Book Reviews

Speciation

Modes of Speciation. MICHAEL J. D. WHITE. Freeman, San Francisco, 1978. viii, 456 pp., illus. $27.50. A Series of Books in Biology.

A number of excellent books dealing with speciation have appeared within the past decade, and another on the subject might seem superfluous were it not that the author has for many years been a major contributor to an understanding of speciation from the vantage point of his own extensive research in animal cytology. This alone commends the present book to the attention of anyone interested in events and conditions leading to speciation. In addition, methods have been developed in recent years that have greatly increased our knowledge of genetic variability at the biochemical level and our knowledge of chromosome architecture. Data based on these newer methods as they relate to speciation are effectively discussed by White in evaluating various models of speciation.

Chromosomal changes in relation to speciation receive special attention, which is understandable not only because of the background of the author but also because the available data indicate to him that over 90 percent and perhaps over 98 percent of all speciation events are accompanied by karyotypic change. Furthermore, in most instances such change is thought to play the primary role in initiating divergence leading to speciation. The author recognizes that speciation may occur in the absence of karyotypic change, as appears to be true for several groups of *Drosophila*, especially those in the Hawaiian fauna, but the suggestion is made that even among species that are indistinguishable in the banding pattern of polytene salivary chromosomes there may be differences in the amount and distribution of heterochromatin. Since so little is known about the genetic role of heterochromatin, however, one can at present merely speculate on the significance to speciation of any differences that may eventually be found in the heterochromatin between species that are otherwise chromosomally identical.

The best-understood model of speciation involving chromosomes is polyploidy, which involves duplication of whole sets of chromosomes, usually following hybridization between chromosomally differentiated species. This is a frequent mode of speciation in plants but apparently of only minor significance in animals. In this book polyploidy is discussed in the interest of completeness, but the discussion is not very rewarding to those familiar with the subject, because this mode of speciation has been so thoroughly treated by others that little of interest could be added.

The discussion of allopatric models of speciation follows, in general, familiar reasoning, but is made particularly interesting by the presentation of an excellent account of the exciting and significant recent studies of speciation among the Drosophilidae in the Hawaiian archipelago. There can be no question that these extensive studies constitute the most significant investigation of speciation in any archipelago. Because the sequence of the origin of a number of closely related species in Hawaii has been demonstrated and because speciation has often followed from the establishment of a very small founder population on a different island, special attention is given to genetic effects associated with founder populations.

Sympatric speciation is accepted as a frequent mode of speciation by the author, who at the same time admonishes the reader to avoid semantic problems by recognizing that sympatry simply means living in the same geographical area. The sympatric model that is presented considers the primary step in speciation to be adaptation to different habitats or niches within the same area. Within this context one should have little difficulty accepting sympatric speciation as a frequent mode of speciation, for there can be little question that contrasting habitats within the same general area can provide a setting for divergence that may lead to speciation. But one should also bear in mind that populations selected for adaptation to different habitats are microgeographically disjunct if not geographically separated.

The discussion of stasipatric speciation is of special interest because it expounds a model of speciation recently proposed by the author. The model was developed in the first instance to explain the pattern of chromosomal relationships in coastal forms of the grasshopper genus *Vandiemenella* in southern Australia. Since similar patterns of relationship are found in a number of other groups of animals, the suggestion is made that stasipatric speciation may be frequent in many groups of animals of limited vagility, such as insects, lizards, and small mammals. The model calls for chromosomal rearrangement, which reduces fecundity when heterozygous, to occur within the area and within the habitat occupied by the ancestral species. The derivative structural homozygote is presumed to be associated with a genotype that is adaptively superior to those associated with the ancestral arrangement. Because of the low fecundity of the heterozygote, the new structural homozygote must arise by chance in a small, at least temporarily isolated population. Once the new arrangement is established it is said to expand the area it occupies by displacing the ancestral species because the derivative species is superior in adaptation to the parental species in the same habitat. Since the hybrid has low fitness, the parental and derivative species are unable to form stable mixed populations in the absence of premating isolation. For this reason their distributions are parapatric, and occasional hybrids may be found along the margins.

The stasipatric model of speciation is compared with the saltational model, which has been developed primarily from studies with annual plants but which is probably more widely applicable. Emphasis is placed on the differences between the two models, most notably that saltational speciation is postulated to be most likely to occur in ecologically peripheral populations subjected to periodic reduction to very small size, whereas stasipatric speciation is postulated to occur in centrally located populations or at least populations that are not necessarily peripheral. The reasoning is that chromosomal rearrangements are statistically more likely to occur in nonperipheral populations because there are more individuals near the center of distribution. This, however, assumes that chromosomal rearrangements of the sort that might lead to speciation occur randomly and with the same

frequency throughout the range of a species. The saltational model, on the other hand, provides for the possibility that chromosomal rearrangement is causally related to the very small size of a population, perhaps as a genetic effect of forced inbreeding. Another difference between the two models is that the product of stasipatric speciation is assumed to be adaptively superior from its inception whereas the saltational model does not call for a priori superiority. In the most extensively studied case of presumed saltational speciation, the origin of *Clarkia lingulata* from *C. biloba*, it has been shown that the derivative species is genetically less variable and, under all conditions tested, less fecund than the parental species.

Of greater significance, I believe, than the presumed differences between the stasipatric and saltational models of speciation are the similarities. Both models involve chance fixation as homozygotes of one or more chromosomal rearrangements that as heterozygotes have a selective disadvantage because of reduced fecundity. Both models call for fixation to occur in very small inbreeding populations that are at least temporarily isolated from populations of the ancestral species. Although the presumed differences pose interesting questions they seem to me to be secondary in evolutionary importance to the similarities.

Species that reproduce asexually are allotted a special chapter. The chapter, however, deals primarily with examples of asexual species of animals and the various interesting mechanisms by which they reproduce asexually, rather than with their origin. Most of the asexual species discussed are demonstrably of hybrid origin, and one might have expected a more extensive discussion of the general role of interspecific hybridization in speciation, especially among plants. The final chapter of the book does contain some discussion of hybridization in relation to speciation, but the subject receives less emphasis than it deserves, perhaps because, although the fact is not stated, the focus of the book is on animals.

The final chapter is entitled "Conclusions," but it is replete with new topics and new examples. Of particular interest is a discussion of the role of ethological isolation in speciation and whether or not speciation is ever initiated by ethological differentiation. One gets the impression from the variety of topics introduced that the final chapter is used to mention and discuss briefly a number of interesting subjects that did not fit into the other chapters. The result is a medley of ideas and examples rather than a tightly reasoned set of conclusions as the title would suggest.

This book is an important contribution and has something new to say to everyone with an interest in speciation, whether that interest be casual or intensely professional. After reading the book no one can help agreeing with the author that speciation is a complex and wide-ranging set of phenomena for further inquiry and not one concerning which all the answers are known.

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A Means of Self-Evaluation

Social Comparison Processes. Theoretical and Empirical Perspectives. JERRY M. SULS and RICHARD L. MILLER, Eds. Hemisphere, Washington, D.C., and Halsted (Wiley), New York, 1977. xii, 372 pp. $23.50.

In 1954 Leon Festinger published his seminal article "A theory of social comparison processes." The article represented a formalization and extension of previous research and theory stemming from the tenet that humans have a basic drive to evaluate their opinions and abilities. The theory suggested that, although people may first attempt to evaluate their opinions and abilities by objective nonsocial means, when such means are unavailable they evaluate themselves by comparisons with the opinions or abilities of other people and that, "given a range of possible persons for comparison, someone else close to one's ability or opinion will be chosen for comparison."

From these and other hypotheses and corollaries, Festinger and later Schachter and others attempted to derive propositions that would aid in our understanding of a number of basic social processes having to do with affiliation, communication, conformity, the rejection of deviates, competition, self-esteem, level of aspiration, the effects of racial integration, equity, and emotion. Now, two dozen years have passed and Suls and Miller have set out to provide for us perspectives on the present status of social comparison theory.

For those who are interested in social comparison, this book provides everything: thorough reviews of the literature, thoughtful critiques of previous experiments, stimulating theoretical applications and conceptual advances, new theoretical ideas, and 16 previously unreported experiments. Between the effective scene-setting first chapter by Suls and an unusually incisive final chapter by Ladd Wheeler and Miron Zuckerman are a dozen original chapters each focusing on a different aspect of social comparison. The 23 authors represented in this volume include old hands and young turks, social comparison theorists and plowers of other theoretical fields.

The authors did not provide, nor did the editors impose, uniformity; the chapters differ in goal, content, style, and scope. Most readers will find some chapters more interesting than others. I especially liked two chapters, one by George Goethals and John Darley that attempts to reformulate social comparison theory in terms of Harold Kelley's attribution model, and one by Philip Brickman and Ronnie Janoff Bulman that sets out to prove that the opposites of three statements from social comparison theory are also true. In the course of their attempt, Brickman and Bulman shed new light on identical twins, married couples, class reunions, the effects of success on friendship, the negative consequences of tourism for developing countries, and the effects of status on the ability to choose evaluation occasions. Although I was not entirely convinced by this chapter, I spent an enjoyable evening with the book and think that others interested in social comparison will also find it stimulating.

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Particles in Space

Topics in Interstellar Matter. Papers from a meeting, Grenoble, Aug. 1976. HUGO VAN WOERDEN, Ed. Reidel, Boston, 1977. viii, 300 pp., illus. $30.

In the past decade, developments in radio, infrared, and space astronomy have led to a revolution in our understanding of the physics and chemical composition of the interstellar medium. The space between the stars of spiral galaxies such as our own is not devoid of material, as 19th-century astronomers believed, but is filled with a low-density gas and with sub-micron-sized particles of matter that are called "interstellar dust." It is known that the gas and dust are mostly concentrated in relatively high-density, low-temperature regions, called clouds, that are separated by a much higher-temperature, low-density intercloud medium.