genetic code constitutes a stable temporal field that can adapt to changing environmental conditions. The sunâ??s energy influx turns the periodic swings of entropy, population number, and resource density into a forced complexity, increasing harmonic motion. Energy fluxes in ecosystem dynamics generate compression to drive extinction and expansion to spur evolutionary change. The endothermic evolutionary cycle accumulates energy in the genetic, morphologic, and intellectual organization, indicating a physical relationship between intelligence and entropy maximization. Therefore, the second law of intellect is the temporal fieldâ??s tendency to accumulate energy in complexity.



The reversed Carnot cycle representation of the evolutionary cycle The genetic and morphological complexity of the biosphere increases in discrete steps. (A-B) Overpopulation generates competition, increasing social temperature. (B-C) Extinction reduces genetic diversity and population (rejecting genetic material as heat). (C-D) The survivors occupy isolated pockets of the segregated environment. (D-A) The sunâ??s energy input increases the population and genetic variety (D-A).

Earthâ??s ecosystemâ??s evolutionary stability reflects equilibrium when mutations are silent (the genetic acceleration is zero). The above condition correlates to Darwinian concepts, such as random mutations and the fittest selection. On the other hand, low entropy conditions are necessary for significant evolutionary jumps. The thermodynamic framework of evolution explains how the genetic

material (i.e., temporal field) brings forth evolutionâ??s unending upward complexity spiral. Although the details and implications of the model remain to be worked out, computer simulations, such as supercomputer analysis of fossil records and long-term evolution studies, can verify its points.

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