

Preface

One of the major challenges currently facing the scientific community is to understand the function of the 20,000–25,000 protein-coding genes that were revealed when the human genome was fully sequenced. This book details the transgenic techniques that are currently used to modify the genome in order to extend our understanding of the *in vivo* function of these genes.

Since the advent of transgenic technologies, the mouse has become by far the most popular model in which to study mammalian gene function. This is due to not only its genetic similarity to humans but also its physiological and, to a certain extent, its anatomical similarities. Whilst a large proportion of this book is dedicated to the use of the mouse in transgenesis, the mouse is certainly not the only model to provide essential information regarding gene function. A number of other valuable models are used in transgenic studies including *Drosophila*, *C. elegans*, *Xenopus*, zebrafish, and rat. For each of these species, a chapter in this book is dedicated to highlighting how each is particularly suited, for example, to the study of embryonic development, physiological function of genes and to study orthologs of human disease genes. These chapters give detailed practical descriptions of animal production, construct design, and gene transfer techniques; recently developed methods will be described along with highly established classical techniques.

A number of chapters in this book are dedicated to the generation of genetically modified mice by the present classic techniques of injection of exogenous DNA into the pronuclei of fertilised eggs and by gene targeting using homologous recombination in embryonic stem cells. These chapters, as with all the others in the book, have been specifically written for this edition of *Transgenesis* and so contain up-to-date details of the practices in the field. Chapters are included describing optimal transgene and construct design, in-depth technical details for pronuclear microinjection of transgenes and associated surgical techniques, details for the optimal conditions in which to culture embryonic stem cells in order to maintain their pluripotent state, and methods for targeting these cells. A combination of chapters (Chaps. 13–15) describe how to generate chimaeras by microinjection of targeted ES cells into blastocysts or by morula aggregation, and the surgical techniques required to transfer the resulting embryos. For a number of years, the use of Cre/loxP and flp/frt recombination systems has gained in popularity; Chap. 16 describes their use and introduces other state-of-the-art site-specific recombination systems that can be used to manipulate the mouse genome. The generation and use of Cre-expressing transgenic lines are described in Chap. 17. One chapter of the book highlights the large-scale international efforts that are being made to systematically knockout every gene in the genome. The remaining chapters detail the breeding and husbandry skills required to successfully propagate a transgenic line and the increasingly essential methods for cryopreserving a mouse line and recovering lines from frozen stocks.

This book is a comprehensive practical guide to the generation of transgenic animals and is packed full of handy hints and tips from the experts who use these techniques on a

day-to-day basis. It is designed to become an invaluable source of information in any lab currently involved in transgenic techniques, as well as for researchers who are newcomers to the field. This book also provides essential background information for scientists who work with these models but have not been involved in their generation.

On a personal note, it has been a great pleasure to edit this latest edition of *Transgenesis*. Firstly, I learnt many of my skills from reading earlier editions of the book and I hope that this edition will help and inspire many others. Secondly, I have been privileged to work with the exceptionally talented researchers in the transgenesis field who have contributed to this book.

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