many, if not most, crimes are committed by individuals in whom the role of heredity is minor, nonspecific, or perhaps irrelevant." Criminality is clearly genetically heterogeneous. Strangely enough, we are here sometimes better able to form an idea of what is inherited and how it interacts with the environment than we are in the functional psychoses. Electroencephalographic and chromosomal abnormalities, low IQ, and psychopathy, some of it under genetic influence, play their part in predisposing to crime.

The author is to be commended for the number of studies he has presented and discussed, reasoning about them step by step, rather than to be criticized for omitting others in his attempt to cover a very wide field. The book was originally intended for students of abnormal psychology, but it will be of equal value to their teachers and to professional workers in the field. It deserves to be widely read, and one hopes it will achieve the author's primary goal, "to get students to see the great, untapped potential in this immature field, and to stimulate a few to take an active interest in advancing it further."

JAMES SHIELDS
Institute of Psychiatry, London

Reproductive Entomology

The Physiology of Insect Reproduction. FRANZ ENGLEMANN. Pergamon, New York, 1970. x, 308 pp., illus. $18.75. International Series of Monographs in Pure and Applied Biology, vol. 44.

It has been becoming more and more apparent in recent years that the variety of reproductive patterns and underlying physiological control mechanisms found in the class Insecta rivals and may well exceed that found in the vertebrates. This book is one of the first attempts to treat insect reproduction in a comprehensive manner. Engelmann has performed an important service in bringing together the diverse and widely scattered literature of this field. Topics covered in his review include sex determination and sex differentiation, gonadal development (spermatogenesis, oogenesis, and vitellogenesis), mating behavior and the control mechanisms involved therein, insemination, factors affecting fecundity, hormonal control of egg maturation, neuroendocrine integration of reproductive processes, parthenogenesis, oviposition, viviparity, hermaphroditism, heterogony, endocrine influences on reproduction in males, and caste determination and control of social structure in social insects. The chapters on gonadal development, mating, fecundity-affecting factors, and hormonal control of egg maturation, which make up the bulk of the book (148 of 243 pages of text), are of the greatest interest not only because these topics have captured a major share of the attention of investigators in recent years, but also because of the substantial contributions to these areas arising from Engelmann's own research.

This reviewer found the chapter on mating to be the least satisfactory one in the book. It is, as the author points out, "a formidable task to extract the essentials" from the vast literature on this subject, and the material presented on this topic seems somewhat less well digested than that presented in other chapters. The minor errors and omissions that occasionally frustrate the reader seem more numerous here than elsewhere in the book. Engelmann cautions repeatedly and wisely against generalizing on the basis of evidence from a few species, yet on occasion he fails to heed his own warnings. For example, experiments on certain laboratory strains of the cockroach *Leucophaea maderae* indicate that the corpus allatum hormone is important in enhancing the sexual receptivity of females, and the author concludes that in cockroaches "the corpus allatum hormone affects the central nervous system, thus changing the female's behavior." Yet other data exist (not all of which are cited) indicating that in other strains of *Leucophaea* as well as in two other cockroach species, hormones from the corpora allata have a negligible effect on female sexual receptivity. A tendency on the part of the author to give top billing to his own interpretations of the processes regulating insect reproduction, and in so doing to ignore data suggestive of other interpretations, appears in the chapter on hormonal control of egg maturation as well as in the one on mating; I did not note it elsewhere. The only other criticism to be made of this book concerns the inordinate amount of time between the completion of the literature survey (1968) and the publication of the book. As a result the book is out of date on a number of points; indeed, some of the issues raised by Engelmann have been substantially resolved in the interim.

The book is quite well illustrated, the illustrations generally serving to enhance the text. There is an adequate index listing both species and subjects, an extensive bibliography, and a brief but useful glossary.

If the foregoing criticisms are borne in mind, this book is an extremely useful survey of the literature of insect reproduction. A careful reading of it should be of particular benefit to students interested in doing research in insect reproduction, for Engelmann takes care to point out subjects in need of further investigation, not only among topics of current interest but also among those that are currently rather neglected, such as sex differentiation (thought to be under strict genetic control until the recent demonstration of the importance of epigenetic factors in certain beetles), endocrine influences on reproduction in male insects, the physiology of oviposition, and caste determination in social insects (a topic that formerly commanded considerable attention). It is to be hoped that the book will serve as a stimulus to research in these and other areas of insect reproductive physiology.

ROBERT H. BARTH, JR.
Department of Zoology,
University of Texas, Austin

Germ Cells

Ovarian Development in Drosophila melanogaster. ROBERT C. KING. Academic Press, New York, 1970. x, 228 pp., illus. $16.50.

This volume is based on the work of King and his collaborators on germ cell proliferation and development in *adult* female *Drosophila.* As an organized presentation of this work, it will be of value to geneticists and developmental biologists who use this species. The author's aim, "to summarize information on how reproduction is accomplished and regulated in this species," emphasizing the analysis of the developmental failure of female-sterile mutants, has been accomplished in part. However, he has failed to produce a comprehensive treatise on the germ cells of female *Drosophila.*

Good account is given of the structure and functioning of the adult ovariole. A detailed, tabular description of the morphologically defined stages of oogenesis is made, and later stages are well illustrated by semidiagrammatic drawings. Rates of growth of egg chambers, nurse cells, and oocyte are given, along with the temporal relations for actively laying, mated females.

The cellular components of the germarium are described in detail and interpreted in terms of the division of stem cell oogonia into daughter stem cells and cystoblasts at each division. Each cystoblast then undergoes four synchronous divisions to become the ring-canal-interconnected 16-cell cyst, made up of an oocyte and its 15 nurse cells.

The author uncritically assumes each germarium to have two stem cells. The progression of stages in the germarium must be more or less in step, new cystoblasts being added by stem cell division at a rate matching the loss of 16-cell cysts by incorporation into the vitellarium, since the germaria remain relatively uniform in cellular content. Finding one too many single cells in the germarium thus creates the ad hoc requirement that some cell type divide at half the cystocyte rate and therefore have two representatives. This cell type could as well be the cystoblast as the stem cell. The two models have quite different consequences, for example, with respect to mutagenesis.

Preadult ovarian development is treated inadequately. The origin, migration, and incorporation of pole cells into the developing ovary are described in three paragraphs. The initiation of division of primordial germ cells is not mentioned, nor are data on growth of the larval ovary. Differentiation of the pupal ovary is described, on the basis of the author's own work, but reference is not made to the major contributions of Aboim and of Bucher, which are pertinent to the theme of the book. It is not recognized that early germ cell proliferation may not follow the linear pattern found in the adult germarium and differences may exist that are significant, for example, for the nature of mutant clusters and for "age" effects on crossing over.

In general, the survey of the literature has been too selective. The works of Bucher and of Aboim are not isolated instances of earlier, significant papers that are neglected. Additional examples include the studies of Guyenot and Naville on the cytology of the pupal ovary and of Painter and Reindorp on the cytology of nurse cell development.

The author has speculated too freely, to the detriment of his worthwhile efforts. Thus, the account of the behavior of the oocyte chromosomes serves primarily to support the author's speculations—inappropriate to a work of this nature—on genetic recombination. There is even a new function for that marvelous stuff, heterochromatin. (Incidentally, only the most peripheral justification is evident for the inclusion of salivary chromosome maps in this—or any—connection.)

Discussions of female-sterile mutants are scattered throughout the book on the basis of the nature of the developmental failure. The idea is sound that the analysis of mutant development should give insight into the genetic control of oogenesis, but the insight actually gained is more than offset by the discontinuity introduced. The descriptions would better have been placed in a separate chapter toward the end of the work.

D. R. PARKER
U.S. Atomic Energy Commission, Washington, D.C.

Biological Spectrochemistry

Atomic Absorption Spectroscopy. Applications in Agriculture, Biology, and Medicine. GARY D. CHRISTIAN and FREDERIC J. FELDMAN. Wiley-Interscience, New York, 1970. xxii, 490 pp., illus. $16.50.

The last 230 pages of this book are recommended to scientists interested in elemental analysis of biological materials by atomic absorption spectrometry (AAS). The occurrence, biological role, and determination of about half the chemical elements are described. Some of the methods are summarized in tables—so that material up to mid-1969 can be included in a text written in early 1968—and none are described in detail. References are given to original publications, however, and the analyst can easily obtain details of the methods. The writing in this part is descriptive, rather than critical, it being left to the reader to evaluate the reliability of analytical methods. This requires knowledge of the chemical and physical principles of the method, and unfortunately these topics are treated quite poorly in the text.

Atomic absorption spectrometry has been used for a century to analyze stellar atmospheres, and flame emission has been used in the laboratory for even longer. The theory of flame AAS as a laboratory method has been built on these foundations and is well established. Unfortunately, the treatment of theory in this book is brief and, more seriously, it is shot through with errors. A knowledgeable practitioner of AAS may enjoy picking out the errors, but I suggest that the neophyte turn to other sources for information.

Some examples of errors can be chosen from page 11. Equation 2.9 purports to describe the Saha equilibrium, but two numbers are wrong (if you have the book, write in 5040 for 5050 in the first term and 3/2 for 5/2 in the second term, and be sure to express T in °K and E_i in eV) and there is an unfortunate use of P as the symbol for statistical weight (the usual symbol is g, and P is used in the preceding equation for partial pressure). Further down the page we read, "When the dissociation energy for a metal atom approaches the ionization potential, a difficulty in the absorption or emission emerges." I think I know what the authors mean, but as it stands the sentence makes no sense because the only dissociation (other than nuclear) for an atom is ionization. A purist may also object to the lumping together of potential and energy.

The following chapters, on instruments and procedures, are better but to my mind less satisfactory than the similar chapters in the books on AAS by Slavin and Ramirez-Munoz. The last chapter in part 1 is a fairly well balanced comparison of AAS with flame emission and atomic fluorescence. Unfortunately, the authors spoil it by gratuitously stating at the end that recent studies "should help to establish the importance of atomic emission. . . ." Really! Flame emission was used by Lundegardh to analyze agricultural, biological, and medical materials before the authors of this book or I were born. A serious problem in AAS has been that practitioners have ignored the flame emission work and have had to rediscover a vast amount of information.

MARVIN MARGOSHES
6806 Delaware Street, Chevy Chase, Maryland

Investigating Glaciers

International Symposium on Antarctic Glaciological Exploration (ISAGE). Hanover, N.H., Sept. 1968. A. J. Gow, C. KEELER, C. C. LANGWAY, and W. F. WEEKS, Eds. Scientific Committee on Antarctic Research of the International Council of Scientific Unions, Cambridge, England, 1970. xviii, 544 pp., illus. Paper, $10. Publication No. 86, International Association of Scientific Hydrology and Scientific Committee on Antarctic Research.

In early September 1968, 125 glaciologists from 15 countries converged on the Dartmouth campus to participate in a symposium devoted to Antarctic glaciological exploration. The 55 papers