PREFACE

Single-molecule biophysics is a burgeoning field that encompasses studies of individual molecules and macromolecular machines in isolation, within the cells, and even inside living organisms. The last two decades witnessed an explosion of single-molecule research. The technological advances made to visualize and investigate biologically important molecules individually, in real time, and under physiological conditions have fundamentally changed our understanding of how cells work and communicate, how the molecular machines of the cell assemble and function, and, in general, how physiological functions emerge from the chaos of stochastic molecular events and interactions. New insights have been gained into the mechanisms of molecular motors, cell division, DNA repair and replication, RNA transcription, translation, protein folding, enzymatic catalysis, and assembly and function of membrane proteins.

The time when the novelty of observing a single molecule was a cause for celebration has passed. Single-molecule techniques have grown more sensitive and sophisticated, capable of multidimensional or high-throughput measurements of biomolecular dynamics. Once arcane, single-molecule methodologies are also becoming more mainstream. With the technologies becoming increasingly available to a broader community of biophysicists, biochemists, and molecular biologists, what lags behind is a comprehensive understanding of the power of single-molecule techniques when combined with rigorous data analysis. Thus, we believe the time is right for a comprehensive text describing the most cutting-edge single-molecule methods. The two volumes in this "Single-Molecule Enzymology" set are not intended to replace the previous set (volumes 472 and 475 on "Single-Molecule Tools")—all the methods and analyses described in it are still highly relevant. Instead, our aim is to expand the previous volumes by providing a comprehensive toolkit of up-to-date methods and expert advice on their utilization and data analysis.

The first volume in the set (volume 581, "Single-Molecule Enzymology, Part A") focuses on advances in the fluorescence-based techniques including single-molecule fluorescence in single or multiple colors, FRET, multidimensional FRET, interferometry, and massively parallel single-molecule enzymatic analyses in nanoliter volumes. The second volume in the series (volume 582, "Single-Molecule Enzymology, Part B") focuses on the

force-based single-molecule techniques and hybrid approaches that combine manipulation of single molecules by force with fluorescence-based observation.

Our philosophy when we selected the topics and contributors was to offer an authoritative practical guide on the most popular and newly emerging aspects of single-molecule enzymology. Our hope is that the two volumes in this series will provide valuable information on everything that goes into a successful single-molecule experiment from sample preparation, to measurements, data acquisition, and rigorous data analysis routines, and will be well used by everyone in the lab, from undergraduates and rotation students to postdoctoral fellows and faculty who wish to expand their research programs.

Maria Spies
University of Iowa
Yann R. Chemla
University of Illinois, Urbana-Champaign