

Contents

<i>Preface</i>	<i>xi</i>
<i>Acknowledgments</i>	<i>xiii</i>
<i>List of Contributors</i>	<i>xv</i>
<i>Introduction: The “Single Molecule” Paradigm</i>	<i>xvii</i>
<i>Alex E. Knight</i>	
The “Single Molecule” Paradigm.....	xvii
Life as a Molecule.....	xxiii
Single Molecule Techniques.....	xxv
Overview of Single Molecule Biology.....	xxix
Conclusions.....	xxxii
Acknowledgments.....	xxxii
References.....	xxxiii
<i>Chapter 1 Single Molecule Studies of Myosins</i>	<i>1</i>
<i>Rachel E. Farrow, Jeremy C. Fielden, Alex E. Knight, and Justin E. Molloy</i>	
Introduction.....	2
Motility Assays.....	5
Molecular Mechanics.....	8
Technologies.....	10
The Myosin Working Stroke.....	14
Force and Stiffness.....	18
Kinetics.....	18
Conclusions.....	28
Acknowledgments.....	28
References.....	29
<i>Chapter 2 Single Molecule Experiments and the Kinesin Motor</i>	
<i>Protein Superfamily: Walking Hand in Hand</i>	<i>35</i>
<i>Lukas C. Kapitein and Erwin J.G. Peterman</i>	
Introduction.....	36
Overall Mechanical Parameters of Kinesins.....	37

Advanced Mechanochemistry of Kinesin-1.....	43
Lattice Diffusion as an Additional Motility Mode.....	46
Regulation of Kinesin Motors.....	50
Final Thoughts.....	54
Acknowledgments.....	54
References.....	55
 Chapter 3 Force-Generating Mechanisms of Dynein Revealed through Single molecule Studies.....61	
<i>Kazuhiro Oiwa and Hiroaki Kojima</i>	
Introduction.....	62
Molecular Organization of Dynein.....	65
Mechanism of Force Generation by Dyneins.....	75
Mechanical Properties of Dyneins Studied by Single molecule Methods.....	77
Dyneins in Axonemes.....	84
Perspectives: From Single Molecules to Ensembles.....	91
Acknowledgments.....	93
References.....	93
 Chapter 4 The Bacterial Flagellar Motor.....105	
<i>Yoshiyuki Sowa and Richard M. Berry</i>	
Introduction.....	105
Structure.....	108
Function.....	114
Outlook.....	130
References.....	131
 Chapter 5 Single Molecule Studies of Chromatin Structure and Dynamics.....143	
<i>Sanford H. Leuba and Laurence R. Brewer</i>	
Introduction.....	144
Sperm Chromatin.....	144
Spermiogenesis.....	146
Previous Studies of Toroid Structure.....	146
Single molecule Experiments.....	146
The Protamines P1 and P2.....	148
The Transition Proteins TP1 and TP2.....	150

Shaping of the Sperm Head and the Role of the Manchette	150
Posttranscriptional Modifications of Sperm Nuclear Proteins	151
Conclusions: Sperm Chromatin	152
Somatic Chromatin	152
Conclusion	162
Acknowledgments	163
References	163
 Chapter 6 Single Molecule Studies of Nucleic	
Acid Enzymes	173
<i>Samir M. Hamdan and Antoine M. van Oijen</i>	
Introduction	173
Methods	174
Single molecule Studies of Nucleic Acid Enzymes	176
Conclusion	188
References	188
 Chapter 7 Single Molecule Studies of Prokaryotic Translation	195
<i>Colin Echeverría Aitken, R. Andrew Marshall, Magdalena Dorywalska,</i>	
<i>and Joseph D. Puglisi</i>	
Introduction	196
Directly Observing Translation	197
Translation at Atomic Resolution	200
Single molecule Translation	201
Conclusions	213
References	214
 Chapter 8 Single Ion Channels	223
<i>David Colquhoun, Remigijus Lape, and Lucia Sivilotti</i>	
Comparison of Fluorescence Methods with	
Single-Channel Recording	224
How to Get Information about Mechanisms from Single molecule	
Measurements	232
Some Recent Results from Single-Channel Recording	240
Conclusions	245
References	246

Chapter 9 Single Molecule Fluorescence in Membrane Biology	253
<i>Lydia M. Harriss and Mark I. Wallace</i>	
The Structure and Function of Cellular Membranes	253
Why Apply Single molecule Fluorescence to Membranes?	254
Fluorescent Labels and Artificial Cell Membranes	255
Single molecule Fluorescence Techniques	256
The Role of SMF in Studying Membranes and Membrane Proteins	260
Probing the Structure and Behavior of Cell Membranes	260
Membrane-Cytoskeleton Interactions	262
Lipid Rafts	264
Understanding the Dynamics and Interactions of Membrane Proteins	266
Signalling	266
Membrane Transport	270
Vesicle Tracking, Docking, and Fusion	273
Conclusions	275
References	276
Chapter 10 Single Molecule Microarray Analysis	289
<i>Jan Hesse, Thomas Haselgrübler, Christian Wechselberger, and Gerhard J. Schütz</i>	
Introduction	290
Speed and Sensitivity: Mutually Exclusive Demands?	291
Microarrays: Attempting a Definition	294
Microarray Surfaces: There is Plenty to Groom at the Bottom	295
Applications: Learning from Singles	299
DNA Methylation Analysis	304
DNA Fragment Sizing	304
DNA (Combing and) Mapping	305
Single Molecule Sequencing	306
Conclusions	307
Acknowledgments	307
References	308
Appendix	317
Index	325