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   Sommario/riassunto
This special issue reviews state-of-the-art approaches to the biophysical roots of cognition. These approaches appeal to the notion that cognitive capacities serve to optimize responses to changing external conditions. Crucially, this optimisation rests on the ability to predict changes in the environment, thus allowing organisms to respond pre-emptively to changes before their onset. The biophysical mechanisms that underwrite these cognitive capacities remain largely unknown; although a number of hypotheses has been advanced in systems neuroscience, biophysics and other disciplines. These hypotheses converge on the intersection of thermodynamic and information-theoretic formulations of self-organization in the brain. The latter perspective emerged when Shannon's theory of message transmission in communication systems was used to characterise message passing between neurons. In its subsequent incarnations, the information theory approach has been integrated into computational neuroscience and the Bayesian brain framework. The thermodynamic formulation rests on a view of the brain as an aggregation of stochastic microprocessors (neurons), with subsequent appeal to the constructs of statistical mechanics and thermodynamics. In particular, the use of ensemble dynamics to elucidate the relationship between micro-scale parameters and those of the macro-scale aggregation (the brain). In general, the thermodynamic approach treats the brain as a dissipative system and seeks to represent the development and functioning of

cognitive mechanisms as collective capacities that emerge in the course of self-organization. Its explicanda include energy efficiency; enabling progressively more complex cognitive operations such as long-term prediction and anticipatory planning. A cardinal example of the Bayesian brain approach is the free energy principle that explains self-organizing dynamics in the brain in terms of its predictive capabilities - and selective sampling of sensory inputs that optimise variational free energy as a proxy for Bayesian model evidence. An example of thermodynamically grounded proposals, in this issue, associates self-organization with phase transitions in neuronal state-spaces; resulting in the formation of bounded neuronal assemblies (neuronal packets). This special issue seeks a discourse between thermodynamic and informational formulations of the self-organising and self-evidencing brain. For example, could minimization of thermodynamic free energy during the formation of neuronal packets underlie minimization of variational free energy?