

Preface

"You know, the proper method for inquiring after the properties of things is to deduce them from experiments." Isaac Newton, 1672.

This book of Problems is our third attempt, now deliberately titled 'An Approach.' It is intended as a companion to the Fourth Edition of *Molecular Biology of the Cell* (MBoC) by Bruce Alberts, Julian Lewis, Sandy Johnson, Martin Raff, Keith Roberts, and Peter Walter. Our aim has been to explore the questions that ought ideally to surface during the reading of a textbook, but rarely do. How do scientists know that? And how did they find it out? Such things are rarely obvious, especially to people who have never worked in a real research laboratory, but the process of discovery is in fact the whole point. Science is a way of knowing, not a dull catalogue of facts. To be understood properly, principles must be examined, questioned, and played with. We would like to encourage a more questioning attitude toward cell biology than is possible in a textbook.

The other problem with textbooks is that, in their quest for clear, elegant, and manageable presentation, they leave out most of the experimental evidence that supports the current view of a topic. Probably our most important task is to introduce readers to the experimental foundations of cell and molecular biology and show how the links between the behavior of molecules and the biology of cells have been revealed. In the real world of research biology, half the battle is knowing what question to ask; the other half is finding a way to answer it. In biology, new knowledge never comes from just sitting back and thinking: experiments are the only way we have to find out how nature works. Unfortunately, no book can replace the actual doing of experiments, but we have tried to capture some of the flavor of the process, especially the thinking that leads from observation to interpretation.

Although our intentions remain the same in this edition, we have made some significant changes in style and content. The book is heavily revised, and we now cover many more topics than in previous editions. For example, you will now find problems dealing with the opening chapters of MBoC, discussing the nature of life, its evolution, simple chemistry, radioactivity, pH, biochemistry, and protein chemistry. We ourselves learned and relearned a great deal in this process, and hope that some of this rubs off on our readers. We discovered to our consternation and frequent puzzlement, that what is supposed to be simple—elementary—often is not. We learned anew how fruitful and illuminating it is to struggle with simple concepts in different surroundings and new contexts.

We hope that the new sections will make our book more generally useful and complete. Especially in these early chapters, we have sometimes elaborated very considerably on concepts that are summarized in a few sentences in MBoC. In addition, we would strongly recommend two little books (both of them still in print) for further study: Howard C Berg's brilliant introduction to diffusion, entitled *Random Walks in Biology* and Irwin H Segel's excellent *Biochemical Calculations: How to Solve Mathematical Problems in General Biochemistry*. Both provided us with enlightenment and ideas for problems.

In preparing this new edition, we also decided to modify two features of the previous book. Biology is notoriously and unavoidably full of unfamiliar terms, which we previously dealt with as a series of definitions with blanks to be filled in. Now, we supply the terms without the definitions under the heading of 'Terms to Learn,' to emphasize that a certain amount of new vocabulary must be learned: there's no escape. These terms are in bold in MBoC and in its glossary, where they are