

## Preface

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Why do we need a book devoted to the thermoregulatory characteristics of laboratory rodents? Such a book will be of obvious benefit to those involved in the study of thermal biology, but this book is also written to meet the needs of more readers than the relative handful of thermal biologists. One or more species of laboratory rodents are used predominantly by researchers in a variety of fields in the life sciences, including neural science, endocrinology, immunology, nutrition, and many others. The biological endpoints commonly measured in these fields would seem not to be related to thermoregulation. Yet manipulation of any one of these systems with surgical, pharmacological, and/or environmental procedures often leads to changes in the rodent's thermoregulation. Because temperature regulation is controlled essentially by a "holistic" regulatory system, meaning that its responses affect the activities of all other physiological and behavioral processes, it is clear that researchers working with rodents must be cognizant of thermoregulatory physiology.

Since completing my graduate work, I have found a need for a comprehensive source on the thermal physiology of laboratory rodents. Most other books on temperature regulation have focused on specific aspects of thermoregulation, such as fever, pharmacological control, exercise, and nonshivering thermogenesis. Other books have concentrated on specific mammalian species, particularly humans and the domesticated species that are of importance to agriculture. However, there are few sources that have examined the responses of a specific group of mammals such as the rodents. In 1971 the eminent Dr. J. S. Hart prepared a thorough monograph on the thermoregulatory characteristics of both wild and domesticated rodents (Hart, 1971). Although that is an excellent source for most thermal biologists, I have often thought that it does not necessarily address the needs of researchers whose primary interests are in fields other than thermoregulation. To address these needs, in 1990 I wrote a review on the thermal biology of the laboratory rat

(Gordon, 1990a). The popularity of that review, as judged from the number of reprint requests, was considerable. Because of the strong response to that review and encouragement from the editors of Cambridge University Press, I was convinced that a thorough comparative analysis of thermoregulatory responses in the commonly used laboratory rodents would be most useful.

The style of this book differs somewhat from the norm. I believe that a comparative book calls for a thorough presentation of the pertinent data from the literature. Because of the variability in some thermoregulatory parameters in a given species, I found it necessary to tabulate data from a number of laboratories to facilitate comparison. The tables allow the reader to quickly assess and compare the thermoregulatory characteristics of a particular species. Moreover, it is hoped that voids in the data presented in these tables will indicate where future research should be directed. In preparing the illustrations, I sought, whenever possible, to show the responses of two or more rodent species. The level of detail in this book was one of my greatest concerns. With over 700 references, it should be obvious that I have tried to make the coverage as extensive as possible without exceeding the publisher's space limitation. However, in the course of doing the research for this book it is likely that I overlooked some pertinent papers. To the authors of those papers I apologize, and I hope that they will inform me of my oversights.

I have attempted to write this text at a level that should meet the needs of researchers with a minimum background of upper-level undergraduate courses in physiology and/or related fields. The book covers the physiological and behavioral responses of the principal laboratory rodents: mouse, gerbil, hamster, rat, and guinea pig. Although recent molecular studies have suggested that the guinea pig is not a true rodent, its thermoregulatory responses are considered here along with those of other rodent species. What I, and many other researchers, consider to be the most pertinent facets of thermoregulatory physiology are covered: neurological control, metabolism, homeostasis of body and brain temperatures, stress, motor effectors, growth and development, temperature acclimation, and intraspecies and gender differences. The final chapter deals with a novel aspect not commonly presented in other texts, but nonetheless crucial to today's researcher: the effects of adverse perturbations, including hypoxia, chemical toxicity, and trauma, on thermoregulation.