Preface

The second edition of *Physical Chemistry for the Biosciences* (PCB) is intended for use in a one-semester introductory course in physical chemistry or biophysical chemistry. It is designed for students interested in the biological sciences who have taken one year of general chemistry, one year of organic chemistry, and one year of physics. Basic skills of differential and integral calculus are required for understanding the equations. For premedical students, this text will form the basis for taking courses like physiology, neurobiology, and pharmacology in medical school. For those intending to pursue graduate study in biochemistry, this text will serve as an introduction to topics in advanced biophysical chemistry courses.

The goal of the second edition of PCB is to emphasize understanding physical concepts and their applications to chemical and biological systems rather than precise mathematical development or experimental details. This textbook keeps the concise, straightforward derivations and easy-to-follow explanations of concepts that distinguished the first edition. All the basic and essential topics in physical chemistry, like thermodynamics, chemical kinetics, and bonding, are treated in detail while certain topics have been abbreviated to keep the text at a reasonable length. Additional chapters on spectroscopy, photochemistry and photobiology, biological macromolecules, and enzyme kinetics are included for courses that lean more towards biophysical chemistry.

To give life-science students an appreciation for the importance of physical chemistry principles in understanding biology, concepts are illustrated with detailed examples at the forefront of biological science. Each chapter has an extensive reference list of texts and journal articles including up-to-date sources in biophysical chemistry. More than 900 end-of-chapter problems focus on real-world physicochemical and biological topics and provide a deeper understanding of chapter concepts. The Additional Problems sections contain more challenging and multi-concept problems. A Solutions Manual written by Helen Leung and Mark Marshall containing full solutions to all even-numbered problems is available.

The second edition includes all the biological topics from the first edition updated to reflect the current state of knowledge. Since the first edition was published, major advances in our understanding of complex biochemical systems have emerged from the application of physical chemistry principles and techniques to the study of these systems at the molecular level. Because increased knowledge of biomolecular structure figured prominently in understanding such biochemical systems, an updated chapter on biological macromolecules is presented earlier in the text. Earlier placement of this material will enhance the appreciation of the biological examples, illustrated with new biomolecular figures, in subsequent chapters. In addition to updated treatment of examples from the first edition such as bioenergetics, membrane transport, protein-ligand binding, biological oxidation, neurochemistry, biological coordination compounds, photosynthesis, and vision, new sections on protein folding diseases, thermodynamics of protein folding, rational design of drugs, and ATP synthase have

been added. Other additions for this edition include techniques such as mass spectrometry of proteins, methods for determining macromolecular structure, fluorescence anisotropy, and Förster resonance energy transfer.

The traditional physical chemistry content from the first edition remains the primary focus and has not been changed much beyond updating to new IUPAC conventions; thus, it is important to once again acknowledge the people involved. Thanks to the following people who provided helpful comments and suggestions for the first edition: Christopher Barrett (McGill University), Ron Christensen (Bowdoin College), Kirsten Eberth (The Royal Danish School of Pharmacy), Raymond Esquerra (San Francisco State University), Gary Lorigan (Miami University), Robert O'Brien (Portland State University), Keith Orrell (University of Exeter), and Karen Singmaster (San Jose State University). Thanks also to Bob Ishi for his elegant design, John Waller and Judy Waller for their pleasing and effective illustrations, and Jane Ellis for her crucial oversight of the first edition and the early stages of the second edition. It is my pleasure to thank the following people for their helpful comments and suggestions for the second addition: Kevin Boyd (Aquinas College), Mark Freitag (Creighton University), Katie Hart (Williams College), Helen Leung (Amherst College), and Mark Marshall (Amherst College). Thanks also to Transforma for composition, indexing, and additional illustrations and to Kot Copyediting & Proofreading for copyediting. A special thanks to the University Science Books team: Katerina Heidhausen and Felicity Hanson for their assistance from the beginning of the process through the writing and review stages; Barbara Dickson for her energy, professionalism, insight, and attention to detail while superbly supervising the production. And, finally thanks to Steve Smith for heading up this exceptional team.

This textbook follows the trajectory that my dear friend and colleague Raymond Chang started in 1977 with his pioneering textbook, *Physical Chemistry with Applications to Biological Systems* (PCABS). The book was designed for a one-semester course in physical chemistry like the one that was taught at Williams College for chemistry majors interested in medical school or graduate school in biochemistry. I taught the course for the first time about 40 years ago using PCABS. As someone who had taken two years of physical chemistry as an undergraduate student using texts that were intimidating and impenetrable at times, I found Raymond's PCABS to be brilliantly written in a way that was clear, concise, and conceptually easy to follow. It was the perfect vehicle to provide life-science students with an appreciation of physical chemistry concepts through relevant and relatable examples. More than two decades later, Raymond revised and improved on PCABS with the first edition of PCB, which included a greater emphasis on biological applications. Recognizing that advances in biophysical chemistry were occurring at a remarkable pace, Raymond asked me, about 10 years ago, if I was interested in updating the biological content in PCB. Although the timing was not right then, I am delighted to finally be able to honor his request.

Chip Lovett