The question of the nature and origins of life has always occupied the minds of both philosophers and scientists. The development of materialism in Western society about 500 years ago prompted specific and directed studies by biologists, and subsequently by physicists, mathematicians, and philosophers, on this, perhaps the most important and intriguing of questions.

In this Special Issue, we concentrate on the attempts by physicists to understand the animate in terms of the known principles of thermodynamics. Many have suggested, and continue to suggest, that the ever-increasing complexity and thermodynamic "order" creation, in apparent violation of the Second Law, may place life outside the bounds of physics as we know it.

It is the purpose of the present Special Issue to oppose this view and to present the many and varied approaches that physics uses to come to terms with this fundamental question. The Special Issue will cover aspects of this problem at the various levels of biological organization: cellular, whole organisms, and evolution itself.

The overriding question of the bio-genesis and evolution of biological structure, i.e., thermodynamic “order”, in the living state will be addressed by such varied approaches as equilibrium thermodynamics, non-equilibrium thermodynamics, the maximum power principle of Lotka and Darwinian natural selection, thermodynamics of multiple gene networks considering network dimensions, entropy production leading to the genesis of information systems, and experiments involving a comparison of energy and entropy differences between a mixture of complex biomolecules and living matter. The specific problem of how thermodynamics relates to primary electron transport in plant photosystems will also be addressed. Furthermore, the generally accepted notion that it is the Gibbs-free energy which drives (bio)chemical reactions and produces (bio)chemical work shall be questioned, and the possible role of environmental heat will be considered.

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Guest Editors

https://www.mdpi.com/journal/entropy/special_issues/Thermodynamics_Life

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