sleeping. Throughout most of their lives women experience another well-known long-term periodicity, the menstrual cycle.

It does not require much scientific acumen to discover that our feelings and our performance vary throughout a normal day, and most of us have ideas and hypotheses about such changes, characterizing ourselves and others by such statements as "I'm an early riser" or "He works best late at night." Aside from such obvious rhythms, our lives are characterized by lesser-known ones, for example, alpha rhythms with a frequency of about 10 hertz and daily variations in body temperature, heart rate, and mental alertness.

This book is concerned with many of these tides of life, a subject that should appeal to a wide spectrum of scientists.

Colquhoun has tried to get a small group of experts to describe what is currently known about specific classes of biological rhythms and human performance. One particular emphasis in the book is on measures of actual performance rather than on feelings and moods, not because variations in the latter are any less apparent or impressive, but rather because they are more difficult to quantify and to measure. Another major emphasis of the book is on *human* performance, an emphasis that has both good and bad points.

The book contains seven chapters. The first, by Keith Oatley and B. C. Goodwin, is on "The explanation and investigation of biological rhythms." The other chapters are "Circadian variations in mental efficiency" by W. P. Colquhoun, "Temperament and time of day" by M. J. F. Blake, "Sleep behavior as a biorhythm" by Wilse B. Webb, "A periodic basis for perception and action" by A. J. Sanford, "Menstrual cycles" by June A. Redgrove, and "Industrial work rhythms" by K. F. H. Murrell. Each chapter has an extensive bibliography with, unfortunately, titles of journal articles not given.

As so often happens with collections of articles, there is in this one an unfortunate lack of continuity between the articles, and together they do not entirely cover the field. The lack of continuity is especially noticeable with regard to the first chapter, which describes several very sophisticated statistical techniques for measuring and quantifying biorhythms. None of these techniques is used anywhere in the rest of the book. For all that, each chapter is a thorough, up-to-date review of its particular subject. The overall impression left by the book, however, is that despite a voluminous literature we can still say very little with much assurance about biological rhythms and human performance.

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Tumor Cytogenetics

The Role of Chromosomes in Cancer Biology. PEO C. KOLLER. Springer-Verlag, New York, 1972. xii, 124 pp., illus. $15.30. Recent Results in Cancer Research, 38.

In this rather compact book the author traces succinctly the history of research pertaining to the role of chromosomes in cancer biology and presents cogent recent findings from karyotypic studies, of both induced and spontaneous tumors in animals and cancers in the human, as they bear on the development of tumors and, particularly, on the behavior of cancer cells once a tumor becomes established. The remarkable variability of the cytogenetic findings in cancers, particularly human, both primary and metastatic, is comprehensively covered and illustrated.

The general theme of these discussions is the author's belief (shared by the reviewer) that the visibly recognizable chromosomal changes in human cancer (and leukemia) are secondary phenomena to the neoplastic state and are not the direct cause of the cancer (or leukemia). This theme is developed logically and substantiated with an ample number of studies from the literature and the author's laboratory as well. The role of congenital or hereditary cytogenetic aberrations in cancer causation, Boveri's theory of the role of chromosomes in cancer, the stemline concept of cancer genesis and the clonal evolution of chromosomal aberrations, and the karyotypic findings in so-called precancerous lesions receive special emphasis.

In each chapter appropriate and informative tables and figures are included; the lack of a picture of a metaphase with the Ph^1-chromosome (Philadelphia chromosome) is regrettable, since this chromosomal anomaly is the only consistent and characteristic one established to date for any mammalian malignancy, in this case chronic myelocytic leukemia in human subjects. The chapter dealing with chromosomes and the treatment of cancer is not quite on a par with the others. Not much space is devoted in the book to human acute leukemia, a condition of especial interest because it tends to be as often aneuploid as diploid. A short chapter on cytogenetic methodologies in cancer and leukemia and on recently described techniques for fluorescent staining and banding patterns of chromosomes would have been welcome. These last few statements should not be taken to indicate, however, that the book, though consisting only of 124 pages, is not packed with important information on chromosomes and cancer. It includes an impressive list of selected references, by an author who has devoted much of his scientific work to the unraveling of the riddle of chromosomes and cancer.

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Epidemiological Problems

Geochemical Environment in Relation to Health and Disease. Papers from a conference, Oct. 1971. HOWARD C. HOPPS and HELEN L. CANNON, Eds. New York Academy of Sciences, New York, 1972. 352 pp., illus. Paper, $25. *Annals of the New York Academy of Sciences*, vol. 199.

This book covers the analysis and distribution of trace elements in the geochemical environment, known relationships of health to the geochemical environment, and the methodology and problems of determining causal relations between disease and the geochemical environment.

The first half of the book is devoted to an overview of the analysis and distribution of trace elements in the natural environment and presents trace element data for rocks, soils, waters, and plants. Various factors that influence the availability of trace elements to the successive members of the rock-soil-water-plant-animal cycle, such as solubility, adsorption phenomena, soil-plant interaction, competition among mineral elements relating to adsorption by animals, and aspects of diet are discussed. Diseases or conditions associated with regional or local trace element anomalies are brought in at various points. Problems encountered in the sampling of rocks, soils, waters, and

plants for trace element analysis are reviewed. Statistical models and approaches in sampling, as well as sample collection, storage, preservation, and contamination, are touched upon. The final section of this portion of the book describes three methods of trace element analysis: activation analysis, atomic absorption analysis, and spark source mass spectrometry. Attempts are then made to assess the relative merits of these methods in analysis of environmental samples.

The second half of the book surveys health problems and the relationship of trace inorganic levels to optimum health and to cancer and cardiovascular and infectious diseases. In reporting on studies relating to deleterious concentrations of trace elements the authors are careful to point out drawbacks inherent in various analytical schemes and the lack of agreement between data from different laboratories. The consensus is that a standardization of methods of sample preparation, analysis, and data interpretation is a necessary first step toward the improvement of communication among participating disciplines.

There is general agreement among the contributors that more understanding of the comparative physiology of the action of trace elements in animals and humans is needed and that there is an increasing demand for a coordinated interdisciplinary effort in environmental epidemiology and for the utilization of the most advanced technologies of sample preparation and analysis.

This book is a good introduction to the epidemiology of trace elements in the natural environment. It is well organized and takes the reader through a logical succession of topics which are all pertinent to the central theme, a feature that is certainly not the general rule for a proceedings publication. It should be remembered that this work does not deal with pollution, and those interested in this aspect of the subject must look to other publications. The material presented also deals more with nutrition than with toxicity, but this is probably dictated by the limitations of present knowledge. One of the weak points of the work is in analytical methodology. Many worthwhile techniques are not mentioned, although this problem is recognized in panel discussions. Another is the occasional, and likely to be quoted, claim of specificity based on inadequate data, as, for example, when a correlation is asserted between particular metals in water and cancer mortality of specific sites when the waters analyzed were all surface waters rather than the sources of the drinking water supply of the cancer victims. Despite these shortcomings, the participants' insights into the nature of problems at hand and their general willingness to share information through coordinated interdisciplinary communication, particularly as revealed in the panel discussions, make the book a valuable one.

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Topics in Statistical Mechanics

Statistical Mechanics. New Concepts, New Problems, New Applications. Proceedings of a conference, Chicago, March 1971. STUART A. RICE, KARL F. FREED, and JOHN C. LIGHT, Eds. University of Chicago Press, Chicago, 1972. viii, 424 pp., illus. $16.

As with all other conferences the proceedings of the sixth International Union of Pure and Applied Physics Conference on Statistical Mechanics suffers from the fact that the title, *Statistical Mechanics: New Concepts, New Problems, New Applications*, represents the organizers' aspirations rather than the speakers' contributions. Of the book's five sections, Fundamental Principles, Developments in Biology, Generalized Hydrodynamics, Phase Transitions, and Liquids, the title seems appropriate to only one, the second. For the most part, the remaining sections deal with familiar problems, and the applications, new or otherwise, are sparse. At the same time, the burst of experimental activity on one- and two-dimensional systems and their phase transitions, the quantitative studies of metastability with superconductors, and the extensive activity on complex fluids like liquid crystals by statistical physicists go unnoticed. In general, the organizers have invited speakers with chemical and mathematical approaches and underrepresented the experimental and theoretical physicists' contributions to the field, tending to open a gap previous conferences had partially closed. Scheduling the conference in coincidence with the American Physical Society solid state meeting also did not help the conference discussions.

In spite of these omissions the book is worthy of attention. There are several interesting innovations. Although I cannot give expert comment on the biological section, I found Elliott Montroll's "Nonlinear processes, especially those involving competitive processes," Jack Cowan's "Stochastic models of neuroelectric activity," and Cohen and Robertson's "Cell migration and the control of development" enjoyable to read. Each gave me new perspective in areas not normally considered by statistical physicists. The section Generalized Hydrodynamics contains a thoughtful review by Robert Kraichnan, "Some modern developments in the statistical theory of turbulence." Since the subject is so opaque and the achievements so obscure, his review performs a particularly valuable function. Three articles by Resibois, Zwanzig, and Kawasaki describe from three different viewpoints the coupled-mode ideas discussed by Kadanoff at the last conference, and the questionable assumptions these theories employ are at least partially aired in the articles and subsequent discussions. Fortunately we seem to be hearing fewer long tales about long-time tails! The first section benefits from the fact that Robert Griffiths writes clearly and simply, and Joel Lebowitz is never dull. The latter's contribution on "Hamiltonian flows and rigorous results in non-equilibrium statistical mechanics" is especially informative. There is also an article on aspects of the microscopic theory of liquid helium by Eugene Feenberg, who has been a leader in this area for many years.

It has been clear for a long time that serious study at a fundamental level of steady states far from equilibrium (metastability, activation energies, and so forth) is highly desirable and long overdue. The present volume contains at least two articles addressed to these problems—Kraichnan's and one by Rolf Landauer and James Woo—but much remains to be clarified. Future conferences should deal more extensively with these questions and the objections that were confined to discussion periods here.

This book suffers from many omissions and includes many contributions better left unmentioned, but it retains redeeming scientific value. It is to be hoped that the worthy aims and innovations will be extended at future conference sessions.

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