



# Contents

Preface, xv

## SECTION 1 ■ DETECTION AND APPROACHES TO LIVE CELL IMAGING, 1

---

- 1 Fluorescent Protein Tracking and Detection, 3  
*M.A. Rizzo, M.W. Davidson, and D.W. Piston*
- 2 Constructing and Expressing Fluorescent Protein Fusions, 35  
*D.L. Spector and R.D. Goldman*
- 3 Micropatterning Cell–Substrate Adhesions Using Linear Polyacrylamide as the Blocking Agent, 43  
*W.-h. Guo and Y.-l. Wang*
- 4 CCD Cameras for Fluorescence Imaging of Living Cells, 53  
*W.C. Salmon and J.C. Waters*
- 5 Fluorescence Perturbation Techniques to Study Mobility and Molecular Dynamics of Proteins in Live Cells: FRAP, Photoactivation, Photoconversion, and FLIP, 67  
*A. Bancaud, S. Huet, G. Rabut, and J. Ellenberg*
- 6 Imaging Protein States in Cells, 95  
*H.E. Grecco and P.I.H. Bastiaens*
- 7 A Versatile, Multicolor Total Internal Reflection Fluorescence and Spinning-Disk Confocal Microscope System for High-Resolution Live Cell Imaging, 119  
*W.D. Shin, R.S. Fischer, P. Kanchanawong, Y. Kim, J. Lim, K.A. Myers, Y. Nishimura, S.V. Plotnikov, I. Thievessen, D. Yarar, B. Sabass, and C.M. Waterman*
- 8 Confocal Microscopy, Deconvolution, and Structured Illumination Methods, 139  
*J.M. Murray*
- 9 Atomic-Force Microscopy for Biological Imaging and Mechanical Testing across Length Scales, 183  
*M. Plodinec, M. Loparic, and U. Aebi*

- 10 OMX: A New Platform for Multimodal, Multichannel Wide-Field Imaging, 203  
*I.M. Dobbie, E. King, R.M. Parton, P.M. Carlton, J.W. Sedat, J.R. Swedlow, and I. Davis*
- 11 Digital Scanned Laser Light Sheet Fluorescence Microscopy, 215  
*P.J. Keller and E.H.K. Stelzer*
- 12 First Steps for Fluorescence Correlation Spectroscopy of Living Cells, 229  
*M. Kinjo, H. Sakata, and S. Mikuni*
- 13 Tracking and Quantitative Analysis of Dynamic Movements of Cells and Particles, 239  
*K. Rohr, W.J. Godinez, N. Harder, S. Wörz, J. Mattes, W. Tvaruskó, and R. Eils*
- 14 Imaging Techniques for Measuring the Materials Properties of Cells, 257  
*K.E. Kasza, D. Vader, S. Köster, N. Wang, and D.A. Weitz*
- 15 Computational Image Analysis of Cellular Dynamics: A Case Study Based on Particle Tracking, 271  
*K. Jaqaman and G. Danuser*
- 16 Software Tools, Data Structures, and Interfaces for Microscope Imaging, 283  
*N. Stuurman and J.R. Swedlow*
- 17 High-Throughput Microscopy Using Live Mammalian Cells, 297  
*S. Terjung, T. Walter, A. Seitz, B. Neumann, R. Pepperkok, and J. Ellenberg*

## SECTION 2 ■ IMAGING OF LIVE CELLS AND ORGANISMS, 315

---

- 18 In Vivo Imaging of Mammalian Cells, 317  
*J.R. Swedlow, I.M. Porter, M. Posch, and S. Swift*
- 19 Live Cell Imaging of Yeast, 333  
*D.R. Rines, D. Thomann, J.F. Dorn, P. Goodwin, and P.K. Sorger*
- 20 Live Imaging of *Caenorhabditis elegans*, 351  
*B. Podbilewicz and Y. Gruenbaum*
- 21 Live Cell Imaging of Plants, 371  
*Y. Fang and D.L. Spector*
- 22 Pushing the Limits of Live Cell Imaging in *Drosophila*, 387  
*R.M. Parton, A.M. Vallés, I.M. Dobbie, and I. Davis*
- 23 Dynamic, Long-Term, In Vivo Imaging of Tumor–Stroma Interactions in Mouse Models of Breast Cancer Using Spinning-Disk Confocal Microscopy, 419  
*A.J. Ewald, Z. Werb, and M. Egeblad*
- 24 High-Resolution Multiphoton Imaging of Tumors In Vivo, 441  
*J. Wyckoff, B. Gligorijevic, D. Entenberg, J. Segall, and J. Condeelis*

- 25 Correlated Live Cell Light and Electron Microscopy Using Tetracysteine Tags and Biarsenicals, 463  
*G.M. Gaietta, T.J. Deerinck, and M.H. Ellisman*
- 26 Intravital Microscopy of Normal and Diseased Tissues in the Mouse, 475  
*R.K. Jain, L.L. Munn, and D. Fukumura*
- 27 Imaging Lipids in Living Cells, 523  
*C. Schultz, A.B. Neef, T.W. Gadella, Jr., and J. Goedhart*
- 28 Development of Mammalian Cell Lines with *lac* Operator–Tagged Chromosomes, 541  
*Y.G. Strukov, M. Plutz, and A.S. Belmont*
- 29 Imaging Gene Expression in Living Cells, 565  
*S.M. Janicki and D.L. Spector*
- 30 Studying Mitosis in Cultured Mammalian Cells, 571  
*P. Wadsworth*
- 31 Imaging Intermediate Filament Proteins in Living Cells, 583  
*E.R. Kuczmarski, T. Shimi, and R.D. Goldman*
- 32 Methods for Expressing and Analyzing GFP-Tubulin and GFP-Microtubule-Associated Proteins, 605  
*H.V. Goodson, J.S. Dzurisin, and P. Wadsworth*
- 33 Imaging of Membrane Systems and Membrane Traffic in Living Cells, 623  
*E.L. Snapp and P. Lajoie*
- 34 Imaging Live Cells under Mechanical Stress, 641  
*B.P. Helmke and P.F. Davies*
- 35 Imaging Single Molecules Using Total Internal Reflection Fluorescence Microscopy, 659  
*S.L. Reck-Peterson, N.D. Derr, and N. Stuurman*
- 36 Cellular Imaging Using Total Internal Reflection Fluorescence Microscopy, 675  
*D. Toomre*
- 37 Visualization and Quantification of Single RNA Molecules in Living Cells, 697  
*Y. Shav-Tal, S.M. Shenoy, and R.H. Singer*

Appendix: Cautions, 713

Index, 721