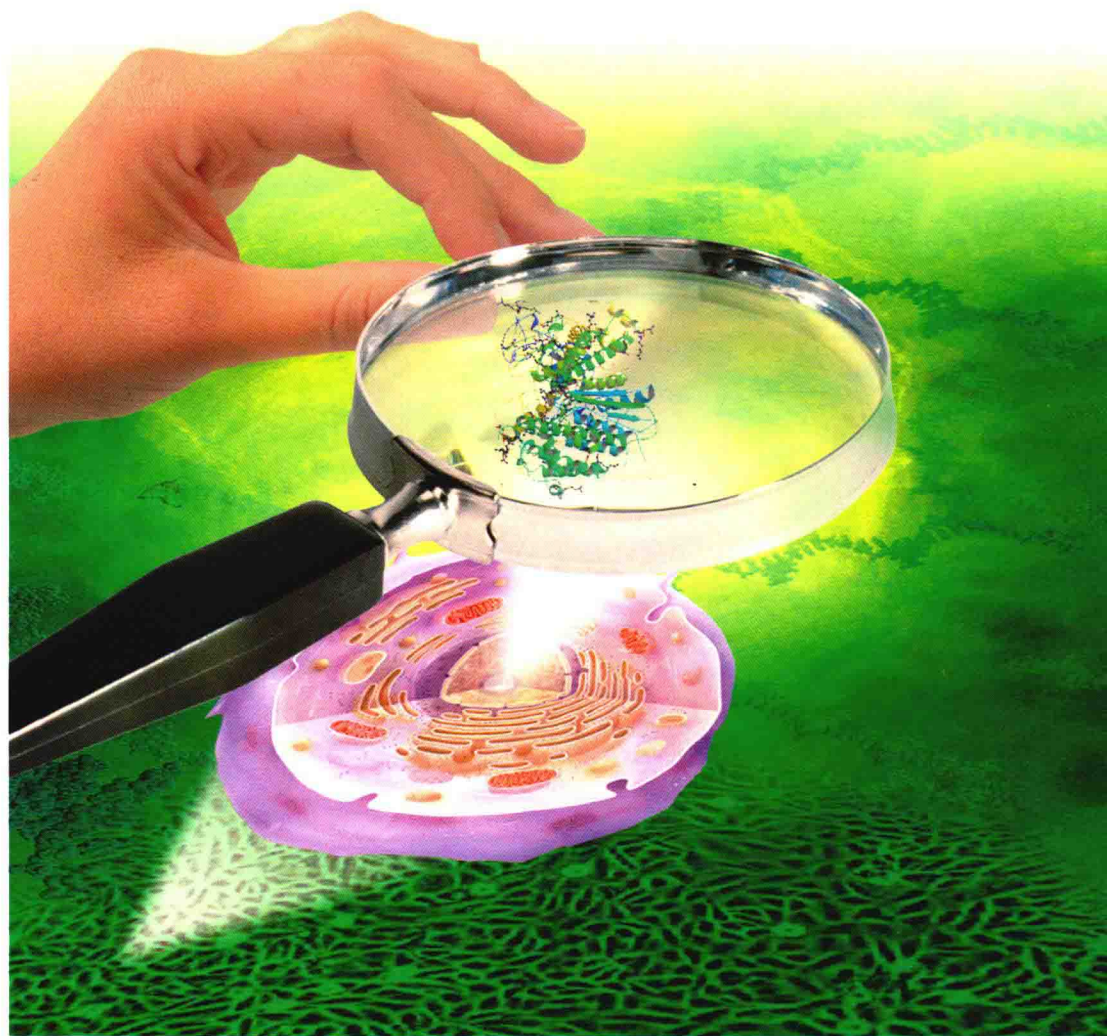


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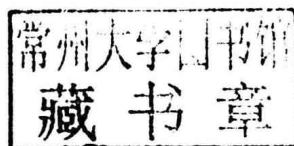
# Single Molecule Dynamics in Life Science



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*Edited by*

*Toshio Yanagida and Yoshiharu Ishii*



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## The Editors

### **Prof. Dr. Toshio Yanagida**

Osaka University  
Laboratory for Nanobiology  
1-3 Yamada-oka, Suita  
Osaka 562-0871  
Japan

### **Dr. Yoshiharu Ishii**

CREST  
Soft nano-machine Project JST  
1-3 Yamada-oka, Suita  
Osaka 562-0871  
Japan

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## Preface

Biomolecules are responsible for various dynamic biological functions ranging from the intracellular to the whole body and brain. Recently developed molecular and cellular biology techniques have allowed biomolecules involved and their roles to be identified. Snapshots of atomic structures and molecular organization of these identified biomolecules, which have been determined using structural biology techniques, have been foundation for understanding the mechanism of their functions. The dynamic behavior of biomolecules, which is essential for the functions, is often inferred from static and average data.

Alternatively, single molecule measurements have been developed to directly measure the dynamic behavior of single biomolecules, which is hidden in average signals that originate from a large number of molecules, which is the case for previous ensemble measurements. Single molecules can be traced while they are working in biological environments. Furthermore, high resolution, reaching the scale of nm, msec and pN, has enabled the unitary events within a molecular function to be measured. For example, the step movement of molecular motors was observed while the motors hydrolyzed single ATP molecules. Single molecule imaging has been used to monitor the dynamic changes in location, structure and interactions of biomolecules in several complicated systems such as molecular machines, organelles and cells leading to significant progress in clarifying the fundamental principles driving cellular functions. With continued progress, we believe that single molecule measurements offer the promise of disclosing the fundamental principles behind biological dynamics.

It has been more than a decade since both single fluorophores attached to biomolecules were detected in aqueous solution and single biomolecules were manipulated. Since then, single molecule measurements have become common tools in a large number of laboratories. However, there is still much that needs to be accomplished. The technology is still immature as new techniques, such as new probes, are needed. Forging single molecule measurements with other fields like nanotechnology will be instrumental to further develop single molecule detection and potentially enable single molecule detection to be applied throughout the whole body. We hope that this book serves as a steppingstone for the next generation of

single molecules measurements, as readers will find information that will guide them to developing future techniques, subjects, strategies and goals.

Finally, we would like to thank all the authors for their valuable contributions to this book. Each is a pioneer for single molecule measurements in their respective biological field. We would also like to thank the staff of Wiley-VCH, in particular Dr. Rainer Muenz, for their help and encouragement.

August 2008

Toshio Yanagida  
Yoshiharu Ishii

## List of Contributors

### ***Toshio Ando***

Kanazawa University  
Department of Physics  
Kanazawa 920-1192  
Japan

and

CREST

JST

Sanban-cho

Chiyoda-ku

Tokyo 102-0075

Japan

### ***Donna J. Arndt-Jovin***

Max Planck Institute for Biophysical  
Chemistry  
Laboratory of Cellular Dynamics  
Am Faßberg 11  
37077 Göttingen  
Germany

### ***Jasha Brujic***

New York University  
Department of Physics  
New York, NY 10003  
USA

### ***Wouter Caarls***

Max Planck Institute for  
Biophysical Chemistry  
Laboratory of Cellular Dynamics  
Am Faßberg 11  
37077 Göttingen  
Germany

### ***Christophe Danelon***

Ecole Polytechnique Fédérale de  
Lausanne (EPFL)  
Laboratoire de Chimie Physique des  
Polymères et Membranes  
1015 Lausanne  
Switzerland

### ***Lorna Dougan***

Columbia University  
Department of Biological Science  
New York, NY 100027  
USA

### ***Julio M. Fernandez***

Columbia University  
Department of Biological Science  
New York, NY 100027  
USA



**Yale E. Goldman**

University of Pennsylvania  
 Pennsylvania Muscle Institute  
 School of Medicine  
 Philadelphia, PA 19104-6083  
 USA

**Taekjip Ha**

University of Illinois  
 Urbana-Champaign and Howard  
 Hughes Medical Institute  
 Department of Physics  
 Urbana, IL 61801  
 USA

**Guy M. Hagen**

Department of Cell Biology  
 Charles University Medical School  
 Albertov 4  
 12800 Prague  
 Czech Republic

**Minako Hirano**

Osaka University, 1-3  
 Graduate School of Frontier Biosciences  
 Laboratories for Nanobiology  
 Soft Biosystem Group  
 Yamadaoka  
 Suita  
 Osaka 565-0871  
 Japan

**Toru Ide**

Osaka University, 1-3  
 Graduate School of Frontier Biosciences  
 Laboratories for Nanobiology  
 Soft Biosystem Group  
 Yamadaoka  
 Suita  
 Osaka 565-0871  
 Japan

**Ryota Iino**

Osaka University  
 The Institute of Scientific and Industrial  
 Research  
 Mihogaoka 8-1  
 Ibaraki 567-0047  
 Osaka  
 Japan

**Noriyuki Kodera**

Kanazawa University  
 Department of Physics  
 Kanazawa 920-1192  
 Japan

and

CREST  
 JST  
 Sanban-cho  
 Chiyoda-ku  
 Tokyo 102-0075  
 Japan

**Yoshiharu Ishii**

CREST  
 Soft nano-machine Project JST  
 1-3 Yamada-oka, Suita  
 Osaka 562-0871  
 Japan

**Thomas M. Jovin**

Max Planck Institute for Biophysical  
 Chemistry  
 Laboratory of Cellular Dynamics  
 Am Faßberg 11  
 37077 Göttingen  
 Germany

**Ted A. Laurence**

University of California  
 Department of Chemistry and  
 Biochemistry  
 Los Angeles, CA 90095  
 USA

**Keith A. Lidke**

University of New Mexico  
Department of Physics  
Albuquerque, NM 87131  
USA

**Diane S. Lidke**

University of New Mexico  
Department of Pathology  
Albuquerque, NM 87131  
USA

**Atsushi Miyagi**

Kanazawa University  
Department of Physics  
Kanazawa 920-1192  
Japan

**Hiroyuki Noji**

Osaka University  
The Institute of Scientific and Industrial  
Research  
Mihogaoka 8-1  
Ibaraki 567-0047  
Osaka  
Japan

**Bernd Rieger**

Delft University of Technology  
Department of Imaging Science &  
Technology  
Quantitative Imaging Group  
Lorentzweg 1  
2628 CJ Delft  
The Netherlands

**Yasushi Sako**

Cellular Informatics Laboratory  
RIKEN

**Tatsuo Shibata**

Hiroshima University  
Department of Mathematical and Life  
Sciences  
Higashi-Hiroshima  
Hiroshima 739-8526  
Japan

**Robert H Singer**

Albert Einstein College of Medicine  
Gruss-Lipper Biophotonics Center  
Department of Anatomy and Structural  
Biology  
1300 Morris Park Avenue  
Bronx, NY 10461  
USA

**Yuko Takeuchi**

Osaka University, 1-3  
Graduate School of Frontier Biosciences  
Laboratories for Nanobiology  
Soft Biosystem Group  
Yamadaoka  
Suita  
Osaka 565-0871  
Japan

**Masaaki Taniguchi**

Kanazawa University  
Department of Physics  
Kanazawa 920-1192  
Japan

**Valeria de Turris**

Albert Einstein College of Medicine  
Department of Anatomy and Structural  
Biology  
1300 Morris Park Avenue  
Bronx, NY 10461  
USA

**Takayuki Uchihashi**

Kanazawa University  
Department of Physics  
Kanazawa 920-1192  
Japan

and

CREST

JST

Sanban-cho

Chiyoda-ku

Tokyo 102-0075

Japan

**Masahiro Ueda**

Osaka University  
Graduate School of Frontier Biosciences  
Laboratories for Nanobiology  
Suita  
Osaka 565-0671  
Japan

**Horst Vogel**

Ecole Polytechnique Fédérale de  
Lausanne (EPFL)  
Laboratoire de Chimie Physique des  
Polymères et Membranes  
1015 Lausanne  
Switzerland

**Shimon Weiss**

University of California  
Department of Chemistry and  
Biochemistry  
Los Angeles, CA 90095  
USA

**Daisuke Yamamoto**

Kanazawa University  
Department of Physics  
Kanazawa 920-1192  
Japan

and

CREST

JST

Sanban-cho

Chiyoda-ku

Tokyo 102-0075

Japan

**Hayato Yamashita**

Kanazawa University  
Department of Physics  
Kanazawa 920-1192  
Japan

**Toshio Yanagida**

Osaka University  
Graduate School of Frontier Bioscience  
and Graduate School of Medicine  
1-3 Yamada-oka  
Suita  
Osaka 562-0871  
Japan

## Contents

**Preface** XIII

**List of Contributors** XV

<b>1</b>	<b>A Road Map to Single Molecule Dynamics</b>	<b>1</b>
	<i>Yoshiharu Ishii</i>	
1.1	Visualization of Single Molecules	1
1.2	Single Molecule Position Tracking	1
1.3	Single Molecules in Live Cells	2
1.4	Fluorescence Spectroscopy and Biomolecular Dynamics	3
1.5	Single Molecule Manipulation and Molecular Motors	4
1.6	Mechano-Chemical Coupling of Molecular Motors	5
1.7	DNA-Based Motors	5
1.8	Imaging with AFM and Force Measurements	6
	References	6
<b>2</b>	<b>Single Molecule Study for Elucidating the Mechanism Used by Biosystems to Utilize Thermal Fluctuations</b>	<b>11</b>
	<i>Toshio Yanagida</i>	
2.1	Introduction	11
2.1.1	Differences between Man-Made and Biological Molecular Machines	11
2.1.2	Single Molecule Imaging and Nano-Detection	13
2.2	Simultaneous Measurements of Individual ATP Hydrolysis Cycles and Mechanical Events by a Myosin Motor	14
2.2.1	ATP Hydrolysis Cycles	14
2.2.2	Mechanical Events	16
2.2.3	Simultaneous Measurements	16
2.3	Resolving the Process of a Displacement by Scanning Probe Nanometry	16
2.3.1	Observation and Manipulation of a Single Myosin Motor	18
2.3.2	Displacements	18

2.3.3	Sub-steps within a Displacement	20
2.3.4	Nature of Sub-steps	22
2.3.5	Comparing the Actions of Individual Myosin Motors with those of Muscle	22
2.3.6	Other Types of Molecular Motors	24
2.4	Biased Brownian Step Model	27
2.4.1	Asymmetric Potential	27
2.4.2	Comparison with Other Studies	29
2.4.3	Computer Simulation: from a Single Molecular Motor to Muscle	31
2.5	Conclusion for the Unique Mechanism of Biological Molecular Machines	33
	References	35

### 3 Imaging and Molecular Motors 41

*Yale E. Goldman*

3.1	Introduction	41
3.2	Methods	42
3.2.1	Detection of Single Fluorophores	42
3.2.2	Sub-Diffraction Localization of Fluorescent Molecules	50
3.2.3	Darkfield Imaging with One Nanometer Accuracy (DIONA)	53
3.2.4	Single-molecule High Resolution Imaging with Photobleaching (SHRIMP)	53
3.2.5	Single Molecule Fluorescence Resonance Energy Transfer (smFRET)	53
3.2.6	Orientation of Single Molecules	54
3.2.7	Polarized Total Internal Reflection Fluorescence Microscopy (polTIRF)	55
3.2.8	Defocused Orientational and Positional Imaging (DOPI)	57
3.3	Molecular Motors	58
3.3.1	Myosin V	60
3.3.2	Myosin II	65
3.3.3	Myosin VI	66
3.3.4	Conventional Kinesin	68
3.3.5	Other Kinesins	69
3.3.6	Dyneins	71
3.3.7	Single Molecule Intracellular Imaging	73
3.4	Conclusions	75
	References	76

### 4 Ion Channels 87

*Toru Ide, Minako Hirano, and Yuko Takeuchi*

4.1	Introduction	87
4.2	Artificial Bilayers	88
4.2.1	Solid Supported Bilayers	88
4.2.2	Self-Standing Bilayers	89

4.3	Simultaneous Optical and Electrical Recording of the Single BK-Channels	92
4.4	Detection of Channel Conformational Change	95
4.5	“Optical Patch-Clamping”	95
4.6	Conclusion	96
	References	96
<b>5</b>	<b>Signal Transduction across the Plasma Membrane</b>	<b>99</b>
	<i>Masahiro Ueda, Tatsuo Shibata, and Yasushi Sako</i>	
5.1	Introduction	99
5.2	Signal Transduction Mediated by Receptor Tyrosine Kinase	99
5.3	Association between EGF and EGFR and Formation of the Signaling Dimers of EGFR	100
5.4	Amplification and Propagation of EGFR Activation	104
5.5	Dynamics of the NGF/NGFR Complex	105
5.6	Stochastic Signal Processing and Transduction in Living Cells	108
5.7	Chemotactic Signaling System of Eukaryotic Cells	109
5.8	Stochastic Nature of Chemotactic Signaling Molecules	109
5.9	Stochastic Model of Transmembrane Signaling by Chemoattractant Receptors	111
5.10	Conclusions	115
	References	115
<b>6</b>	<b>Dynamics of Membrane Receptors: Single-molecule Tracking of Quantum Dot Liganded Epidermal Growth Factor</b>	<b>117</b>
	<i>Guy M. Hagen, Keith A. Lidke, Bernd Rieger, Diane S. Lidke, Wouter Caarls, Donna J. Arndt-Jovin, and Thomas M. Jovin</i>	
6.1	Introduction	117
6.2	Single QD Imaging	118
6.3	Retrograde Transport of Activated EGFR Dimers	118
6.4	Single QD–EGF–EGFR Tracking	121
6.5	Programmable Array Microscopy	122
6.6	Concluding Remarks	125
	Appendix 6.A: Materials and Methods	126
6.A.1	Reagents	126
6.A.2	Cell Lines	126
6.A.3	Cell Treatments	126
6.A.4	QD Conjugation to Epidermal Growth Factor	126
6.A.5	Wide-field Microscopy	126
6.A.6	PAM	127
6.A.7	Hyperspectral Imaging	127
	Appendix 6.B: Software and Image Processing	128
6.B.1	Single Particle Tracking	128
6.B.2	Real Time Optically-sectioned Imaging with the PAM	128
	References	129

<b>7</b>	<b>Studying the Dynamics of Ligand–Receptor Complexes by Single-Molecule Techniques</b>	<b>131</b>
	<i>Christophe Danelon and Horst Vogel</i>	
7.1	Introduction	131
7.2	Labeling Methods for Cell Surface Receptors	132
7.2.1	General Considerations	132
7.2.2	Suppressor tRNA Technology	134
7.2.3	O6-Alkylguanine–DNA Alkyltransferase (AGT)	134
7.2.4	Acyl-carrier Protein (ACP)	135
7.2.5	Nitrilotriacetate (NTA)	135
7.2.6	Reversible Sequential Labeling (ReSeq)	136
7.3	Functional Mobility of Receptors in Cell Membranes	136
7.3.1	Organization and Dynamics of Cell Membranes	136
7.3.2	Techniques	137
7.4	Investigating Kinetics and Thermodynamics of Ligand–Receptor Interactions by FCS	138
7.4.1	Principles	138
7.4.2	FCS at High Fluorophore Concentrations	150
7.5	Modulation of Ion Channel Current by Ligand Binding	151
7.5.1	Ligand-activated Ion Channels: Decoupling Ligand Binding and Channel Gating with Single-molecule Patch-clamp	151
7.5.2	The Nicotinic Acetylcholine Receptor as a Prototypical Example	151
7.5.3	Chemical Gating by Specific Ligand Binding inside Ion Channels	153
7.5.4	Facilitated Translocation of Sugars through Bacterial Porins	154
7.5.5	Combined Electrical and Fluorescence Measurements	157
7.6	Forces of Ligand–Receptor Interactions in Living Cells	157
7.6.1	Principles of Single-molecule Dynamic Force Spectroscopy and Applications to Cell Surface Receptors	157
7.6.2	Novel AFM-based Techniques	159
	References	166
<b>8</b>	<b>RNA in cells</b>	<b>171</b>
	<i>Valeria de Turris and Robert H. Singer</i>	
8.1	Why Study RNA?	171
8.2	RNA Visualization inside Cells	172
8.2.1	Techniques to Label RNA	172
8.2.2	Advancements in Imaging Technologies	175
8.3	RNA Dynamics in the Nucleus	175
8.3.1	Dynamics in Transcription	176
8.3.2	A Journey from the Transcription Site to the Nuclear Envelope	177
8.3.3	Transport through the Nuclear Pore Complex	179
8.4	RNA Dynamics in the Cytoplasm	181
8.4.1	Non-localizing RNA	181
8.4.2	RNA Localization	182

8.4.2.1	Some Examples of Localization in Mammalian Cells and <i>Drosophila</i>	183
8.5	Conclusion	185
	References	185
<b>9</b>	<b>Protein Dynamics and Interactions</b>	<b>191</b>
	<i>Ted A. Laurence and Shimon Weiss</i>	
9.1	Introduction	191
9.1.1	The Single-molecule Approach to Protein Dynamics and Interactions	191
9.1.1.1	Distributions of Subpoupulations	192
9.1.1.2	Dynamics of Unsynchronized Trajectories	192
9.1.1.3	Order of Events/States	192
9.1.2	Example Biological Systems	193
9.2	Fluorescence Spectroscopy as a Tool for Dynamic Measurements of Molecular Conformation and Interactions	194
9.2.1	Jablonski Diagram (Intensity, Spectrum, Lifetime, Polarization)	194
9.2.2	Point Emission-Localization Measurements	196
9.2.3	Fluorescence Polarization-Measures Rotational Movement and Freedom of Movement	197
9.2.4	Fluorescence Resonance Energy Transfer-nm-scale Ruler	197
9.2.5	Single-molecule Electron Transfer-Ångström-scale Ruler	199
9.3	Single-molecule Data Acquisition and Analysis Methods	200
9.3.1	Choosing a Labeling Configuration: What is the Observable?	200
9.3.2	Should a Freely-diffusing or Immobilized Format be used?	202
9.3.3	What Excitation/Optical Isolation Format should be used?	203
9.3.3.1	Optical Isolation of a Single Point	205
9.3.3.2	Multiple Points	207
9.3.3.3	How many Excitation Lasers?	207
9.3.3.4	Pulsed Laser Excitation	209
9.3.4	What Detection Format should be used?	209
9.3.5	Data Reduction and Analysis Methods	210
9.3.5.1	Photon Streams and Films	210
9.3.5.2	Time Traces	211
9.3.5.3	Single-molecule Identification	211
9.3.5.4	Histogram-based Analysis (Including Correlation Analysis)	212
9.3.5.5	Analysis of Histograms of Single Molecules	213
9.3.5.6	Single-molecule Sorting	213
9.3.5.7	Trajectory Analysis of Single Molecules	214
9.3.6	Modeling and Simulations of Single-molecule Experiments	214
9.4	Examples	214
9.4.1	Single-molecule Fluorescence Studies of Protein Folding and Conformations	215
9.4.1.1	Observables for Protein Folding	215



9.4.1.2	Labeling Schemes for Protein Folding	215
9.4.1.3	Equilibrium Unfolding Studies on Simple Model Two-state Folders	217
9.4.1.4	Single-molecule Protein Folding under Non-equilibrium Conditions	219
9.4.1.5	Monitoring Conformational Dynamics using Fluorescence Lifetime	220
9.4.1.6	Single-pair FRET Studies on Immobilized Proteins	222
9.4.1.7	Probing Biomolecular Dynamics via Fluorescence Quenching and Electron Transfer	223
9.4.2	Single-molecule Measurements of DNA-processing Enzymes	225
9.4.2.1	RNAP – Retention of Sigma	227
9.4.2.2	RNAP – Abortive Initiation	229
9.4.2.3	Future Directions	230
9.5	Conclusion	231
	References	231
<b>10</b>	<b>Two Rotary Motors of ATP Synthase</b>	<b>237</b>
	<i>Ryota Iino and Hiroyuki Noji</i>	
10.1	Introduction	237
10.1.1	ATP Synthase: a Significant and Ubiquitous Enzyme in the Cell	237
10.1.2	Boyer's Proposal and Walker's Crystal Structure	238
10.2	Rotation of ATP Synthase	240
10.2.1	Single-molecule Imaging of Rotation of $F_1$ Driven by ATP Hydrolysis	240
10.2.1.1	Strategy for Visualization of Rotation	240
10.2.1.2	Large Torque Generated by $F_1$	240
10.2.1.3	Steps in Rotation	241
10.2.1.4	A Model of Cooperative Chemo-mechanical Coupling in Rotating $F_1$	243
10.2.2	Single-molecule Manipulation of $F_1$ Rotation	244
10.2.2.1	Mechanical Activation of Pausing $F_1$	244
10.2.2.2	Highly Coupled ATP Synthesis by $F_1$ Forced to Rotate in the Reverse Direction	246
10.2.3	Rotation of $F_oF_1$ or $F_o$	249
10.2.3.1	Steps in the Rotation of $F_oF_1$ driven by ATP hydrolysis	249
10.2.3.2	Ratchet versus Power Stroke as the Driving Force of $F_o$ Rotation	249
10.2.3.3	Rotation of $F_oF_1$ Driven by the Proton Motive Force	250
10.3	Perspectives	251
	References	251
<b>11</b>	<b>Single-molecule FRET Studies of Helicases and Holliday Junctions</b>	<b>257</b>
	<i>Taekjip Ha</i>	
11.1	Introduction	257