

Commentary**Modern Biological Theories of Aging****Kunlin Jin**

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ABSTRACT: Despite recent advances in molecular biology and genetics, the mysteries that control human lifespan are yet to be unraveled. Many theories, which fall into two main categories: programmed and error theories, have been proposed to explain the process of aging, but neither of them appears to be fully satisfactory. These theories may interact with each other in a complex way. By understanding and testing the existing and new aging theories, it may be possible to promote successful aging.

Key words: Aging; Biological; Theory; Programmed; lifespan

Why do we age? When do we start aging? What is the aging marker? Is there a limit to how old we can grow? These questions are often pondered by the mankind in the past couple of hundred years. However, in spite of recent advances in molecular biology and genetics, the mysteries that control human lifespan are yet to be unraveled.

Many theories have been proposed to explain the process of aging, but neither of them appears to be fully satisfactory (1). The traditional aging theories hold that aging is not an adaptation or genetically programmed. Modern biological theories of aging in humans fall into two main categories: programmed and damage or error theories. The programmed theories imply that aging follows a biological timetable, perhaps a continuation of the one that regulates childhood growth and development. This regulation would depend on changes in gene expression that affect the systems responsible for maintenance, repair and defense responses. The damage or error theories emphasize environmental assaults to living organisms that induce cumulative damage at various levels as the cause of aging.

The programmed theory has three sub-categories: 1) Programmed Longevity. Aging is the result of a sequential switching on and off of certain genes, with senescence being defined as the time when age-associated deficits are manifested. Dr. Davidovic et al discuss the role of genetic instability in aging and dynamics of the aging process (1). 2) Endocrine Theory. Biological clocks act through hormones to control the pace of aging. Recent studies confirm that

aging is hormonally regulated and that the evolutionarily conserved insulin/IGF-1 signaling (IIS) pathway plays a key role in the hormonal regulation of aging. Dr. van Heerdt discusses the potential mechanism underlying IIS and aging process(2). 3) Immunological Theory. The immune system is programmed to decline over time, which leads to an increased vulnerability to infectious disease and thus aging and death. It is well documented that the effectiveness of the immune system peaks at puberty and gradually declines thereafter with advance in age. For example, as one grows older, antibodies lose their effectiveness, and fewer new diseases can be combated effectively by the body, which causes cellular stress and eventual death (3). Indeed, dysregulated immune response has been linked to cardiovascular disease, inflammation, Alzheimer's disease (AD), and cancer. Although direct causal relationships have not been established for all these detrimental outcomes, the immune system has been at least indirectly implicated (4).

The damage or error theory include 1) Wear and tear theory. Cells and tissues have vital parts that wear out resulting in aging. Like components of an aging car, parts of the body eventually wear out from repeated use, killing them and then the body. So the wear and tear theory of aging was first introduced by Dr. August Weismann, a German biologist, in 1882, it sounds perfectly reasonable to many people even today, because this is what happens to most familiar things around them. 2) Rate of living theory. The greater an organism's rate of oxygen basal

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Modern Biological Theories Of Aging

Imre Zs.-Nagy



Modern Biological Theories Of Aging:

Modern Biological Theories of Aging Huber R. Warner, 1987 **Evolutionary Biology of Aging** Michael R. Rose, 1994-10-27 This unique book looks at the biology of aging from a fundamentally new perspective one based on evolutionary theory rather than traditional concepts which emphasize molecular and cellular processes The basis for this approach lies in the fact that natural selection as a powerful determining force tends to decline in importance with age Many of the characteristics we associate with aging the author argues are more the result of this decline than any mechanical imperative contained within organic structures This theory in turn yields the most fruitful avenues for seeking answers to the problem of aging and should be recognized as the intellectual core of gerontology and the foundation for future research The author ably surveys the vast literature on aging presenting mathematical experimental and comparative findings to illustrate and support the central thesis The result is the first complete synthesis of this vital field Evolutionary biologists gerontologists and all those concerned with the science of aging will find it a stimulating strongly argued account

Handbook of the Biology of Aging Edward L. Schneider, John W. Rowe, 2013-10-22 Handbook of The Biology of Aging Third Edition provides a general overview to a wide scientific audience of some of the most important topics in biomedical gerontology The book discusses methodologies for biological aging studies and on animal models Protein modifications with aging special senses circadian rhythms and the adrenocortical axis are tackled in the book as well Gerontologists psychologists health care professionals and graduate students will find the book useful **Anti-Aging Drug Discovery on the Basis of Hallmarks of Aging** Sandeep Kumar Singh, Chih Li Lin, Shailendra Kumar Mishra, 2022-07-19 Anti Aging Drug Discovery on the Basis of Hallmarks of Aging is a comprehensive and timely book on all aspects of anti aging strategies The book provides comprehensive foundational knowledge on the mechanisms of aging and current anti aging strategies and approaches developed Aging research has experienced an unprecedented advance over recent years with the discovery that the rate of aging is determined at least to some extent mainly by our genetics and modulated by environmental factors The hallmarks of aging describe the molecular and cellular processes that govern biological aging and their variation in individuals Covers different aspects of anti aging research from foundational knowledge to future perspectives Provides understanding on the different hallmarks of aging and how they can be applied in the development of anti aging drugs Discusses various anti aging strategies including telomerase reactivation clearance of senescent cells stem cell based therapy and others Aging Research United States. Congress. House. Select Committee on Aging, 1992 Biology of Aging Robert Arking, 2006-02-02 Robert Arking s Biology of Aging 3rd edition is an introductory text to the biology of aging which gives advanced undergraduate and graduate students a thorough review of the entire field His prior two editions have also served admirably as a reference text for clinicians and scientists This new edition captures the extraordinary recent advances in our knowledge of the ultimate and proximal mechanisms underlying the phenomenon of aging As a result six important

conceptual changes are included here Clarified distinctions between the biological mechanisms involved in longevity determination and those involved in senescent processes A new conceptual framework around which we can organize all the new facts about aging This will assist readers to make sense of the information and use the data to form their own ideas Increased knowledge of aging cells has lead to new ideas on how a cell transits from a healthy state to a senescent state while still allowing for high levels of intra and inter specific variability Discussion of senescent mechanisms assists the reader to understand that aging is a non programmatic loss of function likely arising from the loss of regulatory signals and so is modifiable in the laboratory Because the standard evolutionary story does not fully explain the evolution of social organisms this edition also includes recent work dealing with intergenerational resource transfers Lastly if aging mechanisms are plastic then the demand to move these anti aging interventions into the human arena will inevitably grow A discussion of the biological and ethical arguments on both sides of the question frames the question in an appropriate manner The mass of data related to aging is summarized into fifteen focused chapters each dealing with some particular aspect of the problem The last two chapters integrate all this material into a coherent view of how the relevant biological processes change over the life span This view is expressed in two non technical figures you might say that the whole book exists to fully support Figs 9 4 14 9 whose meanings are elucidated as the reader progresses through the book

The Essentials of Community Medicine Dr Aviraj K S, 2022-06-10 Salient features Question Bank of every topic Cloud diagrams to easily remember multiple essential points Illustrated diagrams Bulleted points of presentations Recent updates on every topic National health programmes A special chapter on Tribal Health A special chapter on Family Medicine Special chapter on Child adolescent and geriatric health care Simplified Epidemiology Miscellaneous topics [Aging and Health - A Systems Biology Perspective](#) A. I. Yashin, S. M. Jazwinski, 2014-10-14 Aging is a major risk factor for chronic diseases which in turn can provide information about the aging of a biological system This publication serves as an introduction to systems biology and its application to biological aging Key pathways and processes that impinge on aging are reviewed and how they contribute to health and disease during aging is discussed The evolution of this situation is analyzed and the consequences for the study of genetic effects on aging are presented Epigenetic programming of aging as a continuation of development creates an interface between the genome and the environment New research into the gut microbiome describes how this interface may operate in practice with marked consequences for a variety of disorders This analysis is bolstered by a view of the aging organism as a whole with conclusions about the mechanisms underlying resilience of the organism to change and is expanded with a discussion of circadian rhythms in aging Finally the book presents an outlook for the development of interventions to delay or to reverse the features of aging The publication is recommended to students researchers as well as professionals dealing with public health and public policy related to an aging society [Reframing Aging](#) Melissa K. Melby, 2025-09-10 How do we age Why do we age How and why does menopause happen Do different cultures have different

approaches and attitudes to and experiences of aging and menopause Reframing Aging Insights from Biology and Culture of Midlife Japanese uses a biocultural framework to try to answer these questions and gain insights on aging and menopause in Japan the United States and beyond Drawing on years of fieldwork and lab work in Japan and over a decade of living and working in Japan at several universities and the National Institute of Health and Nutrition with follow up interviews spanning over 20 years Melissa Melby challenges what are often considered normal experiences of aging and menopause This book introduces a proximate ultimate biocultural framework to guide the reader through questions of how proximate and why ultimate we age and experience menopause as we do Drawing insights from evolutionary biology and societal level phenomena and the language of lived experience it explores how cross cultural variation in expectations medicalization collectivism lifestyles and other factors may influence how symptoms of aging and menopause are perceived experienced and treated Reframing Aging Insights from Biology and Culture of Midlife Japanese offers new approaches and insightful perspectives for students of biological cultural medical anthropology gerontology Asian studies women and gender studies medicine and public health

Oxygen Radicals in Biology and Medicine Michael Simic, 2013-03-09 This book is based on the papers presented at the Fourth International Congress on Oxygen Radicals 4 ICOR held June 27 July 3 1987 at the University of California La Jolla The chapters deal with the phenomena associated with highly reactive oxygen species hydroxy peroxy alkoxy aroxy and superoxide radicals as well as singlet oxygen and their peroxidation products hydrogen peroxide hydroperoxides peroxides and epoxides as they relate to the fields of chemistry food technology nutrition biology pharmacology and medicine The kinetics energetics and mechanistic aspects of the reactions of these species and the interrelationship of oxygen radicals or any other free radicals and peroxidized products have been emphasized Special attention is focused on the mechanisms of the generation of free radicals and peroxy products in biosystems and on the adverse effects of these radicals and products in humans The topics span the continuum from the simple chemistry of model systems to the complex considerations of clinical medicine The book also explores the mechanisms of agents that protect against free radicals and peroxy products in vitro and in vivo These agents include antioxidants used in materials food antioxidants physiological antioxidants and antioxidant enzymes SOD glutathione peroxidase and catalases The use of these inhibitors to prevent damage to organs being prepared for transplantation thereby maintaining the quality of transplanted organs and or extending their shelf life also is examined

The Membrane Hypothesis of Aging Imre Zs.-Nagy, 1994-07-12 The Membrane Hypothesis of Aging offers the most comprehensive multidisciplinary description of the cell maturation and aging process The membrane hypothesis of aging MHA described in this book is based on the actual multidisciplinary knowledge of cell morphology physiology and biochemistry The solid basis of known facts explains the destructive progressive intrinsic and universal character of the aging process The book interprets other aging theories including free radical theory of aging dysdifferentiation hypothesis of aging and cancer and the accumulation theories It presents important

issues for future research The book also outlines the possibilities of an efficient preventive anti aging drug design and presents the first promising results of such research activity

Physiological Basis of Aging and Geriatrics Paola S. Timiras, 2007-08-16 Extensively revised and updated to reflect the current state of knowledge in the study of aging this Fourth Edition offers a complete profile of the aging process at all levels from molecules and cells to demography and evolution Written by international experts in current basic and clinical aging research this text includes aspects of individual comparative and differential aging and discussions of theories and mechanisms of aging This invaluable reference illustrates how bodily systems organs and functions are affected with aging describes how genetic and environmental factors influence age related changes and addresses some of the clinical consequences of these changes for health and longevity Well illustrated with numerous tables and graphs this book presents up to date information from internationally renowned experts in various bio medical fields

Human Senescence Douglas E. Crews, 2003-12-11 Much research on the biology of senescence is on cell lines nematodes or fruit flies that are only of peripheral relevance to the problems encountered in humans Human Senescence is a text which reviews the evolutionary biology of human senescence and life span and the evolutionarily recent development of late life survival It examines how human patterns of and variability in growth and development have altered later life survival probabilities and competencies and how survival during mid life contributes to senescent dysfunction and alteration Discussing possibilities of further extending human life span it gives a better understanding of how humans came to senesce as slowly as we do over our lifespan Bringing together gerontological anthropological and biocultural research it explores human variation in chronic disease senescence and life span as outcomes of early life adaptation and the success of humankind s sociocultural evolution It is a benchmark publication for all interested in how and why we age

Experimental Life Prolongation Vladimir V. Frolkis, Khachik K. Muradian, 1991-10-24 This book presents results of lifespan prolongation studies obtained from experimental animal models and clinical and epidemiological human investigations Modern theories experimental models and mathematical models of aging are described as well as factors identified in lifespan prolongation such as reduced body temperature calorie and protein restricted diets antioxidants enterosorption motor activity modulators of genome expression ionizing radiation vitamins microelements and revitalizers Gerontologists physiologists biochemists and physicians active in the field of aging will find this book to be an interesting addition to their reference library

Research Paradigms and Contemporary Perspectives on Human-Technology Interaction Mesquita, Anabela, 2017-01-25 The integration of technology in modern society has created a deeper connectivity between people around the globe as well as provided ample opportunity for the exchange of knowledge and ideas These interactions allow greater opportunities for developments in research and innovation Research Paradigms and Contemporary Perspectives on Human Technology Interaction presents comprehensive coverage on the application of information technology and systems on daily activities and examines its impacts at an interdisciplinary level Highlighting

numerous insights into relevant areas such as e government web accessibility and social media this book is an ideal reference source for academics professionals practitioners graduate students and researchers seeking material on the relationship between humans and emerging technologies in modern society

Nutrition for the Older Adult Melissa Bernstein, Nancy Munoz, 2019-02-11 Updated to the latest data and expert information the Third Edition of Nutrition for the Older Adult introduces students to the unique nutritional needs of this growing population Designed for the undergraduate the text begins by covering the basics including the demographics of aging physiology of aging and vitamin and mineral requirements for older adults It then delves into clinical considerations including the nutritional implications of diseases and conditions common among older adult Additional coverage includes nutritional assessment pharmacology nutritional support and much more With new pedagogical features along with revamped end of chapter activities and questions Nutrition for the Older Adult is an essential resource for students in the fields of nutrition nursing public health and gerontology

The Journey of Life Thomas R. Cole, 1992-11-27 The Journey of Life envisions growing up and growing old as a voyage down a river flowing inexorably to the sea With this image of the human life cycle the author explores the historical shoreline of later life charting its cultural forms and sounding their depths The result is both a cultural history of aging and a contribution to public dialogue about the meaning and significance of later life The core of the book shows how central texts and images of Northern

Endocrinology of Aging John E. Morley, Lucretia van den Berg, 1999-11-05 Distinguished physicians critically review the clinical consequences of the endocrinological changes that occur with aging in both men and women and examine the use of hormonal therapy to reduce them Topics range from bone disease and water balance in all older people to androgen deficiency in aging males gynecomastia and menopause The authors also discuss Type II diabetes in persons over 65 emphasizing the cognitive benefits of good glycemia control and the interaction of nutrition and metabolism focusing on hypocholesterolemia obesity the anorexia of aging trace elements and vitamins The aging of the sympathetic nervous system and its impact on hypertension in the elderly is also covered Timely and authoritative Endocrinology of Aging offers endocrinologists geriatricians and primary care physicians critical insight into the endocrine problems of our rapidly growing elderly population

Fostering Development in Midlife and Older Age Irina Catrinel Crăciun, 2023-02-22 This handbook integrates and discusses a growing evidence base concerning individual development across middle and late adulthood The book includes a comprehensive analysis of what growth implies within midlife and older age and considers how different developmental areas are intertwined i e physical cognitive social and emotional development as well as personality growth As the gap between theory and practice still constitutes an issue in developmental research the handbook also aims to provide illustrative examples of prevention and intervention from a positive psychology perspective These were selected to represent a variety of topics relevant for individual development where research informs practice ranging from happiness grandparenthood love and sexuality to loneliness depression anxiety suicide prevention and coping with death This handbook

is a must have resource for students and researchers working in developmental psychology health psychology gerontology and public health It will also be of interest to practitioners such as counsellors life coaches psychotherapists organizational psychologists health professionals social workers or public health planners **Dementia and Normal Aging** Felicia A. Huppert, Carol Brayne, Daniel W. O'Connor, 1994-06-30 Age has been identified as the strongest risk factor for Alzheimer s disease and is also strongly associated with vascular dementia With this relationship in mind this book looks upon the challenge of dementia as establishing its true relationship with normal aging The traditional disease model of dementia may have obscured important clues about many underlying causes and features of dementia In this book experts and pioneers in the fields of aging and dementia make an important contribution to the understanding of dementia by reappraising the latest research in the light of the continuum model Evidence for and against numerous models of dementia are discussed with particular relevance to the relationship between Alzheimer s and normal aging Ranging from molecular genetics and fundamental neurobiology to issues of diagnosis and the provision of services this is a challenging work in its breadth and level of argument which has far reaching implications for the study of dementia and indeed of the mind itself As a review of current thinking and research it will serve as an essential text for clinicians and scientific investigators

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Table of Contents Modern Biological Theories Of Aging

1. Understanding the eBook Modern Biological Theories Of Aging
 - The Rise of Digital Reading Modern Biological Theories Of Aging
 - Advantages of eBooks Over Traditional Books
2. Identifying Modern Biological Theories Of Aging
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Modern Biological Theories Of Aging
 - User-Friendly Interface
4. Exploring eBook Recommendations from Modern Biological Theories Of Aging

- Personalized Recommendations
- Modern Biological Theories Of Aging User Reviews and Ratings
- Modern Biological Theories Of Aging and Bestseller Lists
- 5. Accessing Modern Biological Theories Of Aging Free and Paid eBooks
 - Modern Biological Theories Of Aging Public Domain eBooks
 - Modern Biological Theories Of Aging eBook Subscription Services
 - Modern Biological Theories Of Aging Budget-Friendly Options
- 6. Navigating Modern Biological Theories Of Aging eBook Formats
 - ePub, PDF, MOBI, and More
 - Modern Biological Theories Of Aging Compatibility with Devices
 - Modern Biological Theories Of Aging Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Modern Biological Theories Of Aging
 - Highlighting and Note-Taking Modern Biological Theories Of Aging
 - Interactive Elements Modern Biological Theories Of Aging
- 8. Staying Engaged with Modern Biological Theories Of Aging
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Modern Biological Theories Of Aging
- 9. Balancing eBooks and Physical Books Modern Biological Theories Of Aging
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Modern Biological Theories Of Aging
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Modern Biological Theories Of Aging
 - Setting Reading Goals Modern Biological Theories Of Aging
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Modern Biological Theories Of Aging

- Fact-Checking eBook Content of Modern Biological Theories Of Aging
- Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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