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Biology Living Systems

R.K. Mishra



Biology Living Systems:

Biological Processes in Living Systems C. H. Waddington, 2017-09-08 *Biological Processes in Living Systems* is the fourth and final volume of the *Toward a Theoretical Biology* series. It contains essays that deal in detail with particular biological processes: morphogenesis of pattern, the development of neuronal networks, evolutionary processes, and others. The main thrust of this volume brings relevance to the general underlying nature of living systems. Faced with trying to understand how the complexity of molecular microstates leads to the relative simplicity of phenome structures, Waddington, on behalf of his colleagues, stresses on the structure of language as a paradigm for a theory of general biology. This is language in an imperative mood: a set of symbols organized by some form of generative grammar, making possible the conveyance of commands for action to produce effects on the surroundings of the emitting and the receiving entities. Biology, he writes, is concerned with algorithm and program. Among the contributions in this volume are: The Riemann-Hugoniot Catastrophe and van der Waals Equation, David H. Fowler, *Differential Equations for the Heartbeat and Nerve Impulse*, E. Christopher Zeeman, *Structuralism and Biology*, Rene Thom, *The Concept of Positional Information and Pattern Formation*, Lewis Wolpert, *Pattern Formation in Fibroblast Cultures*, Tom Elsdale, *Form and Information*, C. H. Waddington, *Organizational Principles for Theoretical Neurophysiology*, Michael A. Arbib, *Stochastic Models of Neuroelectric Activity*, Jack D. Cowan. *Biological Processes in Living Systems* is a pioneering volume by recognized leaders in an ever-growing field.

Molecular and Biological Physics of Living Systems, R. K. Mishra, 2012-12-06. The living organisms and systems possess extraordinary properties of programmed development, differentiation, growth, response, movement, duplication of key molecules, and in many cases, higher mental functions. But the organisms are physical objects, so they must follow laws of physics; yet they do not seem to obey them. Physicists cannot easily persuade themselves to accept this as finally true. Non-living objects are governed by these laws of physics, and they can explain these properties. However, in the living systems, too, phenomena encountered like coupled non-linear interactions, many-body effects, cooperativity, coherence, phase transitions, reversible metastable states are being understood better with the aid of powerful theoretical and experimental techniques, and hope is raised that these may let us understand the mysteriousness of life. Contributors to this volume are a small fraction of rapidly growing scientific opinion that these aspects of living bodies are to be expected in a hitherto inadequately suspected state of matter, which is in the main directed by these physical properties pushed almost to limit. This state of matter, the living matter, deserves to be called *The Living State*. Mishra proposes that given hydrogenic orbitals, atoms showing easy hybridisability and multiple valences, molecules with low-lying electronic levels, loose structure, and a metabolic pump in a thermodynamically open system, various fundamental properties of living state can emerge automatically. Structurally, these are all known to be present.

Living Systems, James Grier Miller, 1978. *Quantitative Biology: Dynamics of Living Systems*, Noriko Hiroi, Viji M. Draviam, Tetsuya J. Kobayashi, Akira Funahashi, Chun-Biu Li, Douglas B. Murray, Hiroaki Takagi, Ziya Kalay, Rinshi S. Kasai, Jason Edward

Shoemaker, Akatsuki Kimura, Naoki A. Irie, 2017-07-24 With the emergence of Systems Biology there is a greater realization that the whole behavior of a living system may not be simply described as the sum of its elements To represent a living system using mathematical principles practical quantities with units are required Quantities are not only the bridge between mathematical description and biological observations they often stand as essential elements similar to genome information in genetics This important realization has greatly rejuvenated research in the area of Quantitative Biology Because of the increased need for precise quantification a new era of technological development has opened For example spatio temporal high resolution imaging enables us to track single molecule behavior in vivo Clever artificial control of experimental conditions and molecular structures has expanded the variety of quantities that can be directly measured In addition improved computational power and novel algorithms for analyzing theoretical models have made it possible to investigate complex biological phenomena This research topic is organized on two aspects of technological advances which are the backbone of Quantitative Biology i visualization of biomolecules their dynamics and function and ii generic technologies of model optimization and numeric integration We have also included articles highlighting the need for new quantitative approaches to solve some of the long standing cell biology questions In the first section on visualizing biomolecules four cutting edge techniques are presented Ichimura et al provide a review of quantum dots including their basic characteristics and their applications for example single particle tracking Horisawa discusses a quick and stable labeling technique using click chemistry with distinct advantages compared to fluorescent protein tags The relatively small physical size stability of covalent bond and simple metabolic labeling procedures in living cells provides this type of technology a potential to allow long term imaging with least interference to protein function Obien et al review strategies to control microelectrodes for detecting neuronal activity and discuss techniques for higher resolution and quality of recordings using monolithic integration with on chip circuitry Finally the original research article by Amariei et al describes the oscillatory behavior of metabolites in bacteria They describe a new method to visualize the periodic dynamics of metabolites in large scale cultures populations These four articles contribute to the development of quantitative methods visualizing diverse targets proteins electrical signals and metabolites In the second section of the topic we have included articles on the development of computational tools to fully harness the potential of quantitative measurements through either calculation based on specific model or validation of the model itself Kimura et al introduce optimization procedures to search for parameters in a quantitative model that can reproduce experimental data They present four examples transcriptional regulation bacterial chemotaxis morphogenesis of tissues and organs and cell cycle regulation The original research article by Sumiyoshi et al presents a general methodology to accelerate stochastic simulation efforts They introduce a method to achieve 130 times faster computation of stochastic models by applying GPGPU The strength of such accelerated numerical calculation are sometimes underestimated in biology faster simulation enables multiple runs and in turn improved accuracy of numerical

calculation which may change the final conclusion of modeling study This also highlights the need to carefully assess simulation results and estimations using computational tools

Information and Living Systems George Terzis, Robert Arp, 2011-04-15 The informational nature of biological organization at levels from the genetic and epigenetic to the cognitive and linguistic Information shapes biological organization in fundamental ways and at every organizational level Because organisms use information including DNA codes gene expression and chemical signaling to construct maintain repair and replicate themselves it would seem only natural to use information related ideas in our attempts to understand the general nature of living systems the causality by which they operate the difference between living and inanimate matter and the emergence in some biological species of cognition emotion and language And yet philosophers and scientists have been slow to do so This volume fills that gap Information and Living Systems offers a collection of original chapters in which scientists and philosophers discuss the informational nature of biological organization at levels ranging from the genetic to the cognitive and linguistic The chapters examine not only familiar information related ideas intrinsic to the biological sciences but also broader information theoretic perspectives used to interpret their significance The contributors represent a range of disciplines including anthropology biology chemistry cognitive science information theory philosophy psychology and systems theory thus demonstrating the deeply interdisciplinary nature of the volume's bioinformational theme

Energy and Information Transfer in Biological Systems Larissa S. Brizhik, Francesco Musumeci, Mae-Wan Ho, 2003 This volume contains papers based on the workshop OC Energy and Information Transfer in Biological Systems How Physics Could Enrich Biological Understanding OCO held in Italy in 2002 The meeting was a forum aimed at evaluating the potential and outlooks of a modern physics approach to understanding and describing biological processes especially regarding the transition from the microscopic chemical scenario to the macroscopic functional configurations of living matter In this frame some leading researchers presented and discussed several basic topics such as the photon interaction with biological systems also from the viewpoint of photon information processes and of possible applications the influence of electromagnetic fields on the self organization of biosystems including the nonlinear mechanism for energy transfer and storage and the influence of the structure of water on the properties of biological matter

Chaos in Biological Systems Hans Degn, Arunn V. Holden, Lars Folke Olsen, 2013-06-29 In recent years experimental and numerical studies have shown that chaos is a widespread phenomenon throughout the biological hierarchy ranging from simple enzyme reactions to ecosystems Although a coherent picture of the fundamental mechanisms responsible for chaotic dynamics has started to appear it is not yet clear what the implications of such dynamics are for biological systems in general In some systems it appears that chaotic dynamics are associated with a pathological condition In other systems the pathological condition has regular periodic dynamics whilst the normal non pathological condition has chaotic dynamics Since chaotic behaviour is so ubiquitous in nature and since the phenomenon raises some fundamental questions about its implications for biology it seemed timely to organize an

interdisciplinary meeting at which leading scientists could meet to exchange ideas to evaluate the current state of the field and to stipulate the guidelines along which future research should be directed The present volume contains the contributions to the NATO Advanced Research Workshop on Chaos in Biological Systems held at Dyffryn House St Nicholas Cardiff U K December 8 12 1986 At this meeting 38 researchers with highly different backgrounds met to present their latest results through lectures and posters and to discuss the applications of non linear techniques to problems of common interest In spite of their involvement in the study of chaotic dynamics for several years many of the participants met here for the first time

Nonlinear Electrodynamics in Biological Systems W. Adey, 2012-12-06 The past half century has seen an extraordinary growth in the fields of cellular and molecular biology From simple morphological concepts of cells as the essential units of living matter there has been an ever sharper focus on functional organization of living systems with emphasis on molecular dynamics Thus life forms have come to be defined increasingly in terms of metabolism growth reproduction and responses to environmental perturbations Since these properties occur in varying degrees in systems below the level of cellular organization there has been a blurring of older models that restricted the concepts of life to cellular systems At the same time a search has begun for elemental aspects of molecular and atomic behavior that might better define properties common to all life forms This search has led to an examination of nonlinear behavior in biological macromolecules whether in response to electrical or chemical stimulation for example or as a means of signaling along a molecular chain or as a means of energy transfer Experimental knowledge in this area has grown rapidly in the past decade and in some respects has outstripped theoretical models adequate to explain these new observations Nevertheless it can be claimed that there is now an impressive body of experiments implicating non linear nonequilibrium processes as fundamental steps in sequential operations of biological systems

Energy And Information Transfer In Biological Systems: How Physics Could Enrich Biological Understanding - Proceedings Of The International Workshop Mae-wan Ho, 2003-06-13 This volume contains papers based on the workshop Energy and Information Transfer in Biological Systems How Physics Could Enrich Biological Understanding held in Italy in 2002 The meeting was a forum aimed at evaluating the potential and outlooks of a modern physics approach to understanding and describing biological processes especially regarding the transition from the microscopic chemical scenario to the macroscopic functional configurations of living matter In this frame some leading researchers presented and discussed several basic topics such as the photon interaction with biological systems also from the viewpoint of photon information processes and of possible applications the influence of electromagnetic fields on the self organization of biosystems including the nonlinear mechanism for energy transfer and storage and the influence of the structure of water on the properties of biological matter

Problems of the Resistance of Biological Systems Boris Nikolaevich Tarusov, 1973

A Legacy for Living Systems Jesper Hoffmeyer, 2008-02-01 Gregory Bateson's contribution to 20th century thinking has appealed to scholars from a wide range of fields dealing in one way or another with aspects of

communication and epistemology A number of his insights were taken up and developed further in anthropology psychology evolutionary biology and communication theory But the large trans disciplinary synthesis that in his own mind was his major contribution to science received little attention from the mainstream scientific communities This book represents a major attempt to revise this deficiency Scholars from ecology biochemistry evolutionary biology cognitive science anthropology and philosophy discuss how Bateson s thinking might lead to a fruitful reframing of central problems in modern science Most important perhaps Bateson s bioanthropology is shown to play a key role in developing the set of ideas explored in the new field of biosemiotics The idea that organismic life is indeed basically semiotic or communicative lies at the heart of the biosemiotic approach to the study of life The only book of its kind this volume provides a key resource for the quickly growing substratum of scholars in the biosciences philosophy and medicine who are seeking an elegant new approach to exploring highly complex systems

Modeling Complex Living Systems N. Bellomo,2008 Develops different mathematical methods and tools to model living systems This book presents material that can be used in such real world applications as immunology transportation engineering and economics It is of interest to those involved in modeling complex social systems and living matter in general

Principles of Quantitative Living Systems Science James R. Simms,2005-12-02 In 1978 when the book Living Systems was published it contained the prediction that the sciences that were concerned with the biological and social sciences would in the future be stated as rigorously as the hard sciences that study such nonliving phenomena as temperature distance and the interaction of chemical elements Principles of Quantitative Living Systems Science the first of a planned series of three books begins an attempt to fulfill that prediction The view that living things are similar to other parts of the physical world differing only in their complexity was explicitly stated in the early years of the twentieth century by the biologist Ludwig von Bertalanffy His ideas could not be published until the end of the war in Europe in the 1940s Von Bertalanffy was strongly opposed to vitalism the theory current among biologists at the time that life could only be explained by recourse to a vital principle or God He considered living things to be a part of the natural order systems like atoms and molecules and planetary systems Systems were described as being made up of a number of interrelated and interdependent parts but because of the interrelations the total system became more than the sum of those parts These ideas led to the development of systems movements in both Europe and the United States that included not only biologists but scientists in other fields as well Systems societies were formed on both continents

Biological Systems: Complexity and Artificial Life Jacques Ricard,2014-05-06 The exponential increase in computing power in the late twentieth century has allowed researchers to gather process and analyze large volumes of information and construct rational paradigms of systems Life sciences are no exception and computing advances have led to the birth of fields such as functional genomics and bioinformatics and facilitated an expansion of our understanding of biological systems Biological Systems Complexity and Artificial Life is an essential primer on systems biology for biologists and researchers having a multidisciplinary background

The volume covers a variety of theoretical models explaining biological processes The book starts with an introductory chapter on the classical molecular biology paradigm and progresses towards concepts related to enzyme kinetics non equilibrium dynamics cellular thermodynamics molecular motion in cells and more The book concludes with a philosophical note on the concept of the biological system Analysis Of Biological Systems Corrado Priami, Melissa J Morine, 2015-01-29 Modeling is fast becoming fundamental to understanding the processes that define biological systems High throughput technologies are producing increasing quantities of data that require an ever expanding toolset for their effective analysis and interpretation Analysis of high throughput data in the context of a molecular interaction network is particularly informative as it has the potential to reveal the most relevant network modules with respect to a phenotype or biological process of interest Analysis of Biological Systems collects classical material on analysis modeling and simulation thereby acting as a unique point of reference The joint application of statistical techniques to extract knowledge from big data and map it into mechanistic models is a current challenge of the field and the reader will learn how to build and use models even if they have no computing or math background An in depth analysis of the currently available technologies and a comparison between them is also included Unlike other reference books this in depth analysis is extended even to the field of language based modeling The overall result is an indispensable self contained and systematic approach to a rapidly expanding field of science Electromagnetic Fields in Biological Systems James C. Lin, 2016-04-19 Spanning static fields to terahertz waves this volume explores the range of consequences electromagnetic fields have on the human body Topics discussed include essential interactions and field coupling phenomena electric field interactions in cells focusing on ultrashort pulsed high intensity fields dosimetry or coupling of ELF fields into biological systems and the historical developments and recent trends in numerical dosimetry It also discusses mobile communication devices and the dosimetry of RF radiation into the human body exposure and dosimetry associated with MRI and spectroscopy and available data on the interaction of terahertz radiation with biological tissues cells organelles and molecules **Towards a Mathematical Theory of Complex Biological Systems** Carlo Bianca, Concetta Bianca, N. Bellomo, 2011 This monograph has the ambitious aim of developing a mathematical theory of complex biological systems with special attention to the phenomena of ageing degeneration and repair of biological tissues under individual self repair actions that may have good potential in medical therapy The approach to mathematically modeling biological systems needs to tackle the additional difficulties generated by the peculiarities of living matter These include the lack of invariance principles abilities to express strategies for individual fitness heterogeneous behaviors competition up to proliferative and or destructive actions mutations learning ability evolution and many others Applied mathematicians in the field of living systems especially biological systems will appreciate the special class of integro differential equations offered here for modeling at the molecular cellular and tissue scales A unique perspective is also presented with a number of case studies in biological modeling *Laboratory Biology* ,1979 Noise

and Randomness in Living System Sisir Roy, Sarangam Majumdar, 2022-04-13 This book illustrates the role of randomness and noise in living organisms. Traditionally, the randomness and noise have been used in understanding signal processing in communications. This book is divided into two sections: the first of which introduces readers to the various types and sources of noise and the constructive role of noise in non-linear dynamics. It also analyses the importance of randomness and noise in a variety of science and engineering applications. In turn, the second section discusses in detail the functional role of noise in biological processes, for example, in the case of brain function at the level of ion channel, synaptic level, and even at cognitive level. These are described in various chapters. One of the challenging issues, finding the neuronal correlates of various meditative states, is to understand how the brain controls various types of noise so as to reach a state of synchronized oscillatory state of the brain corresponding to the state of Samadhi. This is described in details in one chapter called Noise Coherence and meditation. The concept of noise and the role of randomness in living organisms raise a lot of controversy for the last few decades. This is discussed in a separate chapter. Finally, the epistemic and ontic nature of randomness as discussed in physical science are investigated in the context of living organisms. *Living Systems* Liat Margolis, Alexander Robinson, 2008-02-01 The use of innovative new materials is an important trend in landscape architecture today. These materials include biodegradable geotextiles, super absorbent polymers, and plants that react to changing soil conditions. This book presents the available materials and technologies in the context of practical applications.

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