

Preface

Because of significant improvements in health style and medical science, an increasingly large number of individuals are living to advanced ages in the United States and other developed nations. According to 2004 U.S. Census Bureau estimates, the number of people over 65 is expected to rise from 35 to 72 million by 2030, resulting in the elderly comprising one fifth of the population within the next 20 years. Many elderly people will develop cognitive decline ranging from severe dementia to mild impairment, in part due to diseases such as Alzheimer's disease and myocardial infarction, and in part as a consequence of the "normal" aging process. Importantly, however, cognitive loss associated with advanced age is not inevitable and, as such, modern society has placed new emphasis on "successful" cognitive aging. In addition to increasing the quality of life for elderly individuals, understanding the factors that impact cognitive aging and developing new treatments to combat age-related mnemonic decline also is advantageous from a societal standpoint. Health-care costs are substantial for those elderly who lose independence as a result of impaired cognition and can only be expected to rapidly escalate with the projected increase in life expectancy.

Animal models that accurately mimic age-related cognitive loss in humans are essential tools for understanding cognitive changes associated with the aging process and are necessary to developing novel and putatively more effective treatments to combat loss of function. While animal models for understanding human normal biological processes and disease states have long been used in scientific and medical research, models of cognition and aging are relatively new in accordance with the recent increase in human life expectancy. With the completion of the human genome project and other technical advances, significant work in the field of aging has focused on understanding changes of biological phenomena at the molecular and cellular levels across the life span. Solid animal models of cognitive aging remain essential to the interpretation of consequences of such findings. Human research, though clearly most directly relevant, presents barriers with regard to manipulation and also with understanding the temporal sequence of events that may have led to cognitive deficits and abilities. As such, translational research related to improving human health at advanced ages depends upon modeling age-related cognitive decline in rodents and nonhuman primates.

This book is designed to provide substantive background on some of the most widely used animal models in studies of cognition and aging. The goal is to present sufficient detail to aid neurobiological researchers in choosing and implementing appropriate animal models of cognitive aging, understanding the benefits and drawbacks of each. The authors also have related each of these cognitive models to human systems and circumstances.

Berchtold and Cotman start the book by discussing normal and pathological processes of brain aging in humans, relating these processes to animal models. The authors emphasize the role that lifestyle choices, such as exercise, may play in successful aging. Since primates are phylogenetically most similar to humans, use of nonhuman primate models is essential to many aging studies and can be critical when investigating complex neocortical-based cognitive functions that are difficult to model in rodents. LeCreuse and Herndon provide a comprehensive overview of the many such models currently used to study cognitive aging, and Baxter provides a comprehensive review of frontal cortical deficits and executive function in primates as related to not only humans but also rodents. Indeed, in many instances rodents provide an excellent model system for human cognitive aging, in part due to the wealth of background data available regarding the neuroanatomy, physiology, and behavior of this species. LaSarge and Nicole detail similarities and differences among different rat models most often used to model medial temporal lobe dysfunction related to nonpathological aging. A separate chapter by Calhoun describes important and often overlooked differences between using rat versus mouse models, while LaFerla and colleagues review the use of transgenic modulation in mice to model Alzheimer's and other age-related diseases. Sohrabji and Lewis continue an important discussion originally introduced by Berchtold and Cotman relating to sex differences in cognitive aging and the consequence of variations in hormones across the life span on cognition. Finally, Balci, Moore, and Brunner present a comprehensive review on the topic of "timing," which is well documented as altered in aging and may be related to impaired decision-making and other deleterious cognitive outcomes at advanced ages.

With the aging population steadily on the rise, studies focusing on cognitive decline both with normal aging and with age-related disease are a crucial focus of current research. New technologies, such as neuroimaging and molecular techniques, are helping to shed new light on how the brain changes across the life span, but animal models retain, and in many ways demand, an increasingly important role with respect to providing a necessary context by which to evaluate age-related neurobiological changes. It is in this spirit that we have put this book forth, as a collection of expert experience in animal models of cognitive aging. We thank the authors for their valuable contributions and hope that this volume will be of substantial value to neurobiological researchers in their understanding, selection, and implementation of appropriate animal models to aid in the translation of research from the bench to the betterment of human cognition well into advanced ages.

College Station, Texas, USA
Boston, Massachusetts, USA

Jennifer L. Bizon
Alisa G. Woods



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Bizon, J.L.; Woods, A.G. (Eds.)

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