

Contents

Preface

Acknowledgments

Special Sections

Map of the Maps

vii

xiii

xxix

xxx

PART 1 THE FACTS OF LIFE

Chapter 1:	Why: Biology by the Numbers	3
Chapter 2:	What and Where: Construction Plans for Cells and Organisms	35
Chapter 3:	When: Stopwatches at Many Scales	87
Chapter 4:	Who: "Bless the Little Beasties"	137

PART 2 LIFE AT REST

Chapter 5:	Mechanical and Chemical Equilibrium in the Living Cell	187
Chapter 6:	Entropy Rules!	237
Chapter 7:	Two-State Systems: From Ion Channels to Cooperative Binding	281
Chapter 8:	Random Walks and the Structure of Macromolecules	311
Chapter 9:	Electrostatics for Salty Solutions	355
Chapter 10:	Beam Theory: Architecture for Cells and Skeletons	383
Chapter 11:	Biological Membranes: Life in Two Dimensions	427

PART 3 LIFE IN MOTION

Chapter 12:	The Mathematics of Water	483
Chapter 13:	A Statistical View of Biological Dynamics	509
Chapter 14:	Life in Crowded and Disordered Environments	543
Chapter 15:	Rate Equations and Dynamics in the Cell	573
Chapter 16:	Dynamics of Molecular Motors	623
Chapter 17:	Biological Electricity and the Hodgkin-Huxley Model	681
Chapter 18:	Light and Life	717

Olaf Andersen (Cornell University),
(California Institute of Technology),
Joanny (Institut Curie), Stephen
(California Institute of Technology),
(Rockefeller University), Chris Mill
(University), Paul Miller (Brandeis
University), Nelson (University of Pennsylvania)

Chapter 19:	Organization of Biological Networks	801
Chapter 20:	Biological Patterns: Order in Space and Time	893
Chapter 21:	Sequences, Specificity, and Evolution	951
Chapter 22:	Whither Physical Biology?	1023
Index		1039

Chapter 18

Maja Bialecka-Fornal (California Institute of Technology), Bill Bialek (Princeton University), David
Chandler (University of California, Berkeley), Anna
Damjanovic (Johns Hopkins University), Gavrilas
(University of Illinois, Urbana-Champaign), Gray
(California Institute of Technology), Heun
Jin Lee (California Institute of Technology), Rudy
Marcus (California Institute of Technology), Tom
Miller (California Institute of Technology), Ron Milo
(Weizmann Institute of Science), Jose Onuchic (Rice
University), Nipam Patel (University of California,
Berkeley), Mark Rainer (Northwestern University),
Matthias Rydenfelt (California Institute of Technol
ogy), Dave Savage (University of California, Berke
ley), Klaus Schulten (University of Illinois, Urbana-
Champaign), Kurt Warncke (Emory University), Jay
Winkler (California Institute of Technology)

Chapter 19

James Boedicker (California Institute of Technol
ogy), Robert Brewster (California Institute of Tech
nology), Titus Brown (Michigan State University),
Nick Buchler (Duke University), Eric Davidson (Cal
ifornia Institute of Technology), Avigdor Eldor (Tel
Aviv University), Michael Elowitz (California Insti
tute of Technology), Robert Endrey (Imperial Col
lege London), Daniel Fisher (Stanford University),
Scott Fraser (California Institute of Technology),
Gerard (University of California, San Diego),
Ling (Baylor College of Medicine)