follow a logical sequence, covering drainage basin (watershed) controls of river channels, flow mechanics, sedimentary processes, magnitude-frequency effects of storms, controls of cross-sectional, planform, and long-profile geometry, and channel changes. In chapter 10, channel management and design are considered.

Each chapter is thoroughly researched and combines the author's own work with that reported in the literature. The bibliography contains well over a thousand entries, including most of the better relevant references from the engineering, geologic, geographic, and sedimentological literatures. In places the text becomes somewhat bogged down by the multiplicity and length of citations, which are by author and date rather than by number.

The chapters on flow mechanics and sediment transport are coherent and competent. They lack the detail and the worked examples of computational procedures expected in an engineering textbook. The chapters on magnitude-frequency, controls of channel geometry, and channel changes are quantitative, process-based geomorphology at its best. The book is at its best when discussing hydraulic and sedimentary processes in rivers and links between these processes and channel form and channel changes. The chapter on river management and design is a little thin by comparison, but in any event this is not the main thrust of the book.

Each chapter begins with well-established material and ends at the research frontier, where theories and hypotheses are still unproven. Though this gives the book appeal for both students and researchers, it makes it vulnerable to becoming dated quickly. For example, recent work by researchers at the University of Washington and the University of California at Berkeley calls into question much of the book's treatment of the sedimentology of meandering streams (pp. 206–211).

The book has few typographical errors. The figures are not easy to read, for each one contains several diagrams crowded together. Because of their small size the graphs can only be interpreted qualitatively. Also, the concentration of many diagrams at a single location makes it inevitable that some are far removed from the relevant part of the text.

In conclusion, *Rivers* can be comprehended by engineers and geomorphologists alike, and all but the very best read river scientists will find new material and ideas in it. It will certainly become a standard textbook in many geomorphology courses and will be useful in engineering courses too when used in conjunction with a suitable textbook on hydraulics and sediment transport. In a subject with the split personality of river studies that is praise indeed.

COLIN R. THORNE
Engineering Research Center, Colorado State University, Fort Collins 80523

Sexual Selection in Insects

The Evolution of Insect Mating Systems. RANDY THORNHILL and JOHN ALCOCK. Harvard University Press, Cambridge, Mass., 1983. xii, 547 pp., illus. $35.

The Evolution of Insect Mating Systems fills two large gaps in the growing literature in which behavior is considered from an evolutionary perspective. First, it brings to a vertebrate-biased literature a well-documented and persuasive demonstration of the importance of insects for the generation and testing of theory. Second, it organizes an immense and diverse literature on insect reproductive behavior into a logical framework that will allow more efficient and effective exploration of both insect behavior and sexual selection theory. Thornhill and Alcock demonstrate the utility of evolutionary (selectionist) thinking for organizing and explaining diverse and complex patterns of behavior. They also make a powerful case for the importance of sexual selection in molding much of insect reproductive behavior. As a result, their book goes well beyond a review and synthesis of the literature on insect behavior.

The book is filled with hypotheses, both general and specific, that are generated by its main thesis, which is as follows:

> The primary characteristic of males is their drive to secure mates, which leads to competition for access to females and the evolution of a host of traits associated with this struggle. Females, on the other hand, have the luxury of choosing among many potential partners; their preferences are expected to raise their genetic success and in turn exert pressure on males favoring traits considered desirable by females.

Following an introduction to the formulation and testing of evolutionary hypotheses, an overview of insect reproductive behavior, and a review of sexual selection theory, the authors expand upon their thesis. Eight chapters are devoted to male-male competition and male perspectives and three to female choice and female perspectives. Each chapter begins with one or more detailed examples of recent studies that illustrate its main point or points. These examples are then supplemented with others as each topic is explored. The result is a very effective presentation of ideas and evidence. Most of the major insect orders get ample treatment.

The text flows remarkably smoothly despite its 471 pages and over 1000 references, and it is handsomely illustrated. Its readability makes the book easily accessible to a wide range of readers, undergraduate to professional and evolutionary theorist to applied entomologist. Although the book is best read from beginning to end, the detailed author and subject indexes make searching for specific topics or taxa easy.

The book is not without its flaws. As in any work of this size, there are errors of both omission and interpretation. Few studies prior to 1960 are cited, but in exchange the bibliography is remarkably up to date. There is little discussion of the more quantitative aspects of sexual selection theory (for example, of frequency-dependent selection) or of the central problem of how one measures costs and benefits of behavior in terms of reproductive success. There is also little emphasis given to the kinds of quantitative testing of models, nicely demonstrated by G. A. Parker's dung fly studies, that insects are so well suited for. Some hypotheses are given stronger justification than others, and alternative hypotheses, especially nonselectionist ones, are occasionally ignored. Some ideas are developed over the entire book, and one must be careful to keep track of them. For example, there is a recurrent suggestion that females would enhance their fitness by mating with males that have proven themselves in combat or survival. Yet this theme is not strongly developed in the chapters on mate choice.

One particularly frustrating problem is that female perspectives are continually understated relative to male perspectives—even in the chapters on mate choice and female mating systems. For example, on p. 62 the ways in which females have more control over reproduction than do males are discussed, but some 20 pages later (pp. 85–89) a discussion of why polygyny is prevalent among insects focuses almost entirely on male perspectives and it is not until the last third of the book that female perspectives relative to monogamy and polygamy are discussed in any detail. Thornhill

and Alcock obviously recognize the importance of female evolutionary perspectives for sexual selection theory and for understanding the evolution of mating systems. For example, they point out (p. 398) that "insects are typical animals in that females have more control over the reproductive process than males." For this very reason both mate choice and male-male competition should be strongly influenced, if not governed, by the reproductive control females have. Perhaps much of the male bias comes from the literature being reviewed, but this book would have been a good place to expose the problem and to work toward its resolution.

The emphasis on male perspectives and the number of highly speculative hypotheses presented may cause some to dismiss the book as superficial or excessively adaptationist. I suggest that these people keep in mind the authors' intention to illustrate the power of a Darwinian approach in organizing a diverse and complex array of insect reproductive behavior and in generating exciting, if controversial, ideas about its evolution. It is in this that *The Evolution of Insect Mating Systems* will make its mark as one of the more important contributions to behavioral ecology, sociobiology, evolutionary theory, and entomology.

JONATHAN K. WAAGE
Division of Biology and Medicine,
Brown University,
Providence, Rhode Island 02912

Molecular Biology of Cancer

Genes and Proteins in Oncogenesis. I. BERNARD WEINSTEIN and HENRY J. VOGEL, Eds. Academic Press, New York, 1983. xxii, 403 pp., illus. $55. P & S Biomedical Sciences Symposia Series. From a symposium, New York, June 1982.

Recent years have seen a dramatic increase in understanding of several central aspects of oncogenesis, in particular the roles of viral and cellular *onc* genes and the multistep nature of carcinogenesis. A reading of this book makes it clear, however, that a complete merger of the traditions of virology and chemistry is not quite at hand (or at least wasn't in June 1982). Nonetheless, several key points have become generally accepted. First, abuse of certain normal cellular (c-*onc*) genes can be sufficient to transform a normal cell into a malignant one (as with v-*src*) or at least to initiate the process (as with c-*myc*). Such abuse can include incorporation of an *onc* gene into a retroviral provirus, insertion of a provirus in the vicinity of an *onc* gene, or simple point mutation in the absence of retroviral involvement. Second, mutagenic damage to DNA is the initiating event in most, if not all, chemical and physical carcinogenesis. Third, in most cases more than one event must occur before a fully malignant cell can arise, as is demonstrated most clearly by initiation-promotion models of experimental carcinogenesis.

Major gaps in our knowledge nevertheless remain. We do not know the particular DNA sequences that serve as targets for physical and chemical carcinogens or the exact nature of the key lesions. Both point mutations and DNA rearrangements affecting the well-characterized c-*onc* genes *myc* and *ras* have been identified in spontaneous and chemically induced tumors; it cannot yet be determined whether these changes were caused directly by the initiating agent or occurred as secondary events. The mechanism of action of tumor promoters such as the phorbol esters also remains elusive. General classes of models put forward to explain promotion include direct hormone-like stimulation of cell division or mutagenic effects mediated by active oxygen radicals or other compounds released as a consequence of membrane damage. Finally, both the normal function of c-*onc* genes and the deranged function of v-*onc* genes remain obscure, as is also the case with the analogous sequences that serve both transformation and replication functions in DNA tumor viruses, despite considerable advances in understanding the biochemistry of their products.

The 26 papers in this book contain many of the recent famous stories in the molecular biology of carcinogenesis as told by some of the major players. Roughly one-third of the papers are concerned with mechanisms of carcinogenesis and mutagenesis by chemical and physical agents; a similar number deal with oncogenic viruses, oncogenes, and their products; and the remainder are concerned with a variety of topics from cell biology that are of particular recent interest to cancer research. The first group includes papers on chemical and physical mutagenesis by Grunberger and Santella, Lo *et al.*, and Fuchs *et al.* as well as papers on tumor promoters by Cerutti *et al.*, Weinstein *et al.*, and Fujiki and Sugimura. Of the subjects in the book, this one is covered with the most success. Each paper is clearly written and well backed up with sufficient introductory material to make the subject comprehensible to the non-expert, and there is generally a good balance between breadth and detail so that a sense of both the relationship of the work to the field as a whole and the flavor of each experimental approach comes through. Also, the authors are well chosen so that the papers make a comprehensive set that provides an informative and interesting overview of current ideas about mutagenesis and chemical carcinogenesis.

The papers dealing explicity with viral carcinogenesis and oncogenes include offerings by Hayward, Rovigatti and Astrin, Wigler *et al.*, Erikson *et al.*, Hinuma, and Woodworth *et al.* This group is distinctly less successful than the first. It includes papers that are significantly more parochial than those in the first group and not as well written or as clearly illustrated. The topics covered are rather scattered and do not present a unified whole. Many of the papers, particularly those dealing with human T-cell lymphoma virus or with oncogenes directly (such as *myc* and *ras*), are badly out of date. These subjects have advanced very rapidly during the past year, and the papers dealing with them are of little more than historical interest.

The remaining papers include some rather nice short reviews of topics such as transforming growth factors (Todaro *et al.*), receptor-mediated endocytosis (Willingham and Pastan), and gene amplification and methotrexate resistance (Schimke *et al.*). The authors of these three papers are closely associated with major contributions to the subjects and present here clear, concise summaries of recent and ongoing work. Also in this category but of less obvious significance are papers on possible roles of the nuclear matrix in carcinogenesis, mutations in β-actin genes, and studies of mitochondria with rhodamine-123.

The volume is introduced by a brief paper by Temin. Although it doesn't provide much in the way of a general introduction to the subject, the paper does provide an interesting, if rather brief, exposition of some of the possible mechanistic aspects of oncogene acquisition by retroviruses. Some additional introductory material, with a short background on the major topics in each section, would have been a useful addition to the book, as would abstracts of the papers.

Considering the pace with which some of the subjects covered in the book have progressed in the last few years, the