1969, and Graves devotes much of his article to discussing alternatives and the need for flexibility in long-range planning. The New York metropolitan area is an area of perennial water surplus and runoff and, as Boyle notes, there is no shortage of water, just a shortage of clean water because of long-continued waste and pollution. To make proper use of what the region has to offer, he lists such alternatives as universal metering of water and elimination of leaks in mains in New York City, and reclaiming and reusing sewage and industrial waste water—but these would ruin the concept of water as a free good.

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Biological Psychiatry

The Genetics of Mental Disorders. ELIOT SLATER and VALERIE COWIE. Oxford University Press, New York, 1971. viii, 414 pp., illus. $25. Oxford Monographs on Medical Genetics.

That genes affect behavior is now a widely accepted fact. Much of the supporting evidence derives from animal experiments carried out under laboratory conditions. Although not as unambiguous, the evidence in man is nonetheless substantial. The evidence bearing on the role of heredity in the etiology of the psychoses, personality disorders, senile and presenile dementias, epilepsy, and mental subnormality comprises a vast literature, much of it inaccessible to the English reader. In this volume, the authors present a critical review of a considerable portion of this evidence. They do so with authority and scholarship, although sometimes in difficult literary style.

The authors intend their book primarily for the clinical psychiatrist, but it is doubtful whether American clinicians will receive it with much enthusiasm. A considerable portion of it is devoted to topics which in this country have only peripheral relevance to the practice of psychiatry. Moreover, American psychiatrists have become wary of one-sided approaches to behavioral phenomena, and this book strongly reflects the predominantly biological bias of European (particularly German) psychiatry. The literature on interpersonal, familial, social, and other experiential factors gets little attention in it, and that little is mostly of a disparaging kind.

The authors show a strong preference for traditional genetical interpretations and methods. In their discussion of the vulnerability to schizophrenia, they review the pros and cons of the monogenic and polygenic hypotheses and admit that the bulk of the evidence is not incompatible with a threshold-polygenic model. However, in the final analysis they retreat to a monogenic theory resembling one advanced by Slater more than a decade ago. They do so purely on intuitive grounds and because they feel more comfortable with its familiarity and seeming simplicity. Unfortunately, it has become apparent that the "simple" models are neither parsimonious nor compatible with what we know of the genetic determination of complex behavior from animal research. Where traditional research styles come into conflict with modern ones, they prefer the former. Thus, although few current investigators would attempt to carry out a study without double-blind procedures and other safeguards against subjective bias, these authors are skeptical of the need for such elaborate precautions.

The research on monozygotic and dizygotic twin groups is the mainstay of the genetic evidence in the behavioral disorders. Although these studies receive considerable discussion in the book, at no point is the disturbing question raised of their validity in demonstrating the operation of heredity in behavioral and psychological traits; higher rates of concordance among monozygotic twins than among dizygotic twins have been used to support both biogenic and psychogenic positions. Where alternative research designs are available, as for example in the important studies of schizophrenia in adopted children, recently carried out in Copenhagen by Kety, Rosenthal, and their colleagues, they do not receive the attention they deserve. These particular studies are barely mentioned in the book. Where the genetic evidence is at best ambiguous, as in the personality disorders, the authors prefer biological explanations to other plausible possibilities. Thus they ascribe the differential rate of criminality in the two sexes to chromosomal and other biological factors, not mentioning the possibility that the differences might be due largely to sex-role differentiation and other cultural factors.

Half the volume is given over to a review of the numerous metabolic and chromosomal disorders underlying mental subnormality. A comprehensive discussion of these data has long been overdue. The authors accept some of the evidence too uncritically, however. For example, in their discussion of the chromosomal anomalies, the purported association between an extra Y-chromosome and "severely disturbed aggressive behaviour" is presented as though it were firmly established. When the pertinent data are reviewed, it is clear that this conclusion is not warranted, being based on a small, biased sample of institutionalized individuals who have not been shown to differ psychologically in any major way from similarly institutionalized males without the chromosomal anomaly.

The strengths of the book lie in its scholarship and in the broad range of the material reviewed, for which it will be welcomed by human and medical geneticists as a reference book and text. Students of human behavior, however, will find that it does not provide a full picture of the multidimensional character of human behavioral variation. Its greatest shortcoming is in its perspective; the book looks backward rather than forward, giving the reader a sense of the past achievements rather than of the future promise of psychiatric genetics research.

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Social Insects

Army Ants. A Study in Social Organization. T. C. SCHNEIRLA. Howard R. Topoff, Ed. Freeman, San Francisco, 1971. xxii, 350 pp. + plates. $12.

The spectacular raids and emigrations of the Dorylinae, or army ants, have attracted the attention (and defensive behavior) of numerous biologists, but T. C. Schneirla was the first person to study the behavior of these ants systematically and intensively. Schneirla began to study Neotropical army ants in 1932, following his graduate training in psychology and his classic studies of maze learning in ants, and during the following 36 years he expanded his research to include related species in the southwestern United States and the Philippines. Although Schneirla published in other areas of comparative psychology, army

ants were the subject of his primary research. It is indeed fortunate that he was able to get this book almost completed before his death in 1968. Howard R. Topoff, his last graduate student and the only one to do field research with him, completed the final chapter, wrote captions for illustrations, compiled the bibliography, and did final editing. It is clear that the editing was minimal, and the style of Schneirla's writing has basically remained. This was probably the most practical approach, but it has perpetuated Schneirla's talent for hiding simple concepts and minimal data in abstruse sentences.

The book is written in a "semipopular style," and the reader needs no previous knowledge of ants or social insects. I believe Schneirla went too far in not including descriptions of techniques and accounts of his own experiences. Had the book thus conveyed more of the essence of fieldwork with these insects it would have been more likely to stimulate readers to finish it and go out and find a colony. The account is highly personal, however, in that it emphasizes the research of Schneirla and his immediate associates, citing other work primarily when, as in the case of all the African *Dorylus* species, Schneirla had no direct experience with the ants being discussed. Because Schneirla so dominated the field the book does not suffer heavily by ignoring some of the literature, but readers should be aware that the treatment is not comprehensive. For example, papers by Akre, Haddow *et al.*, Rettenmeyer, Watkins, and Willis published up to 1968 have been omitted, not to mention literature since that date.

Schneirla was the first to demonstrate that army ants have a functional cycle composed of alternating nomadic and statary phases. During the nomadic phase colonies have a brood of larvae that usually develop into worker ants, and the colonies emigrate nightly for about two weeks. When the larvae spin cocoons, the colony enters the statary phase, in which it stays in one site for about three weeks and a new brood of eggs is laid. The next nomadic phase is started when the one brood emerges as young adults and the second brood is eggs and young larvae. Schneirla has assembled a mass of convincing data indicating that stimulation from the broods is the primary factor influencing the alternating nomadic-statary cycles. The physiological cycle of the queen is an integral part of the functional cycle of the colony. She becomes gravid periodically, about once a month, and lays up to 300,000 eggs in about eight days.

This nomadic-statary functional cycle is most precise and consistent in *Eciton hamatum*, the species which Schneirla studied first and on which his description of the cycle is primarily based. This is one of the two most epigaeic or surface-adapted of the 140 or so species of army ants in this hemisphere. Most of the species of *Eciton* and the other genera of army ants are largely or completely subterranean. Therefore the book gives a distorted impression of how most army ant species behave.

Schneirla also proposed (contrary to the prevailing view before his research) that lack of food in the vicinity of the nest is not the main or proximate stimulus for emigration. His most recent work with *Aenictus* in the Philippines demonstrated that the emergence of a new brood of adult workers is not adequate to initiate a new nomadic phase. Furthermore, the multiple emigrations within a single day are attributed in part to the fact that lack of food causes larvae to stimulate greater activity among workers.

The main weakness of Schneirla's approach is his tendency to overgeneralize, emphasizing similarities within and among the different genera and species while sometimes omitting conflicting data. Schneirla was an outstanding observer of insect behavior in the field but did not conduct carefully controlled experiments to back up his hypotheses. This is partly due to the difficulty of keeping army ants successfully in the laboratory for long periods. Schneirla did perform numerous "tests" in the field and laboratory, but the exact methods used and quantitative results are almost universally absent from his publications. In this book phrases such as "observations and tests show" frequently precede conclusions enforcing his brood-stimulative theory. Although I do not question the soundness of most of the conclusions, they would be more convincing if supporting data were provided.

The role of pheromones in the entire functional cycle was recognized as important by Schneirla, but almost nothing is known about their source and role in this group of ants. It also seems likely that circadian rhythms play some role in the pronounced nocturnal-diurnal activities shown by some species, but the book makes no mention of them.

There is an extensive literature on the ant-birds and arthropod ant-guests or inquilines associated with army ants. Most of this literature is ignored in the book, and where guests are mentioned incorrect information and misleading statements predominate.

The book has some excellent photographs, including 13 in color, chosen by Schneirla, but it is unfortunate that all the color plates are reprinted in the text in black and white when supplementary and better photographs could have been used instead. It is also a mystery why an out-of-focus picture of a bivouac is used for a full-page color plate and an unnatural drawing of a dead ant is placed on the cover.

In spite of its shortcomings, the book is essential for anyone seriously studying the evolution of social behavior in insects. The army ants are perhaps the best example of group action and interdependence in insect colonies. Anyone publishing on army ants must be greatly indebted to and dependent upon the tremendous volume of data which Schneirla assembled in his lifetime. This book is a guide to those data, including some heretofore unpublished observations and a summary of numerous papers. It is a prime source of what is known and a stockpile of ideas for future research.

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Regulatory Agent

Cyclic AMP. G. ALAN ROBISON, REGINALD W. BUTCHER, and EARL W. SUTHERLAND. With contributions by Th. Posternak and Joel G. Hardman. Academic Press, New York, 1971. xii, 532 pp., illus. $17.50.

Cyclic AMP (adenosine 3′,5′-monophosphate) was discovered in 1957 in the course of a study of the mechanism by which two hormones, glucagon and epinephrine, cause the breakdown of glycogen in mammalian liver. Since that time it has been shown to mediate the actions of a wide variety of hormones and other environmental stimuli. The number and diversity of biological processes for which there is good evidence of cyclic AMP involvement continue to grow rapidly. The nature of the involvement of cyclic AMP in various biological systems suggests the generalization that cyclic AMP is a regulatory agent