

Table of Contents

Preface	ix
----------------------	----

Part I Metabolic Networks and Engineering

<i>Reinhart Heinrich, Thomas Höfer</i> Introduction to Part I	3
<i>Finn Hynne, Sune Danø and Preben G. Sørensen</i> A Functional Dynamics Approach to Modelling of Glycolysis	7
<i>Peter Ruoff</i> Temperature-Compensation in Biological Clocks: Models and Experiments	19
<i>Jeroen A.L. Jeneson, Hans V. Westerhoff and Martin J. Kushmerick</i> Metabolic Control Analysis of the ATPase Network in Contracting Muscle: Regulation of Contractile Function and ATP Free Energy Potential	31
<i>Jochen Förster, Mats Åkesson and Jens Nielsen</i> En Route for Systems Biology: <i>In Silico</i> Pathway Analysis and Metabolite Profiling	47

Part II Intracellular Signal Transduction

<i>Thomas Höfer, Reinhart Heinrich</i> Introduction to Part II	61
<i>Michael Meyer-Hermann, Frido Ertler and Gerhard Soff</i> Presynaptic Calcium Dynamics of Neurons in Answer to Various Stimulation Protocols	63
<i>Birgit Schöberl, Martin Ginkel, Ernst Dieter Gilles, Gertrud Müller</i> Mathematical Modeling of Signaling Cascades: Principles and Future Prospects	73
<i>Paramita Ghosh, Debasish Bose, Subhendu Ghosh</i> Collective Behavior of Membrane Channels: Electro-physiological Studies on Gap Junctions	89
<i>Antonio Politi, Thomas Höfer</i> Modelling of Periodic Intercellular Ca^{2+} Waves	99

<i>Erik Plahte, Leiv Øyehaug</i> Travelling Waves as a Mechanism of Pattern Generation in Discrete Cell Lattices	111
<i>Eberhard O. Voit</i> Design and Operation: Keys to Understanding Biological Systems	119
<hr/>	
Part III Cellular Materials: Mechanics and Motility	
<hr/>	
<i>Erwin Frey, Wolfgang Alt</i> Introduction to Part III	135
<i>Chris H. Wiggins, Loïc Le Goff</i> Biopolymer Dynamics	139
<i>Andrea Parmeggiani, Christoph F. Schmidt</i> Micromechanics of Molecular Motors: Experiments and Theory	151
<i>Wolfgang Pompe, Katharina Flade, Michael Gelinsky, Birgit Knepper-Nicolai and Antje Reinstorf</i> The Role of Osteocalcin in the Remodeling of Biomimetic Hydroxyapatite-Collagen Materials for Bone Replacement	177
<i>Ralf Kemkemer, Hans Gruler, Dieter Kaufmann, Joachim P. Spatz</i> Cell Shape Normalization of Normal and Haploinsufficient NF1-Melanocytes by Micro-Structured Substrate Interaction	185
<i>Peter Dieterich, Jochen Seebach, Hans-J. Schnittler</i> Quantification of Shear Stress-Induced Cell Migration in Endothelial Cultures	199
<hr/>	
Part IV Complex Network Dynamics in Biological Cells	
<hr/>	
<i>Alexander S. Mikhailov</i> Introduction to Part IV	211
<i>Kunihiko Kaneko</i> Constructive and Dynamical Systems Approach to Life	213
<i>Hans-Philipp Lerch, Pedro Stange, Benno Hess</i> Coherent Dynamics in Networks of Single Protein Molecules	225
<i>Thimo Rohlf, Stefan Bornholdt</i> Gene Regulatory Networks: A Discrete Model of Dynamics and Topological Evolution	233

<i>Mads Ipsen</i>	
Evolutionary Reconstruction of Networks	241
<i>Rengaswamy Maithreye, Somdatta Sinha</i>	
Modelling Simple Biochemical Networks	251
<i>Jan T. Kim, Thomas Martinetz, Daniel Polani</i>	
On the Evolution of Information in the Constituents of Regulatory Gene Networks.....	259

Part V Interacting Cell Systems

<i>Dirk Drasdo, Angela Stevens</i>	
Introduction to Part V.....	267
<i>Gabor Forgacs, Ramsey A. Foty</i>	
Biological Relevance of Tissue Liquidity and Viscoelasticity	269
<i>Till Bretschneider</i>	
Reinforcement of Cytoskeleton-Matrix Bonds and Tensiotaxis: A Cell-Based Model	279
<i>Ingo Roeder, Markus Loeffler</i>	
Simulation of Haematopoietic Stem Cell Organisation Using a Single Cell Based Model Approach.....	287
<i>Uwe Börner, Andreas Deutsch, Markus Bär</i>	
Pattern Formation in an Interacting Cell System: Rippling in Myxobacterial Aggregates.....	295

Part VI How Cells Construct an Organism: Experiments and Modeling

<i>Markus Kirkilionis</i>	
Introduction to Part VI.....	305
<i>Ulrich Technau, Bert Hobmayer, Fabian Rentzsch, Thomas W. Holstein</i>	
Molecular and Cellular Analysis of De Novo Pattern Formation in <i>Hydra</i>	309
<i>Hans Meinhardt</i>	
The Small Freshwater Polyp <i>Hydra</i> as a Model for Axis Formation in Higher Organisms.....	323

<i>Lennart Olsson</i> Cell Migration, Cell Fate and Pattern Formation During Head Development in Lungfishes and Amphibians.....	335
---	-----

<i>Markus Kirkilionis</i> Cell-Based Modelling of Tissues.....	347
---	-----

Part VII Tumors, Diseases and the Immune System

<i>Michal Or-Guil, Angela Stevens, Dirk Drasdo</i> Introduction to Part VII.....	363
---	-----

<i>Dirk Drasdo, Sabine Dormann, Stefan Hoehme, Andreas Deutsch</i> Cell-Based Models of Avascular Tumor Growth.....	367
--	-----

<i>Alexander R.A. Anderson</i> Solid Tumor Invasion: The Importance of Cell Adhesion.....	379
--	-----

<i>Peter Walden</i> Interrelationship of Tumor and Immune System.....	391
--	-----

<i>Ulrich Behn, Markus Brede, Jan Richter</i> Nonlinear Dynamics and Statistical Physics of Models for the Immune System.....	399
---	-----

<i>Susanne Schreiber, Kai Ludwig, Hermann-Georg Holzhütter, Andreas Herrmann</i> Stochastic Model of Influenza Virus Fusion.....	411
---	-----

<i>Markus A. Dahlem, Thomas Mair, Stefan C. Müller</i> Spatio-Temporal Aspects of a Dynamical Disease: Waves of Spreading Depression.....	421
---	-----

List of contributors.....	435
---------------------------	-----

Index.....	443
------------	-----

Color Plates