
Preface

We are living in an era of biotechnology revolution. To many molecular and cellular biologists, the flood of information on human genome and new methodologies is particularly overwhelming because biotechnology is forging ahead and bringing rapid changes every day. Because every single organism depends on molecular actions for survival, molecular biology research has become more and more dominant in multiple disciplines. In fact, there is a general trend for the U.S. National Institutes of Health (NIH) and other funding agencies to award grants with high priority to those research proposals using molecular biology approaches. How can one catch up with new biotechnologies, and use the most recent, proven techniques for novel research? One of the aims of this book is to provide investigators with the tools needed for modern molecular and cellular biology research.

Another aim of this book is to guide graduate students in their thesis research. In our experience, good graduate training mandates independent performance with minimal advice from one's mentor. How do you select a novel research project for your thesis? What are your hypotheses, objectives, and experimental designs? How can you grasp technical problems and master current techniques? Where do you begin and what are the predicted results? How do you write your thesis and research manuscripts for publications? It is apparent that a graduate student needs some help with these questions. This book will provide the clues.

This book covers a wide range of current biotechnologies and methods that have been developed and are widely used in molecular biology, biochemistry, cell biology, immunology, recombinant protein biochemistry, biopharmaceutics, etc. The methods and protocols described in the appropriate chapters include the following: approaches to novel research, rapid isolation of specific cDNAs or genes by PCR; construction and screening of cDNA and genomic DNA libraries; preparation of DNA constructs; nonisotopic and isotopic DNA or RNA sequencing; information superhighway and computer databases of nucleic acids and proteins; characterization of DNA, RNA, or proteins by Southern, northern, or western blot hybridization; fluorescent techniques; gene overexpression; gene underexpression; and gene knockout in mammalian systems; analysis of cellular DNA or abundance of mRNA by radioactivity *in situ* hybridization; localization of DNA or abundance mRNA by fluorescence *in situ* hybridization; *in situ* PCR hybridization of low copy genes and *in situ* RT-PCR detection of low abundance mRNAs; strategies for gene double knockout, large-scale expression, and purification of recombinant proteins in cultured cells; high-throughput analysis of gene expression by real-time RT-PCR; gene expression profiling via DNA microarray, phage display, and siRNA technology; protein-protein binding and proteomic interactions; conditional gene knockout; and determination of gene copy numbers. Each chapter covers the principle(s) underlying methods and techniques, detailed step-by-step descriptions of each protocol, notes, tips, and a troubleshooting guide. We have observed that many of the currently available books in molecular biology contain only protocol recipes. Unfortunately, many

fail to explain the principles and concepts behind the methods outlined or to inform the reader about the possible pitfalls in the methods described. We intend to fill these gaps.

More importantly, this technology book provides unique features: (1) how to write a research paper for publication in English journals, (2) how to protect research discoveries and inventions via patents, and (3) discussion on practical biocalculation. The authors believe that research paper publication, intellectual property (IP) protection via patent(s), and biocalculations are very important topics to graduate students, researchers, and university faculty members.

For the information of the reader, Chapter 1 was written by William Wu, Peter B. Kaufman, and Michael J. Welsh. Chapters 2, 3, 6, 7, 9, 10, 13–17, 19–22, 23, 25, and 26 were written by William Wu. Chapter 8 was written by William Wu and Michael J. Welsh. Chapter 5 was written by William Wu and Peter B. Kaufman. Chapters 4, 11, 12, 18, 24, and 27 were written by William Wu and Helen Zhang. Nonetheless, all four authors have worked as a team.

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