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BOOK REVIEWS

DEVELOPMENT AND EVOLUTION OF THE NEURAL CREST[1]

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The evolution of vertebrates is inextricably linked with a distinct yet enigmatic population of embryonic cells called the neural crest. The wide variety of adult tissues whose developmental origin can be traced in whole or in part to the neural crest includes the skull and teeth, pigment cells, sensory and autonomic ganglia, thyroid and adrenal glands, and the heart. Indeed, neural-crest contributions are so pervasive in all vertebrates that the appearance of the neural crest itself has been hailed as a key feature in the initial evolution of the vertebrate subphylum from nonvertebrate chordates (Northcutt and Gans, 1983). In view of the extreme importance of the neural crest to vertebrate biology and the current evolutionary climate with its renewed focus on the relation between development and evolution, it is not surprising that, over the last several years, the neural crest has received increased attention from a wide spectrum of biologists. A prime example of this trend is *Developmental and Evolutionary Aspects of the Neural Crest,* which comprises the proceedings of a symposium held in December 1985 at the annual meeting of the American Society of Zoologists.

As promised in its title, the book includes contributions by both developmental biologists and evolutionary biologists. To the editor's credit, these include some of the foremost investigators now working on the neural crest. The book's organization reflects the focus of current studies. Thus, following the introductory chapter by Maderson, there are sections on developmental biology (by M. Bronner-Fraser, J. Bagnara, and D. Noden), development and organization of the nervous system (by R. Bellairs, A. Jacobson, and M. Gershon), and skeletal development and evolution (by B. Hall, A. Lumsden, K. Thomson, and B. Halstead). The volume closes with an epilogue by C. Gans, mirroring his role in the symposium. As is typical of contributed volumes, many chapters include previously published work. However, unlike many cases in which this is a liability, here it adds to the book's value. For example, much of what is known about the developmental biology of the neural crest has been discovered in only the last 10–15 years. While this includes a tremendous amount of information relevant to comparative and evolutionary biologists, most of it has been published in journals and books typically ignored by (if not inaccessible to) these researchers. Many of the chapters provide excellent introductions to this literature.

There also is much that is new. For example, in his excellent review of the role of the neural crest in tooth development (ostensibly in mammals, but also with a substantial discussion of amphibians), Lumsden provides evidence that trunk (i.e., postcranial) neural crest can, at least in experimental situations, form bone and teeth. These data stand in stark contrast to one of the central axioms of neural crest biology, that neural crest skeletogenic potential is confined to the head, at least during normal development, and open the door to the possibility that the neural crest is the embryonic source of some postcranial skeletal tissues in at least some vertebrates. I agree with Thomson, who speculates along these lines in his chapter, that this is especially likely for the dermal skeleton of fishes.

An explicit goal of the symposium was to provide a " 'face to face meeting' between interested specialists [and thereby] permit evolutionary biologists to consider further the mechanisms underlying phenotypic change . . ." (p. 6). Clearly, evolutionists need more time to contemplate these mechanisms. Developmental biologists have been intensely studying the neural crest for years, due in no small part to its biomedical importance. On the other hand, interest in the neural crest as a key to understanding vertebrate evolution is a much more recent phenomenon. Evolutionary scenarios, however well argued, remain speculative in the absence of confirmatory data. For example, both Thomson and Halstead took on the commendable but unenviable task of discussing the evolution of the dermal skeleton in fishes in the context of the neural crest, even though there exists no direct evidence of a neural crest contribution to it. It is not that there is evidence against a neural-crest contribution; there is no evidence for it either. Consequently, while Thomson and Halstead provide a good deal of information about the evolution of early vertebrate skeletal tissues, as well as models for their formation, very little is added to current knowledge of the neural crest per se. At the same time, developmental biologists, to whom many of us are turning for answers, are noticeably reluctant to discuss the evolutionary implications of their work. In the present volume, only Hall and Lumsden made earnest attempts to bridge the two disciplines.

The neural crest provides an opportunity to examine and, in some cases, to resolve both long-standing and

[1] *Developmental and Evolutionary Aspects of the Neural Crest.* P. F. A. Maderson, editor. John Wiley & Sons, N.Y. 1987. xvi + 394 pp. $74.95 cloth.

contemporary questions in vertebrate evolutionary biology. These include the developmental basis of homology, the role of heterochrony in morphological diversification, the nature of developmental constraints, and the developmental basis of size and shape change. A great deal of basic information already exists but remains underutilized; more data must be obtained, especially concerning taxa other than the few "laboratory" species so well-studied by developmental biologists. If this volume is viewed in its proper context—as an introduction and not a conclusion—then it will have served a valuable purpose.

LITERATURE CITED

NORTHCUTT, R. G., AND C. GANS. 1983. The genesis of neural crest and epidermal placodes: A reinterpretation of vertebrate origins. Quart. Rev. Biol. 58:1–28.

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OXFORD SURVEYS IN EVOLUTIONARY BIOLOGY[1]

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The fourth annual volume of the Oxford Surveys in Evolutionary Biology was published in 1987. The stated objectives of this series are to stimulate discussion, review current areas of investigation, and present new theoretical ideas and frameworks. The editors have done a good job of balancing the diverse areas of evolution. Each volume generally contains articles on a wide variety of evolutionary topics. For example, Volume 3 contains articles on paleobiology (M. K. Hecht and A. Hoffman), patterns in codon usage (R. Grantham et al.), life-history evolution (G. Bell and V. Koufopanou), two articles on natural selection (F. T. Cloak, Jr. and E. G. Leigh, Jr.), and a review of books dealing with some conceptual problems in evolution (J. A. Endler). Volume 4 seems somewhat weighted towards population genetics (four of the nine articles: J. Maynard Smith, J. H. Gillespie, M. Kreitman, and E. G. Leigh, Jr.). Nevertheless, this series achieves its aim of presenting wide coverage of the field of evolutionary biology. Four of the 31 articles published in the series review the contributions of R. A. Fisher to evolutionary biology. This is perhaps not too surprising for a series published by Oxford University Press, considering Fisher's role in what Turner (Vol. 2) calls "Oxford School of Ecological Genetics."

A list of the authors of the 31 articles published in the first four volumes attests that the editors have been successful in attracting some of the major innovators in evolutionary biology to contribute to this series (e.g., J. Maynard Smith, G. C. Williams, and J. T. Bonner). The quality of the papers generally has been excellent. Any evolutionary biologist would profit by spending a day or so reading the three or four articles that he or she finds of special interest in any of the volumes.

Volume 4 contains nine high quality articles. I found the article by M. Kreitman on molecular population genetics to be especially valuable. J. Maynard Smith provides a personal and entertaining view of J. B. S. Haldane. J. Gillespie reviews the ever ongoing debate about molecular evolution and the neutral allele theory. Although travelling well-trod ground, Gillespie's article is an important contribution, because it outlines a comprehensive alternative to the neutral-allele theory and because it considers the implications of recent data from DNA sequencing to the problem.

The only article I found disappointing in Volume 4 is entitled "What is bet-hedging?" by J. Seger and J. Brockmann. Authors who use question titles should try to answer the question. This article provides an interesting consideration of the importance of distinguishing between expected fitness and the variance of fitness, but it does not tell us what the authors mean by bet-hedging. This and several other aspects of this paper would have benefited from more active editing; the apparent disorganization of this paper makes it difficult to follow. Especially disconcerting is the general lack of topic sentences at the beginning of paragraphs.

The article by F. T. Cloak in Volume 3 also could have benefited greatly by more active editing. There are 76 footnotes in this 55-page article, and the use of new and nonstandard terminology makes this presentation virtually incomprehensible. The introduction of a variety of new terms is usually disconcerting to the reader, but sometimes necessary, especially when trying to achieve the objective of this series to publish new ideas and frameworks. However, there is no justification for redefining many of the most common terms

[1] *Oxford Surveys in Evolutionary Biology*. R. Dawkins and M. Ridley, editors (Vol. 1–3); P. Harvey and L. Partridge, editors (Vol. 4). Oxford Univ. Press, Oxford, U.K. Vol. 1: 1984, 227 pp. $65.00; Vol. 2: 1985, 232 pp. $55.00; Vol. 3: 1986, 256 pp. $60.00; Vol. 4: 1987, 256 pp. $60.00.