

## AGING

*A Natural History*ROBERT E. RICKLEFS  
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## A NATURAL HISTORY

by Robert E. Ricklefs and  
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Aging is familiar to all of us if only from our earliest observations of family members and pets. Indeed, most of us tend to consider aging to be a well-understood biological phenomenon. However, reflection reveals that from a biological perspective, it is not at all obvious why aging should occur. Why should an organism that has developed into a complex structural and functional entity from a fertilized egg not be able to indefinitely maintain the integrity of the adult system? Indeed, biological organisms are thermodynamically open systems which can draw upon external energy sources to repair damage. Moreover, why has a trait so harmful to the individual as aging not been eliminated by evolution? These fundamental questions are the substance of this less than 200 page well-written and beautifully illustrated book. The authors Robert E. Ricklefs, an ecologist and field biologist, and Caleb E. Finch, a neuroendocrinologist and molecular biologist, have effectively utilized their combined breadth of knowledge to produce a book that can be understood

by the educated layman and yet also will interest biologists, even those who are biological gerontologists. Indeed, it is the melding of these disciplines that has led to the unique contribution of this book to the gerontologic literature.

The authors commence by emphasizing how important it is to be clear about definitions. In my experience most academic polemics in the field of biological gerontology relate to unrecognized differences in definitions between and among investigators; indeed, the definition of aging (senescence) has been a major problem in this regard. The need to measure the rate of aging is also a major issue, and how to measure it is carefully considered. The use of the Gompertz and related concepts to measure the rate of aging is presented, and the recent studies questioning the validity of this approach are assessed. The conclusion is that the Gompertz analysis provides a good first approximation of the rate of aging when used appropriately.

Much of the book focuses on two major themes: the 'how' and 'why' theories of aging. The authors define the 'how' theories as the biological processes that may underlie aging or postmaturational deterioration (senescence), whereas the 'why' theories relate to the attempt of evolutionary biologists to establish senescence as a necessary consequence of the processes of life.

The authors discuss many of these specific theories of senescence from molecular biology or cell biology or systems physiology in a brief and simple manner and yet do so in most cases in a reasonably accurate fashion. The complex interactions between the environment including the internal environment and the genes in the aging of organisms are effectively examined. The authors present these concepts in a fashion that is free of their personal biases. The consideration of Hayflick's controversial concept that the loss of proliferative ability of cells in culture is a model of organismic aging is an example of the careful and even-handed way such issues are considered. This highly promoted and popular concept is not uncritically accepted nor is it dismissed out of hand, it is thoughtfully discussed.

As a prelude to the consideration of the theories of why aging takes place, the natural histories of life spans in different species are described, and the question of why the aging rate differs among species is examined. Issues such as the influence

of body size, metabolic rate and development on aging are discussed. Also, the question of why aging does not occur in the germ line and in certain asexual clones is pondered.

The puzzle of why aging, which is so detrimental to the individual, is maintained by natural selection is considered in depth. The relationship between chronological age and the strength of selection is assessed, and the view that senescence results from the declining force of natural selection with advancing age is developed. The support from laboratory studies for the evolutionary theories of aging is evaluated, and the limitations of such studies are pointed out. The need to obtain similar information for animals in the wild is stressed, and the limited information currently available in this area is presented. Possible genetic mechanisms underlying the evolution of senescence are evaluated in a critical and lucid fashion. The presentation of these theories in this book is a scholarly achievement.

The question as to whether human aging can be modulated is an underlying theme of the book. This general emphasis is not surprising because an increase in life span (at least one's own life span) is a strong, long held, widespread human desire. Moreover, the current and projected societal effects of an aging population loom as an almost insurmountable challenge. For example, major concerns of geriatric physicians and other health care providers are the availability of the resources needed to maximize the quality of life of the elderly and the ethical challenges encountered in caring for terminally ill geriatric patients. Also, societal concerns are growing and will continue to grow in regard to the economic, legal and ethical challenges of balancing the needs of the old and the needs of the young. In designing strategies to meet these challenges, an understanding of biological aging and of the potential of developing interventions that modulate its adverse effects is essential. This book provides geriatricians and other health service providers, economists, politicians and, indeed, all of us, with needed biological information in the quest to cope with the challenges posed by an aging population. In addition, biologists will find the book a thought-provoking work which provides new insights even to those of us who have spent most of our scientific careers studying the biological process of aging.