tologists' view that coelacanths and tetrapods both descended from Devonian rhipidistians. Yet similarities in the inner ear and spinal cord of *Latimeria* and fossil rhipidistians are explainable on grounds other than ancestry, namely convergence. Other theories suggest that lungfishes and coelacanths are the sister group to the tetrapods, supported by brain characteristics, or that *Latimeria* is the sister group to lungfish and tetrapods (assumed by Thomson), on the basis of evidence from certain soft anatomy and skeletal characters. The most provocative theory suggests that *Latimeria* is more closely related to sharks and other cartilaginous fishes, sharing with them similarities in the anatomy of the pituitary and pancreas and possession of a rectal gland, large eggs, and a mechanism of osmoregulation using urea and trimethylamine oxide. This is dismissed by many as the result of the retention of primitive vertebrate features; however, the complex shared pituitary condition is hard to explain away by convergence.

This work would have benefited from a more extensive bibliography (literature is cited only as notes to text) and a discussion of the recent discoveries made by the Japanese. Last, a more extensive discussion of the recent Comoran political and social milieu (including the coups by soldier of fortune Bob Denard, the recent presidential assassination, and the increasing population and poverty of the Comores) would help to explain the difficulties that coelacanth protection will encounter in such a poor fishing nation.

*Latimeria* and its kin, enigmas since the Cretaceous, remain such.

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## The Biology of Aging

**Longevity, Senescence, and the Genome.** CALEB E. FINCH. University of Chicago Press, Chicago, IL, 1991. xvi, 922 pp., illus. $49.95. John D. and Catherine T. MacArthur Foundation Series on Mental Health and Development

It is not an easy task to review a book that spans survival analysis, endocrinology, biochemistry, paleobiology, morphogenesis, life history theory, molecular biology, neurobiology, and immunology and that introduces 600 or so animal and plant species along the way.

While trying to think about how to synthesize the book, I find myself instead thinking about the author. Here, too, a profusion of images arises. First there is Caleb Finch, professor in the neurobiology of aging and doyen of an influential and productive research group on neuroendocrine and reproductive senescence. Then, pushing this image aside, comes that of an old-time prospector. Scientific discovery is a bit like digging for gold. The pioneering work gets done by individualists, frequently following lonesome trails, commonly a little eccentric, and often failing in their quests. Every now and then, an inspired or lucky strike turns up a vein rich and promising enough to draw a crowd. Gerontology has been slow to yield up its nuggets of gold, but in this remarkable book Finch has dug up a veritable treasury of information. That he has prospected far and wide is evidenced by the 163 pages of bibliography, listing nearly 4000 scientific papers.

In Finch's case, the work was not done when the gold was dug. Now Finch emerges as curator of a vast and heterogeneous collection, classifying and cataloguing his finds for those who would come and browse. Finch the curator guides us through his collection with an agenda of key questions: How valid is the lifespan as a measure of the rate of senescence? When does senescence begin? At what levels of organization do genes influence senescence? What are the relative contributions of selective (nonrandom) and random changes in gene expression and other cell functions during senescence? How directly do genes operating during development or adult life specify senescence? How do species vary in reproductive senescence, including the total production of gametes and incidence of developmental abnormalities? How much plasticity in senescence arises from environmental (that is, nongenetic) factors? How universal among species are age-related degenerative changes at the organismic, cellular, and molecular levels? When the agenda is reviewed in the closing chapter, we remain a long way short of the definitive answers we would like, but we know much better the limits of our knowledge.

It is probably fair to say that progress in gerontology has so far been slow. The reason can be summed up in a single word: diversity. *Longevity, Senescence, and the Genome* is above all a book about diversity. The diversity begins at the level of individual survivorship. Even if two individuals are physically identical in every respect, the chances are that they will live different lifespans. The moment of death, that ultimate phenotypic character, is strongly influenced by chance. Diversity extends through species' life history patterns, through gene effects on aging within a population, through nongenetic factors like diet and exercise, and through the random, insidious defects that accumulate hour by hour and day by day in the molecular machinery of the cells. When a subject is as diverse as senescence, what is important to work on assumes a fuzziness quite unlike the problems faced, for example, in cancer research.

And yet, in spite of the immense diversity of its phenomena, gerontology does gain some degree of coherence from the application of evolutionary theory. Successive generations of evolutionary biologists, beginning with August Weismann and Alfred R. Wallace, have refined our understanding of the evolution of senescence to the point where we now have pretty good reason to believe that in a species like our own aging occurs because natural selection places higher priority on turning out progeny to carry our genes forward than on keeping individuals going; in effect, late survival is sacrificed for reproduction. Extending through a more diverse range of reproductive patterns, the burgeoning discipline of evolutionary life-history theory provides us with the intellectual framework to approach questions like why some species get only a single shot at reproduction (semelparity) while others get more (iteroparity) and why species differ in their longevities. Using the theory to good effect, Finch mingles with it his obvious collector's joy in classifying species according to whether they show rapid, gradual, or negligible senescence and, later, in exploring the evolutionary record for clues to how senescence really evolved.

A book as broad-ranging as *Longevity, Senescence, and the Genome* is bound to have some flaws. On the whole, the structure is good. In addition to the extensive bibliography, there are comprehensive indexes of authors, species, and subjects and a glossary. These are essential for a major reference work such as this. Sometimes, however, Finch has relied too heavily on organizing material within chapters on a phylogenetic basis. This is most obviously a problem in the chapter on gene expression and macromolecular biosynthesis, where general concepts are tucked into some oddly narrow slots. I am also somewhat puzzled by two consecutive sections in the chapter on "Negligible senescence" that are headed "indeterminate lifespans and negligible senescence" and "finite lifespans with negligible senescence," since negligible senescence, as Finch defines it, is logically linked with indeterminate lifespan.

But the book as a whole is magnificent. Not since Alex Comfort's *The Biology of Senescence*, last updated in 1979, has there been a book in the field as broad in scope as this one. I am tempted to say that *Longevity, Senescence, and the Genome* is worth its weight in gold, but it is a big book and this would be pushing imagery too far. Suffice it

to say that it is sure to become an essential resource for anyone even remotely interested in the biology of aging.

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## Spectrometry for Biology

**Biological Mass Spectrometry**. A. L. BURLINGAME and J. A. MCCLOSKEY, Eds. Elsevier, New York, 1990. x, 700 pp., illus. $230.75. From a symposium, San Francisco, CA, Aug. 1989.

Biological mass spectrometry is a field that, for the most part, did not exist only 10 years ago. Mass spectrometry has long demonstrated an exceptional capability to characterize minute quantities of less complex molecular species, but most biomolecules are notoriously resistant to volatilization, which is the necessary adjunct to the production of gas-phase ions. The development in the last decade of a variety of techniques (MeV and keV ion impact, electrospray, and pulsed laser ablation) that can produce intact gas-phase molecular ions and structurally significant fragment ions of peptides and proteins, sugars, nucleotides, and small oligonucleotides has produced an explosion of interest in the use of mass spectrometry for biomolecular characterization.

This book, the proceedings of an international conference, draws together significant contributions from most of the major players in this game and does so in a way that makes it most useful, particularly for newcomers to the field. Most of the 36 papers contained in the volume deal with various aspects of the techniques and applications of biomolecular mass spectrometry, and together they provide a broad overview of the subject. These contributions are usually detailed and of high quality. Protein sequencing is particularly well covered, but applications to oligosaccharides, glycopeptides and glycolipids, nucleosides, and pharmaceutical problems are also discussed. There are also some contributions from people outside the field, both general overviews and discussions of specific problems, that take a biological rather than a mass-spectroscopic viewpoint. These papers retain a chatty style, complete with jokes of varying quality, which indicates that they were largely transcribed from tapes of the original lectures, with appropriate figures usually added so that the sense of the lecture can be followed. By getting close to the spirit of the talks, these papers enhance the volume.

Significant portions of the discussions that followed the oral presentations are included, which can be of great value in giving the newcomer a sense of perspective and a feeling for personalities that cannot be gained solely from reading the papers themselves. Attention has been paid to details: the book is printed in an attractive font, figures are scaled so as to be legible, references contain the full titles of works.

The editors mention in their preface that no graduate-level textbook in this area yet exists and express the hope that this volume will prove useful to students and newcomers to the field. I believe that they have succeeded in that endeavor. I recommend the book highly, both to new and existing practitioners of mass spectrometry and to those researchers in the pharmaceutical and life sciences who are not yet fully aware of the new power of this old technique.

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## Books Received

**Accretion-Powered Compact Binaries**. Christopher W. Mauche, Ed. Cambridge University Press, New York, 1991. xxii, 474 pp., illus. $54.50. From a workshop, Santa Fe, NM, Oct. 1989.

**Adolescent Stress**. Causes and Consequences. Mary Ellen Colten and Susan Gore, Eds. De Gruyter, New York, 1991. xii, 330 pp., illus. $42.95; paper, 19.95. Social Institutions and Social Change. From a conference Nov. 1987.

**Advances in Core Evaluation**. Accuracy and Precision in Reserves Estimation. Paul F. Worthington, Ed. Gordon and Breach, New York, 1990. xii, 555 pp., illus. $106. From a meeting, London, U.K., May 1990.

**Advances in Dental Anthropology**. Marc A. Kelley and Clark Spencer Larsen, Eds. Liss (Wiley), New York, 1991. xiv, 389 pp., illus. $96. From a conference, Kansas City, MO, 1988.

**Basic, Clinical, and Therapeutic Aspects of Alzheimer's and Parkinson's Diseases**. Vol. 2. Toshiharu Nagatsu, Abraham Fisher, and Mitsuo Yoshida, Eds. Plenum, New York, 1990. xviii, 619 pp., illus. $115. Advances in Behavioral Biology, vol. 38B. From a conference, Kyoto, Japan, Nov. 1989.

**Cerebral Sinus Thrombosis**. Experimental and Clinical Aspects. Karl Einhäupl, Oliver Kempski, and Alexander Baethmann, Eds. Plenum, New York, 1990. viii, 234 pp., illus. $69.50. From a symposium, Nymphenburg, F.R.G., Sept. 1987.

**The Challenging Questions**. Antonino Zichichi, Ed. Plenum, New York, 1990. viii, 468 pp., illus. $120. Subnuclear Series, 27. From a course, Sicily, Italy, July 1989.

**Chemical Graph Theory**. Introduction and Fundamentals. Danail Bonchev and Dennis H. Rouvray, Eds. Abacus (Gordon and Breach), New York, 1991. xii, 288 pp., illus. $115. Mathematical Chemistry, vol 1.

**Chemical Signals in Vertebrates 5**. D. W. MacDonald, D. Muller-Schwarze, and S. E. Natynczuk, Eds. Oxford University Press, New York, 1990. xxiv, 659 pp., illus. $95. From a meeting, Oxford, U.K. Aug. 1988.

**Chemistry of Nucleosides and Nucleotides**. Vol. 2. Leroy B. Townsend, Ed. Plenum, New York, 1991. x, 468 pp., illus. $95.

**Chernobyl**. A Policy Response Study. Boris Segerstáhl, Ed. Springer-Verlag, New York, 1991. x, 179 pp., illus. $59. Springer Series on Environmental Management.

**Children's Drawings**. Iconic Coding of the Environment. Martin Krampen. Plenum, New York, 1991. x, 238 pp., illus. $45. Topics in Contemporary Semiotics.

**Dynamics of Polyatomic Van der Waals Complexes**. Nadine Halberstadt and Kenneth C. Janda, Eds. Plenum, New York, 1990. x, 542 pp., illus. $120. NATO Advanced Science Institutes Series, vol. 227. Series B, Physics. From a workshop, Castéra-Verduzan, France, Aug. 1989.

**The Economic Organization of the Household**. W. Keith Bryant. Cambridge University Press, New York, 1991. xviii, 286 pp., illus. $64.50; paper, $19.95.

**Groundwater Geomorphology**. The Role of Subsurface Water in Earth-Surface Processes and Landforms. Charles G. Higgins and Donald R. Coates, Eds. Geological Society of America, Boulder, CO, 1990. xii, 368 pp., illus. Paper, $60. Geological Society of America Special Paper 252. From a symposium, Reno, NV, 1984.

**Handbook of Mental Retardation**. Johnny L. Matson and James A. Mulick, Eds. Pergamon, New York, 1991. xvi, 672 pp., illus. $100. Pergamon General Psychology Series, 121.

**International Law and Pollution**. Daniel Barstow Magraw, Ed. University of Pennsylvania Press, Philadelphia, 1991. xviii, 368 pp. $37.95. From a colloquium, Charlottesville, VA, April 1988.

**Neotectonics in Earthquake Evaluation**. Ellis L. Krinitzsky and D. Burton Slemmons, Eds. Geological Society of America, Boulder, CO, 1990. vi, 160 pp., illus. $37.50. Reviews in Engineering Geology, vol. 8. From a symposium.

**Preparative Polar Organometallic Chemistry**. Vol. 2. L. Brandsma. Springer-Verlag, New York, 1990. xii, 227 pp., illus. $49.

**Principles of Geology**. Vol. 2. Charles Lyell. University of Chicago Press, Chicago, IL, 1991. xii, 330 pp., illus. Paper, $15.95. Reprint, 1832 ed.

**The Psychology of War and Peace**. The Image of the Enemy. Robert W. Rieber, Ed. Plenum, New York, 1991. xx, 282 pp., illus. $39.50.

**Quasicrystals, Networks, and Molecules of Fivefold Symmetry**. István Hargittai, Ed. VCH, New York, 1990. xiv, 314 pp., illus., + plates. $85.

**Radar and Sonar**. Part 1. Richard E. Balahut, Willard Miller, Jr., and Calvin H. Wilcox. Springer-Verlag, New York, 1991. xii, 260 pp., illus. $34. Institute for Mathematics Volumes in Mathematics and Its Applications, vol. 32. From a summer school, June 1990.

**Relativistic Quantum Mechanics and Quantum Fields**. T.-Y. Wu and W.-Y. Pauchy Hwang. World Scientific, Teaneck, NJ, 1991. xiv, 405 pp., illus. $68; paper, $38.

**Reproductive Behavior of Insects**. Individuals and Populations. W. J. Bailey and J. Ridsdill-Smith, Eds. Chapman and Hall (Routledge, Chapman, and Hall), New York, 1991. x, 339 pp., illus. $95.

**Reptiles and Amphibians**. Eastern/Central North America. Roger Conant and Joseph T. Collins. Illustrations by Isabelle Hunt Conant and Tom R. Johnson. 3rd ed. Houghton Mifflin, Boston, MA, 1991. xx, 450 pp., + plates. $22.95; paper, $15.95. Peterson Field Guide Series.

**The Role of Women in the Development of Science and Technology in the Third World**. A. M. Farugui, M. H. A. Hassan, and G. Sandri, Eds. World Scientific, Teaneck, NJ, 1991. xx, 970 pp., illus. $58. From a conference, Trieste, Italy, Oct. 1988.

**Salt Diapirs of the Great Kavir, Central Iran**. M. P. A. Jackson *et al.* Geological Society of America, Boulder, CO, 1990. x, 139 pp., illus. + plates. $36.25. Geological Society of America Memoir 177.

**The Stockholm School of Economics Revisited**. Lars Jonung, Ed. Cambridge University Press, New York, 1991. xxii, 471 pp., illus. $64.50. Historical Perspectives on Modern Economics. From a conference, Stockholm, Sweden, Aug. 1987.

**Tectonic Evolution of the North Sea Rifts**. D. J. Blundell and A. D. Gibbs, Eds. Clarendon (Oxford University Press), New York, 1990. xiv, 272 pp., illus. $125. International Lithosphere Programme Publication no. 181.

**The Virgin and the Mousetrap**. Essays in Search of the Soul of Science. Chet Raymo. Viking, New York, 1991. xx, 182 pp. $18.95.

**Voices of the Mind**. A Sociocultural Approach to Mediated Action. James V. Wertsch. Harvard University Press, Cambridge, MA, 1991. xii, 169 pp. $24.95.

**What is Integrability?** V. E. Zakharov, Ed. Springer-Verlag, New York, 1991. xiv, 321 pp., illus. $69. Springer Series in Nonlinear Dynamics.

**Youth and Drugs**. Society's Mixed Messages. Hank Resnik *et al.*, Eds. Office for Substance Abuse Prevention, U.S. Department of Health and Human Services, Rockville, MD, 1991 (distributor, National Clearinghouse for Alcohol and Drug Information, Rockville, MD). viii, 174 pp. OSAP Prevention Monograph, 6.