phase of the life cycle, actively maintain mutual contact, and manifest, or may manifest at any moment, organized actions which are as a rule biologically useful for all members of the group." He confirms that schools serve multiple functions, and that the same school often varies in organization from moment to moment according to the function being served. The responses of schools to live predators and to trawls are compared in an interesting way, and numerous accounts of schooling in less familiar species are presented. This is a useful book, but the reader will look in vain for any important new discoveries or conceptual advances.

EDWARD O. WILSON
Museum of Comparative Zoology Laboratories, Harvard University, Cambridge, Massachusetts

New Direction in Epidemiology

Life Stress and Illness. Papers from a symposium, Beito, Norway, June 1972. E. K. ERIC GUNDERSON and RICHARD H. RAHE, Eds. Thomas, Springfield, Ill., 1974. x, 264 pp., illus. $19.50.

Stressful Life Events. Their Nature and Effects. Papers from a conference, New York, June 1973. BARBARA SNELL DOHRENWEND and BRUCE P. DOHRENWEND, Eds. Wiley-Interscience, New York, 1974. xii, 340 pp., illus. $19.95.

Scientific paradigms are sometimes not so much discarded or revised as revitalized by methodological innovations. The theory that stressful life events cause physical and psychological illness in predisposed individuals is as old as medicine, and was a cardinal principle in the beginnings of psychiatry. But the study of this theory centered largely on clinical investigations of individual patients who selected themselves by complaining of illness. Psychological and sociological field studies were also concerned with the concept of stress, but the meanings attached to the term were diffuse, operational definitions varied, and differing methods of uncertain reliability prevailed. A resurgence of interest in the relationship of life events to the onset of illness is now upon us. It is due in large part to the devising of simple scaling procedures for deriving single scores for presumptive life stress. Those procedures and their preliminary results are the central topics of these two books. The findings are strikingly interesting but not decisive.

Both books derive from conferences on stress. *Life Stress and Illness*, edited by Gunderson and Rahe, consists of papers presented at a NATO-sponsored symposium at Beito, Norway, in 1972. *Stressful Life Events*, edited by the Dohrenwends, is also based on a symposium, this one held in New York in 1973. Although there is some overlap in contributions, owing to the importance of the work of Rahe, Paykel, Theorell, and Brown, found in both volumes, the two books together form a package vital to investigators. They carry the latest word on methods and methodological problems in the quantification of stressful life events.

One reason for the recent wave of interest in life event scaling is the face validity of the new methods. In these volumes chapters by Holmes, Masuda, and Rahe summarize how the authors developed lists of specific life events that may evoke either pleasure or pain but share the feature of causing change in the life habits of an individual. The total presumptive impact of events, in a given time period such as six months, is obtained by weighting each event numerically and adding the weights for every event experienced during that time period.

The weights are derived from subjective judgments of the degree of upset or adjustment triggered by an event, and these judgments can be assembled as group means. Persons are given a scale of 1 to 100, and asked to rate, for example, the death of a child somewhere along this range. In order to locate sectors of the scale "100" is designated as the maximum conceivable "upset" for a person and "1" as no impact at all, with, in some studies, "50" given as an appropriate score for the degree of impact of a marriage. Naturally persons vary in their numerical judgments, but the group average will assign the death of a child a score or weight in the 90's. Later, after the values for various events are established in this way, other groups of persons can be given the list of events and asked simply to check those that have recently happened to them.

Here is where face validity comes in: persons will not vary widely in the accuracy of such yes-or-no responses. Major memories about car accidents, separations, divorces, deaths, or bankruptcies are less subject to response biases than answers to questions about moods, emotions, ideation, or adequacy of psychosocial function. Similarly, episodes of illness are also fairly definite and can be counted. A denial tendency will remain as a confounding variable, but there is less variance than with inquiry into subjective states.

Once a person has checked off events that pertain to him, a rapid procedure, a life event cumulative score can be obtained by finding and adding the weights assigned to those events. The sum is a number indicative of the presumptive degree of "life change" or "life stress," however these terms are defined in the procedures of a particular study. An extension in which weights are applied according to the recency of an experience is offered by Horowitz, Schaefer, and Cooney in the Gunderson and Rahe volume. The cumulative effect of these methods of scaling is to allow investigators to composite life event data into numerical forms suitable for use in large-scale field studies on the interaction of life events and their possible physical and psychological consequences.

The conferences were held to examine these methods and to consider their potential in the light of promising early findings. These findings, from multiple laboratories, consist of significant, positive, and sometimes large-scale correlations between life change or stress and a variety of physical and psychiatric illnesses. The main problem of interpretation of the findings lies with the fact that most of the studies obtain retrospective data. Commendably, this issue is ably discussed in both volumes.

Among the findings of compelling interest are those of Holmes, Masuda, and Rahe. In various chapters in the two volumes, these investigators report a general correlation between all types of life events and all types of physical illness, with a focus on life changes that vary from positive to negative in effects.

Theorell, in the Dohrenwend book, and Rahe and Romo in the Gunderson and Rahe book, find significant positive correlations between heart attacks, occurring relatively early in mid-life, and total "upset" from life events occurring in the preceding year. Those who died as a result of myocardial infarctions had higher levels of recent life change than those who survived such attacks. With respect to psychological consequences, Paykel, in Gunderson and Rahe, reports a significant positive correlation between life events and various types of psychiatric illness. Patients who had made suicide attempts reported the highest magnitude of antecedent life events, followed by persons diagnosed as depressive, and then by persons who had experienced schizophrenic episodes. In the Dohren-

wend book, Brown reports similar results, obtained independently: more antecedent and stressful life events in persons with depressive disorders than in persons with schizophrenic reactions. Neurotic patients showed a linear relationship between quantitative "stress" scores and severity of symptoms.

These findings for psychiatric illness and antecedent stress are not new or in any way startling. The relationship between loss of loved ones or cherished functions and subsequent depressive symptoms is an old and well-established clinical observation. But clinical findings are frequently criticized because the subjectivity of the clinician and the patient is not compensated by random selection of subjects, independent evaluation, or quantification using operational definitions. These new-style epidemiological studies offer a means for checking and refining clinical observations. They also can extend biological investigations by providing a simplified psychosocial variable for use in large-scale field studies. Heart disease, for example, has been studied largely in terms of physical antecedents such as elevated serum lipids and blood pressure. These life event scaling methods offer a tool for use in prospective studies using the large populations necessary to obtain meaningful results.

The two volumes contain formidable discussions of life event scaling methods, especially on issues such as assessment of degree of stress for groups versus individuals, the advantages and disadvantages of having each subject rate the event for degree of impact, and the danger of circular reasoning with regard to which events are causes and which effects. The participants bring a high level of methodological sophistication to their examination of both the mechanisms that might explain the substantive findings, and the artifacts that might obviate or reduce the size of the effect. The Dohrenwends, in particular, present a well-written concluding overview containing critiques of recent data. This chapter includes a chart on "decision making in definition and measurement of stressful life events" that describes which measures are applicable to specific research aims.

Participants in both conferences emphasize the need for prospective designs, further elaboration of reliable measurements of discrete life events, more epidemiological sophistication in specification of contrasting populations, and comparison of effect sizes for differing contributing variables. For example, future prospective studies may support the retrospective findings of increased life stress in persons with premature heart disease, but they must also relate such a "risk factor" in terms of size of effect and possible common causality to other "risk factors" such as high blood pressure, smoking, personality styles, and family history of heart disease.

These volumes together are the vital texts on the currently powerful issue of the correlation between stressful life events and the onset of physical or psychological illness. If one had to choose between them, the book edited by the Dohrenwends is the more complete.The paradigm central to both volumes follows a strategy of simplification to achieve conceptual clarity and quantification. Both life events and instances of illness are brought into a yes-no or gradient system which allows a quantification of both types of episodes. The moral is that simplification leads to revitalization rather than stagnation. The significant and large-scale findings excite enough interest to assure that further methodological sophistication will be forthcoming and that this area of investigation will not fixate prematurely on these early forms of life event scaling procedures.

MARDI J. HOROWITZ
Department of Psychiatry,
University of California
School of Medicine, San Francisco

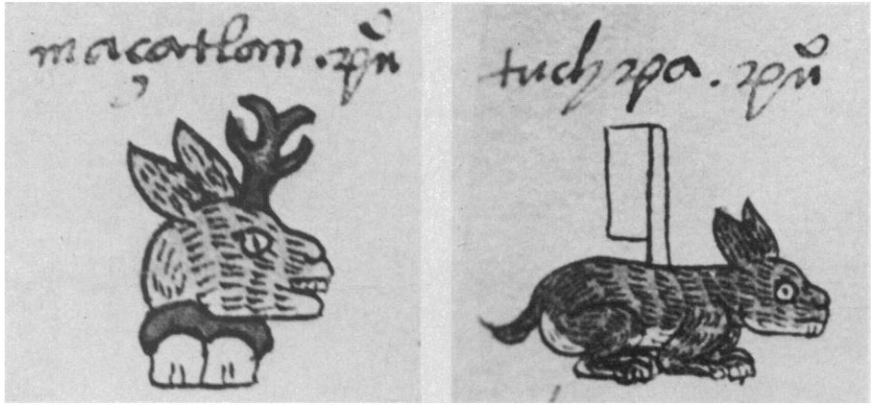
Deciphering Ancient Writing

Mesoamerican Writing Systems. Papers from a conference, Washington, D.C., Oct. 1971. ELIZABETH P. BENSON, Ed. Dumbarton Oaks Research Library and Collections, Washington, D.C., 1973. x, 226 pp., illus. $10.

Prior to the works of A. Caso, H. Berlin, and T. Proskouriakoff most scholars maintained that Mesoamerican hieroglyphic texts and scenes referred to astronomical events and to celestial deities. Pre-Columbian dates were believed to record eclipses and planetary cycles, particularly of Venus, Mercury, and Jupiter. Today, although the astronomical interpretation of certain hieroglyphic passages (for example, pertaining to the moon) is still acknowledged, most researchers agree that the Maya, Zapotec, Mixtec, and Aztec inscriptions have a substantial historical content—information about dynasties, genealogies, wars, tribute, and so on—which is presented within a chronological framework.

This symposium volume contains four papers devoted to Maya writing, one each to Aztec and Mixtec writing, and one to figurines. This last article, "Late Classic figurines from Tlaxcala, México, and their possible relation to the Codex Borgia-group" by B. Spranz, seems a bit out of place, especially since not all of Mesoamerica's writing systems are covered in the book. One other puzzling feature of the book is that none of the authors actually define a writing system or provide a rigorous distinction between partial and true writing systems.

Among the matters the contributions are concerned with are matching sounds to particular hieroglyphic affixes, ascertaining the extent of phoneticism in pre-Columbian writing, recovering the relation-



Place signs from the Codex Mendoza. *Left*, Mazatlan, fol. 12r; *right*, Tochpan, fol. 52r. [From H. B. Nicholson's paper in *Mesoamerican Writing Systems*]