METHODS IN MOLECULAR BIOLOGY

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Mouse Genetics

Methods and Protocols

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Preface

Although evolution has separated mice and humans about 75 million years ago, they still share an incredible level of anatomical, physiological, and especially genomic resemblance. Modeling human disease in mice offers numerous advantages over other mammalian animal models because they are small, easy to breed, available in large number of inbred strains, and their genome is fully sequenced. Most of all, early stage mouse embryos are conducive to in vitro manipulation, and many embryonic stem (ES) cell lines have shown robust homologous recombination and germline transmission in existence. All these elements have allowed researchers to develop innovative technologies that efficiently edit the mouse genome in vivo. It is now possible to engineer targeted alterations such as gene knockout and knockin or elegant conditional gene modification, which allows temporal-spatial regulation and cell lineage tracing. Other genetic technologies such as Recombinase-Mediated Cassette Exchange (RMCE), which can generate allelic series of mutants and mutagenesis, can also be obtained by use of transposons. Over the years, almost all human diseases including cancer, diabetes, obesity, cystic fibrosis, arthritis, and heart and neurodegenerative diseases have been modeled in mice.

Mouse Genetics: *Methods and Protocols* provides selected mouse genetic techniques and their application in modeling varieties of human diseases. The chapters are mainly focused on the generation of different transgenic mice to accomplish the manipulation of genes of interest, tracing cell lineages, and modeling human diseases. Composed in the highly successful *Methods in Molecular Biology series* format, each chapter contains a brief introduction, a list of necessary materials, systematic methods, and a notes section, which shares tips on troubleshooting to avoid known pitfalls.

We hope that *Mouse Genetics*: *Methods and Protocols* would provide fundamental techniques and protocols to geneticists, molecular biologists, cell and developmental biologists, students, and postdoctoral fellows working in the various disciplines of mouse biology and modeling human disease.

We would like to thank Prof. John M. Walker and the staff at Springer for their invitation, editorial guidance, and assistance throughout the preparation of the book for publication. We also would like to express our sincere appreciation and gratitude to the contributors for sharing their precious laboratory expertise with the mouse community. Finally yet importantly, we would like to thank our family members for their continued support.

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