lished in Great Britain by Burnett Books Limited.] 1986.

Many recent books have announced that orthodox Darwinian views on evolutionary processes have been, or are about to be, radically altered in light of new data and theories from a variety of biological disciplines. Denton goes much further: his "radical" approach concludes that the very idea that life has descended from a remote common ancestor is itself about to be abandoned—in recognition of what Denton claims is the empirically established fundamental discontinuity of life.

The book is fraught with distortions. In perhaps the most egregious instance, natural selection is presented as a "random" process. Only once does Denton acknowledge that it is mutation that is random (and then only with respect to the ambient regime of natural selection). Never does he tell us that selection is the anti-chance design-producing element of evolutionary theory.

Denton says many times that the only demonstration of evolution is the existence of "continuous" series—be they homologies among living organisms, or sequences from the fossil record. He claims, astonishingly, that nested sets of organisms—taxa—demonstrate discontinuity rather than expected continuity. He never acknowledges that Darwin's perhaps strongest argument in favor of evolution was his realization that *if* evolution had occurred, there *must be* a single, grand nested set of resemblances linking up all members of the earth's biota.

In harping on discontinuity, in adopting a form of typology forcefully reminiscent of "basic created kinds," Denton's book converges on a creationist tract rather than a sober account of current problems in evolutionary theory. As I reached the final pages, my dawning suspicions were confirmed: Denton tells us that most of western morality and ethics derive from Darwinism, and that he is deeply troubled by the untrustworthiness of the foundations of the entire system. There are several creationist books that are based on precisely this specious premise. Whether Denton is a bonafide creationist, or we are witnessing a case of parallel evolution towards "secular creationism," I cannot judge.

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THE PROBLEMS OF EVOLUTION. *An Opus Book. By Mark Ridley. Oxford University Press, Oxford and New York.* $16.95 (hardcover); $8.95 (paper). viii + 159 p.; ill.; index. 1985.

This is a small book that confronts some large issues with admirable sense and clarity. Some are old controversies discussed from a new perspective, such as creationism and the importance of Mendelian heredity for evolutionary thought. Some are more modern problems that form foci for much current research: neutral mutations, molecular clocks, phenetic versus cladistic classifications, punctuated equilibria versus phyletic gradualism. The author argues decisively for his preferred answers to some questions, but presents the currently indecisive evidence and reserves judgment on others. Where the issues are still open, he points out the kind of evidence that will be needed for confident conclusions.

I can recommend the book to anyone who needs a concise introduction to some of the major ideas on evolution or wants a new look at some already familiar issues. It would be especially valuable as supplementary reading for advanced undergraduates.

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MORPHOMETRICS IN EVOLUTIONARY BIOLOGY. *The Geometry of Size and Shape Change, with Examples from Fishes. Special Publication 15. By Fred L. Bookstein, Barry Chernoff, Ruth L. Elder, Julian M. Humphries, Jr., Gerald R. Smith, and Richard E. Strauss. The Academy of Natural Sciences of Philadelphia, Philadelphia (Pennsylvania).* $22.00 (hardcover); $14.00 (paper). xvii + 277 p.; ill.; index. 1985.

In his book, *On Growth and Form*, originally published in 1917, D'Arcy Thompson proposed the use of deformed Cartesian coordinate grids as a pictorial method for analyzing differences in structure between closely related organisms. Since then, his novel approach to studying the morphological transformations that characterize both ontogeny and phylogeny has been widely cited; indeed, few morphologists can claim unfamiliarity with Thompson's illustration of the transformation between the fishes *Diadon* and *Mola*. Yet, the widespread familiarity with deformed-coordinate analysis has never been equaled by its frequency of application. The main problem has been the lack of rigorous, quantitative methods for applying the principle of transformation analysis.

Nearly ten years ago, Fred L. Bookstein began devising statistical techniques that preserve the spirit of Thompson's deformed-coordinate method for form comparison, yet in addition address problems in contemporary evolutionary biology, such as discrimination of taxa, description of ontogenetic and phylogenetic change, and hypothesis testing. This book represents a summation of these techniques, along with a number of illustrative examples from fishes, amassed by Bookstein and several colleagues and students at the University of Michigan.

Two general features of these morphometric techniques distinguish them from many others. First,

with respect to their emphasis on analysis of transformation they are seemingly more effective than traditional quantitative methods for static shape description and comparison. For example, in the illustrations provided, both the biorthogonal-grid method for quantifying the principal directions of shape change within an entire form and the shear method for among-group discrimination provide more effective resolution than standard principal-components procedures. Second, they are intended specifically for biological application. Central to virtually all of the techniques is the identification of homologous landmarks, or reference points, which tremendously facilitates the biological interpretation of transformations during both growth and evolution. For instance, identification of principal axes of change can immediately be translated into experimentally testable hypotheses concerning growth gradients and other developmental parameters.

The only substantive drawback of the techniques as presented is one of pedagogy: given their apparent worth, how does one actually do the analyses? As stated in the Preface, "Some of the computer programs for techniques described are presently dependent on features of the University of Michigan computing environment" (p. ix). The appendixes contain instructions for doing some of the methods by hand, but these will be practical in only the simplest of cases and only to the most devoted (and patient) of morphometricians. Likewise, although two computer programs are included, neither includes instructions for some of the more powerful and interesting methods, such as biorthogonal-grid analysis. The Preface states that an "exportable statistics/morphometrics package" (p. ix) containing the relevant programs will eventually be available, and the authors invite collaborators and visitors interested in their use. Potential users should be forewarned that getting this book is only the first step towards being able to apply its contents.

In terms of printing quality, the book is well done, including numerous helpful illustrations; one really can't ask for more at such a modest price. Most of the text is error free; the few oversights I noticed were the title for the opening section of Chapter 1 which differed from the one listed in the Table of Contents, and the labeling for three figures in Chapter 5 (5.1.1—5.1.3) which didn't conform to the accompanying text.

All in all, this book makes a substantial contribution to the field of biometry and contains many techniques which are likely to be of great use in addressing many contemporaneous issues in evolutionary biology.

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THE ORIGIN AND EVOLUTION OF SEX. *Proceedings of a meeting held July 30–August 4, 1984, at the Marine Biological Laboratory, Woods Hole, Massachusetts. MBL Lectures in Biology, Volume 7.*

Edited by Harlyn O. Halvorson and Alberto Monroy. Alan R. Liss, New York. $68.00. xi + 345 p.; ill.; index. 1985.

This volume consists of reviews by 32 specialists on the various aspects of the origin and evolution of sex, sexual differentiation, sexual reproduction, and sex determination. Seven chapters deal with prokaryotes, five with eukaryotic unicells, five with segregation patterns in germ lines, and four with sexual differentiation and sex determination in multi-cellular organisms (mammals and *Drosophila*). Each section is provided with a concluding discussion. The presentation suffers somewhat from different interpretations of sex and sexuality. Although a strong point of the book is the broad spectrum of related topics covered by the various papers, integration of the many viewpoints expressed into a fundamental picture of the origin and evolution of sex is often left to the reader.

Various authors emphasize that sex in prokaryotes and eukaryotes has developed independently; it exhibits remarkably similar basic mechanisms. In both prokaryotes and eukaryotes, sex is not necessarily connected with reproduction.

In prokaryotes, sex is understood as a process whereby DNA is transmitted without cell division. Defined in such a broad sense, it includes genetic exchange by transduction, conjugation, and transformation (Halvorson). Sex originated as a recombinational repair process (Bernstein et al.). Plasmids may play a decisive role, and the latest experimental evidence of their function is described (Clark). In eukaryotes the term "sex" refers to all those features in an organism's phenotype that bring two genomes together and distribute recombinant genomes to daughter cells (Goodenough). Meiosis arose from mitosis and is counteracted by fertilization. Sex contact components are complementary glycoproteins or lectins and account for gamete recognition. They are designed for variation, providing a molecular basis for speciation. Meiosis arose according to the concepts of Cleveland or as perfection of the phenomenon called parasexuality (Adelberg). Segal outlines problems of sexual differentiation in vertebrates, and Taketo et al. study the gonadal differentiation in mammals (HY-antigen). Whereas the presence of primordial germ cells does not affect the differentiation of the gonads, the gonads influence the phenotypic sex of the germ cells (McLaren). The sex-specific tissue environment affects the timing of meiosis, which in turn determines the phenotypic sex of the developing germ cells.