Preface: How to Use This Manual

This book is intended as a laboratory companion to *An Introduction to Experimental Biophysics: Biological Methods for Physical Scientists* (Boca Raton, FL: Taylor & Francis 2012). It is structured according to the chapters in the textbook as much as is feasible. A series of 14 chapters presents a wide variety of techniques that may be performed during a semester-long, 3-credit course or during a 1-month intensive. The manual is organized to follow a logical experimental progression beginning with a DNA construct. The construct is amplified, mutated, or fused to another gene; expressed in bacteria; and purified as either a protein or plasmid DNA. The purified protein is characterized using spectroscopy, crystallization, and lipid bilayer expression. The purified plasmid DNA is expressed in mammalian cells and characterized by advanced imaging techniques and electrophysiology. The laboratories also include two sessions on nanoparticle characterization and synthesis.

All of the experiments in the manual have been tested in a pedagogical setting and found to be appropriate in terms of time, cost, and complexity.

The book is aimed primarily at instructors of laboratory courses in biophysics/molecular biology at the advanced undergraduate or graduate level. This manual will allow instructors to schedule a full-term or summer course based on the textbook. The manual is intended to aid course design and planning by suggesting sample experiments that use a select set of commercially available reagents; by scheduling the experiments so that gaps occur during weekends or lecture/computer lab time; and by providing a guide to results and pitfalls for each experiment.

Expected results and pitfalls are given for each experiment. End-of-chapter questions and problems are added to reinforce conceptual understanding. The DNA construct chosen as an example is the *Aequorea victoria* green fluorescent protein (GFP) gene and several of its variants. However, the general structure of the laboratories can be readily adapted to other constructs and proteins besides GFP. A section on advanced options is included to help guide instructors who wish to go beyond the simple example constructs. The course may be as simple or as sophisticated as time, students, and infrastructure warrant. One or more of the experiments may also be performed by students on their own if they wish to learn techniques without a formal course. Although all of the molecular biology experiments must be done in sequence, the more advanced experiments (transfection, nanoparticle synthesis, electrophysiology) stand alone.

The chapters are organized according to a schedule that permits completion of the laboratories in a 13-week quarter or 3-week intensive summer term, with minimal dead time. This schedule has been refined over 3 years of teaching the course and has been found to work well.

The experiments are designed to be performed by teams of two students; each team performs all of the experiments together throughout the term (notebook entries and reports should be written by individuals). Some experiments are divided into parts A and B for scheduling reasons. An experiment designated Part B must be done after a certain interval of time to allow something to grow or develop but is usually fast (<30 minutes to complete). In a summer course, A and B sections may be done on subsequent days. In a course given during the year when there is only one laboratory session per week, the B parts must be specially scheduled or performed by teaching assistants.