
Preface

It usually starts with a wonderful hypothesis but could be suddenly stopped by the wrong choice of the animal model to test it. Biomedical research is a dynamic process that initiates with a hypothesis, continues with the selection of an appropriate experimental model and ends with the publication of data confirming or rejecting that initial hypothesis. Thanks to biomedical research the human race has found the cure for multiple diseases, has alleviated pain and suffering and has prolonged its life span to levels unimaginable hundred years ago.

An important step in biomedical research is the selection of the appropriate animal model that fulfils the required characteristics to test a specific hypothesis. For years, experimental animals have been used in biomedical research since it is widely accepted that a living organism provides an interactive, dynamic system that can be observed and manipulated experimentally in order to investigate mechanisms of normal function and of disease. As a result, a greater understanding of living systems can be attained and this knowledge can be generalized to other species including humans, facilitating the development of effective therapies. Several aspects of using experimental animals, such as life conditions and ethical issues, have become pivotal in biomedical research always looking for the best and more humane care for these animals.

Osteoporosis research has not been the exception. Numerous animal models have been used to understand the mechanisms of osteoporosis and age-related bone loss as well as to test new therapies to prevent osteoporosis and fractures. Animal models of osteoporosis, going from murine to non-human primates, are now established. In addition, diagnostic techniques have significantly advanced due to the fact that they have been tested in these animals prior to their validation in humans.

In this very diverse field of experimental animal models for osteoporosis, the bone researcher has to decide the most suitable model to assess a hypothesis and to provide valid and reliable data. Selecting the appropriate animal model could be confusing and time consuming. This book attempts to solve this challenge by providing the bone researcher with a handy and practical guide on how to select the appropriate animal model and what type of experimental approach would be more suitable for that specific model.

The book starts with a chapter on how to select your animal model. This chapter describes the particular characteristics of most animal models in terms of bone structure, changes in bone cellularity and the role of hormones and growth factors in their

bone metabolism. After reviewing this chapter, the reader would find that using models other than the usual murine ones could be a good choice for their particular experimental approach.

From [Chaps. 2–6](#), we have focused on the most common techniques in bone research and their particular characteristics and requirements for each animal model. These chapters describe in detail how to manipulate the samples and how to obtain the best results from every particular model. We expect that the readers will find these chapters extremely useful when selecting their experimental techniques and when interpreting their results.

[Chapter 7](#) is dedicated to the impact of cancer on bone. Metastatic cancer directly affects bone structure and cellularity and therefore preventing bone metastasis is a subject of intense research. Considering that animal models for cancer research have very specific features and requirements, a chapter has been fully dedicated to this subject. The authors explain in detail how to select an appropriate model of metastatic bone disease as well as the particular features of the most common animal models used for this purpose.

Moving from the diagnostic methods to the use of animal models to assess potential therapeutic targets of osteoporosis in [Chap. 8](#), the authors provide with a very useful guide on how to test treatments for osteoporosis in experimental animals. Using the wrong experimental model to assess new compounds would prevent potential major advances in osteoporosis research. Therefore, in this chapter the authors guide the reader on the selection of the right experimental model and the most appropriate techniques to administrate osteoporosis medications without affecting the quality of life of the experimental animals.

The later chapters of this book highlight the two most common models of osteoporosis: the oophorectomized (OVX) and the aged mice and rats. [Chapter 9](#) describes the advantages and disadvantages of the OVX model and provides some useful tips to obtain the best results from this model.

A particular unique component of this book is the inclusion of animal models of normal and accelerated aging ([Chaps. 10 and 11](#)). In an “estrogen centered” field, which is slowly moving into accepting the very relevant role of aging in the pathogenesis of osteoporosis, the description of the unique characteristics, advantages and disadvantages of the aging animal model constitutes one of the major strengths of this book giving it a major relevance for osteoporosis research in the near future.

In [Chaps. 12 and 13](#), we wanted to include other large animal models and non-human primate models of osteoporosis. Although less commonly used due to costs and logistic issues, these animal models provide a closer approach to the features of osteoporosis in humans and therefore could be the optimal models when assessing new therapeutic targets.

Finally, in addition to the use of animal models to test therapeutic targets of osteoporosis, animal models are also useful to assess the characteristics of fracture healing and fracture fixation. [Chapter 14](#) elegantly describes the animal models and techniques used to assess different approaches to fracture healing and fixation. With multiple figures, the authors illustrate to the reader with the most advanced techniques and their practicalities in a very descriptive and didactic manner.

In summary, this book is expected to constitute the most practical guide for the selection of animal models as well as the identification of the most appropriate

techniques for bone research. Due to the importance of using animal models in a very ethical manner, throughout its pages the reader would find the Editors' particular emphasis on human treatment to experimental animals. In fact, we would like to highlight that experimental animals should be used only when *in vitro* techniques are limited, and that ethical care of experimental animals should be pivotal in every aspect of biomedical research. The best way of thanking our animals for the evidence and medical advances they are providing us is to treat them as humanly as possible. At the end we are the same creatures in the eyes of a Great Architect.

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Animal Models

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