

Preface

This book is intended for several different categories of potential readers. First, are students who have completed their university studies in biology or medical sciences and wish to undertake a PhD project making use of mice but who have no experience with this model organism. Reading this book will enable them to acquire, rapidly and in a relatively condensed form, a background that will be helpful for the critical reading of primary scientific publications and for the optimal design of their projects. Genetics instructors will also find useful examples to illustrate undergraduate biology courses. Molecular and developmental biologists whose research program is focused on a gene or gene family will also be interested and will realize that the mouse is an exceptional model with which they may be able to develop studies impossible or difficult to achieve with any other mammalian species. For example, they may be able to produce a variety of point mutations in the same genetic background or exactly the same point mutation in a variety of different backgrounds, allowing exploration of the function of this gene and its interplay within gene networks. This book will also be helpful to physicians and pediatricians by allowing them to choose or design the best possible model for their research related to a specific human pathology. This would be true not only for the diseases resulting from point mutations in orthologous genes but also, and more interestingly, for those mutations whose phenotypic expression is influenced by the environment or the genetic background of the animal. Finally, laboratory animal veterinarians and technicians, who are in charge of the breeding and preservation of mouse models, will find useful explanations about their increasing complexity.

This book covers all aspects of mouse genetics. The first four chapters describe the origin of laboratory mice, the reproductive biology, the cytogenetics, and the mapping of genes. The establishment of highly detailed genetic maps was a major and fundamental contribution to mouse geneticists during the twentieth century that ultimately led to the complete sequencing of the genome. This topic has been presented in a relatively condensed form in this book, because we have considered that the excellent book published in 1995 by Lee M. Silver, which is freely available on the site “Mouse Genome Informatics”, is still a major reference in

this matter. On the contrary, the transcriptome and the parental imprinting of the genome are topics that have been the subject of intensive research over the last 10 years. For this reason they are presented in more detail along with the techniques for the production of mutations, which is one of the most attractive features of the mouse. Finally, quantitative genetics, a branch of genetics that is in expansion, is presented in a didactic manner.

This book greatly benefited from the contributions of some of our colleagues whom we would like to cordially thank. François Bonhomme, an old friend with whom we have collaborated many times in the past, reviewed and commented on Chap. 1. Marie-Geneviève Mattei read and amended Chaps. 3 and 6 and allowed us to share her extensive knowledge of cytogenetics. Yann Herault also made interesting suggestions about Chap. 3 and provided us with a schematic figure representing the best models of Down syndrome. Benoît Robert accepted the difficult task of writing an original synthesis concerning the regulation of gene expression (Chap. 5). Edith Heard, Luisa Dandolo, and Deborah Bourc'h's abundantly corrected and commented on Chap. 6 dealing with X-inactivation and parental genetic imprinting. Michel Cohen-Tannoudji corrected and completed our initial versions of Chap. 8, and Tomoji Mashimo read the section of the same chapter dealing with the production of targeted alterations using engineered nucleases and provided a summary picture. Finally, Robert P. Erickson kindly read the whole of our manuscript, making many insightful comments. The authors also wish to thank Drs. Hesed M. Padilla-Nash and Thomas Ried from the Genetics Branch, National Cancer Institute, National Institutes of Health, Bethesda for providing a picture of a mouse spectral karyotyping, Dr. Dianne Creasy, Huntingdon Life Sciences, East Millstone, for providing a picture of the seminiferous epithelium with identification of the different cell types, and Ms Annie Orth for providing a picture of a sample of her unique collection of wild mice. Finally, the authors are greatly indebted to their colleague Dominique Simon, who helped in the preparation of many illustrations and to Mrs. Sarah Adai, MD Anderson Cancer Center, who undertook to "translate" their awkward English into a more readable form.

Writing this book has kept us busy for nearly two years, but it was really an enthralling experience. Whatever the chapter, we realized that the Genetics of the Mouse has changed considerably over the last 20 years and, with an increasing number of transnational collaborative projects, we can expect even more dramatic changes in the years to come.

Genetics of the Mouse

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