1. Record Nr. UNINA9910254576603321

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Titolo	Modelling Protocells : The Emergent Synchronization of Reproduction and Molecular Replication / / by Roberto Serra, Marco Villani
Pubbl/distr/stampa	Dordrecht : , : Springer Netherlands : , : Imprint : Springer, , 2017
ISBN	94-024-1160-7
Edizione	[1st ed. 2017.]
Descrizione fisica	1 online resource (XV, 182 p. 46 illus., 33 illus. in color.)
Collana	Understanding Complex Systems, , 1860-0832
Disciplina	660.6
Soggetti	Statistical physics Dynamical systems Biophysics Biological physics Evolutionary biology Biotechnology Complex Systems Biological and Medical Physics, Biophysics Evolutionary Biology Statistical Physics and Dynamical Systems
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Foreword -- Introduction -- About protocells -- Why modelling protocells -- Collective self-replication -- Self-replication in a vesicle -- Self-replication in a reproducing protocell -- Generic properties of dynamical models of protocells -- Introduction. -Generic properties of biological systems: data -- Generic properties of biological systems: concepts -- What shall we model -- Dynamical models of protocells and synchronization -- Simplified surface-reaction models of protocells -- Synchronization in surface reaction models -- Several linearly interacting replicators -- Several interacting replicators with nonlinear interactions -- Internal reaction models -- Models of self-replication -- Introduction -- Autocatalytic sets -- The properties of some replication models -- Products and substrates -- Reflexive autocatalytic food-generated (raf) sets -- A stochastic model of

growing and dividing protocells -- Semipermeable protocells -- The role of active membranes -- The effects of passive membranes -- Coupled dynamics of rafs and protocells -- Maintaining novelties.-A comment on evolvable populations of protocells -- Conclusions, open questions and perspectives -- Introduction -- The hypothesis of spontaneous fission and synchronization -- The formation of self-sustaining autocatalytic cycles -- The role of membranes -- A virtual laboratory.

Sommario/riassunto

The monograph discusses models of synthetic protocells, which are cell-like structures obtained from non-living matter endowed with some rudimentary kind of metabolism and genetics, but much simpler than biological cells. They should grow and proliferate, generating offsprings that resemble in some way the parent protocells with some variation, so that selection may take place. Sustainable protocell populations have not yet been obtained experimentally and mathematical models are therefore extremely important to address key questions concerning their synthesis and behavior. Different protocell “architectures” have been proposed and high-level abstract models like those that are presented in this book are particularly relevant to gain a better understanding of the different properites. These models are able to treat all the major dynamical phenomena in a unified framework, so they can be seen as “virtual laboratories” for protocell research. Particular attention is paid to the problem of synchronization of the fission rate of the whole protocell and the duplication rate of its "protogenetic" material, which is shown to be an emergent property that spontaneously develops in successive generations. The book is of interest for a broad range of scientists working in soft matter physics, chemistry and biology, interested in the role protocells may play on the development of new technologies with medical, environmental and industrial applications as well as scientists interested in the origin of life.