

especially the genetics) of nematode aging, the rest of reductionist gerontology is floundering in a morass of irreproducible results, exaggerated claims, and antiaging hustles. The author's mapping of this sad terrain of dubious practices and false dawns is bracing, by turns amusing and tragic.

It might be suggested that the misfortunes of most reductionist gerontology arise in part from its studied neglect of the evolutionary foundations of aging. But the last 50 years of research on those foundations are largely absent from a book that claims to cover *The Science of Longevity*. However, any thoughtful biologist would profit from reading about the detailed genetics of life-history characters in nematodes expertly illuminated in this volume.

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AGING: GEROSCIENCE AS THE NEW PUBLIC HEALTH FRONTIER. *Second Edition. Cold Spring Harbor Perspectives in Medicine.*

Edited by James L. Kirkland, S. Jay Olshansky, and George M. Martin. Cold Spring Harbor (New York): Cold Spring Harbor Laboratory Press. \$55.30. xiii + 246 p.; ill.; index. ISBN: 9781621824312 (hc); 9781621824329 (eb). 2024.

CONCEPTUAL BREAKTHROUGHS IN THE EVOLUTIONARY BIOLOGY OF AGING. *Conceptual Breakthroughs Series.*

By Kenneth R. Arnold and Michael R. Rose; edited by John C. Avise. Academic Press. Amsterdam (The Netherlands) and New York: Elsevier. \$102.00 (paper). xix + 288 p.; ill.; author index and index. ISBN: 978-0-12-821545-6. 2023.

The biology of aging (biogerontology) is currently a confused and fragmented field, short on consensus about general principles. However, one certainty is that the process of aging is largely specified by the genome; this is clear from the large differences in maximum life span between animal species. Why our genes cause us to age and die is explained by the evolutionary theory of aging; late-life ailments—Alzheimer's, osteoarthritis, COPD—are caused, ultimately, by the evolutionary process. Thus, the evolutionary theory of aging offers a conceptual foundation for biogerontology.

Michael Rose is major figure in biogerontology, particularly for his experimental validation of the evolutionary theory of aging. He is also one of the field's best writers: his 1991 *Evolutionary Biology of Aging* (New York: Oxford University Press) remains one of the finest books ever written about aging. This new work, written with his graduate student Kenneth Arnold, serves as an update of the previous volume, and

as such is extremely useful. Its format is unusual: as specified by the Conceptual Breakthroughs series it mainly consists of 59 short chapters, each defining a standard paradigm and then describing the conceptual breakthrough that transformed it. Starting with Aristotle in 384–322 BC and ending with findings from 2020 on evolutionary adaptation to diet, the book provides a sweeping history of the development of ideas on the subject.

The first third of the volume gives particular emphasis to the development of explicit population genetic models that describe the evolution of aging, particularly by W. D. Hamilton and Brian Charlesworth (who was Rose's PhD supervisor at the University of Sussex). These created the foundation for experimental tests, proof, and elaboration of the theory in the subsequent decades, which is the subject of many of the remaining chapters. This excellent book, distinguished by its high level of intellectual rigor and firm grounding in the evolutionary paradigm, is essential reading for anyone who wants to understand biogerontology. I myself learned a great deal from it. Its clarity and presentation in easily digestible, bite-sized chunks makes it well suited for university courses on aging.

A striking feature of the volume is its trenchant criticism of the current state of the aging field, particularly its neglect of the proven evolutionary theory in favor of a traditional view of aging as a passive process of damage accumulation, mainly arising at the subcellular level. Arnold and Rose rail against such "reductionist gerontology," describing it as "utterly defunct" (p. 261), and draw parallels with 19th-century failures in the medical field to abandon the old miasma theory of disease after Pasteur and Koch's development of germ theory. Some readers might mistake such criticism for inective, but in fact it simply states what is the case.

Why such neglect? The following quote offers one explanation: "The challenge that the evolutionary biology of aging faces is the difficulty of proceeding from patterns of natural selection through genetic machinery to the specific physiological mechanisms involved in the loss of function at later adult ages" (p.181). There remains a gap in the theory to explain exactly how evolutionary mechanisms act in terms of actual biological processes that cause late-life diseases. Bridging that could help evolutionary theory take its rightful place as the main paradigmatic driver of research on the biology of aging.

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