Or, on learning that four mummified rats recovered from a wall in Christ's College were black rats, whereas this species in England subsequently was largely displaced by the Norway rat, Hutchinson states, even though he was not yet nine years when this happened, that his "interest in interspecific competition was first aroused at this time." Or, through a paper he wrote on masochism in mollusks he thinks he may have contributed unwittingly to the development of the "gay" movement, and he regrets the loss of the very useful original meaning of the word, for which no adequate substitute has been found. More minor distractions are nonetheless real, such as the propensity for trying to demonstrate personal connections with famous persons, sometimes by the most circuitous routes.

Hutchinson's chief role has been as a gatherer (with the additional function of synthesis implied), perhaps epitomized by the carrying-baskets on girls' bicycles, which his father didn't want him to use even for transporting field equipment. Gordon Riley, Hutchinson's first Ph.D. at Yale, remarked in the celebratory issue of *Limnology and Oceanography* (p. 178) that in the chemistry laboratory, where they worked together, Hutchinson's manipulative skill was rather deficient. If as a result and as compensation he left the laboratory to concentrate on synthesis and theory, science has been so much the better for it. Hutchinson's carrying-basket is enviably large, with many strange items in it reflecting the "extraordinary richness" of the academic environment in which he grew up, but the basket is developing holes. Memory is capricious.

Near the beginning of the book and again at the end, Hutchinson comments on the role of the serious amateur in science, particularly natural history. Some of the various societies and clubs in Cambridge, which played such a major role in his early development, were open to and attended by nonacademic persons. Now he sees a need for the resurgence of informed amateurism as people retire earlier, live longer, and remain active intellectually. I will second this.

The most recent issue of the *American Scientist* (vol. 67, No. 4) lists the book under the category "History and Philosophy of Science." This is appropriate, for Hutchinson discusses persons, places, events, and ideas, provides many personal insights into the lives of distinguished scholars and the genesis and development of major ideas, and roams comfortably through religion, folklore, psychoanalysis, and art in addition to science. The scholarship is generally intense but irregular and at times frustratingly truncated by the absence of additional material and ideas one senses are accessible, yet on the whole the book is fascinating to read.

DAVID G. FREY
Department of Biology, Indiana University, Bloomington 47405

An Ecological Study

Pattern and Process in a Forested Ecosystem. Disturbance, Development and the Steady State Based on the Hubbard Brook Ecosystem Study. F. HERBERT BORMANN and GENE E. LIKENS. Springer-Verlag, New York, 1979. xiv, 254 pp., illus. $19.80.

This volume is the second in a trilogy on the Hubbard Brook Ecosystem Study, which began 15 years ago and whose name is rapidly becoming a household word among biologists, foresters, hydrologists, and others involved in the controversies and practical problems of forest and landscape management. The study is a rich source of quantitative data on the response of defined biogeochemical processes to clear-cutting and certain other perturbations within a temperate hardwood forest at Hubbard Brook, New Hampshire. More than this, the study provides in this second volume one of the few comprehensible attempts at modeling what the authors call "the ever mind-boggling complexity of natural ecosystems." The book is avowedly written for the reader interested in the ecology of ecosystems rather than for the ecosystem specialist. Instead of beginning, as most ecologists have, with plants or animals and then getting bogged and boggled in the modeling of species interactions that are thought to be ecosystems, Bormann and Likens and their many co-workers tackle ecosystem dynamics from the point of view of biogeochemical processes. The present book draws heavily on the first volume stemming from the project, *Biogeochemistry of a Forested Ecosystem* (1977), for data about flux, cycling, biomass accumulation, and nutrient budgets and aims to present "an integrated view of the structure, functions, and development of the northern hardwood ecosystems." It is concerned with change on different time scales, resulting from either endogenous or exogenous forces, in the relationships between animate and inanimate sides of ecosystem function.

To begin with the inanimate processes of a small watertight watershed as a delimited ecosystem, as Bormann and Likens and their co-workers have done at Hubbard Brook, enables fairly precise measurement of inputs and outputs, and a budget of these components can be used to estimate unknown parameters such as net weathering release or cationic denudation. Emphasis can then be placed on the role of biological processes in controlling destabilizing forces. Thus, each biological response and strategy discussed is highly pertinent. Total environmental effects and additive impacts are always kept in mind, so that the ecosystem models do not remain intellectual curiosities.

The book is well laid out, with a summary at the end of each chapter. The style is relaxed, sometimes even chatty, and in places somewhat repetitious, but this makes for easy reading and assimilation of the many complex, interlinked ideas. There is an abundance of diagrams or models scattered as figures throughout the text, and the captions often reach half a page.

The first five chapters are factual and pivot on the biomass accumulation model's four phases of reorganization, aggradation, transition, and steady state. Discussion of the results begins with the aggradation phase, characterized by storage of biomass and nutrients and by maximum biotic regulation over energy, nutrient, and hydrologic flux. The biogeochemistry and ecology of the other phases are best understood in terms of departure from the highly predictable parameters of the aggradation phase. For the development of vegetation after clear-cutting there is an extensive and stimulating discussion of the fundamental and often poorly understood processes of buried-seed storage, type of regeneration and seedling growth, and floristic responses via species richness and diversity.

Only in the sixth and seventh chapters do the authors permit themselves to move from observation and measurement of actual forest stands to the least verified aspects of the steady state. Can there be any absolute steady state, or only a system undergoing slow, long-term change? In the absence of drastic exogenous disturbance (fire, hurricanes), it takes several centuries for an all-aged condition, termed the shifting-mosaic steady state, to develop. The authors compare their interpretations of its mechanisms to those of Alex Watt, whose classic research "on the Breck" near Cambridge, England, was done over 30 years ago. They could have also invoked similar ideas developed for tropical rain forest dynamics that are well summarized in the Unesco state-of-

knowledge report on tropical forest ecosystems published last year. It is clear that the work by Bormann, Likens, and co-workers in a temperate hardwood forest in New Hampshire is highly relevant to understanding the dynamics of the rather more complex forests of the humid tropics.

In the eighth and final chapter some examples are given of how the Hubbard Brook Ecosystem Study can contribute some answers about environmental impacts and appropriate forms of forest management, as well as help to formulate questions on such issues more precisely. We must await the fleshing out of these suggestive principles in the next volume of the Hubbard Brook series.

L. J. WEBB

Rain Forest Ecology Section,
CSIRO Division of Plant Industry, Long Pocket Laboratories, Indooroopilly,
Queensland, 4068 Australia

Decoding Nonverbal Behavior

Sensitivity to Nonverbal Communication. The PONS Test. ROBERT ROSENTHAL, JUDITH A. HALL, M. ROBIN DIMATTEO, PETER L. ROGERS, and DANE ARCHER. Johns Hopkins University Press, Baltimore, 1979. xxiv, 408 pp. $20.

Although scientific interest in nonverbal communication dates back a century to Charles Darwin, recent proliferation of research on the topic covers a mere two decades. That brief period has yielded a voluminous and often disorderly body of knowledge. This state of affairs results in part from the wide range of behavior that nonverbal communication encompasses, including how people sound, move, gesture, and touch, how they approach and look at each other, and even how they dress, adorn, and equip themselves. Anthropologists, sociologists, linguists, and psychologists have been among the many who study these topics. It is perhaps not surprising then that this diversity of domain and range of researchers have produced more questions than answers about the nature of nonverbal communication. This book presents the results of seven years of research by a team of social psychologists who have developed a "film test" of nonverbal sensitivity. Their work too produces more questions than answers.

The research grew out of Rosenthal's previous studies of the effects on performance of expectations held by experimenters and teachers, work which suggested that these effects are mediated by nonverbal communication. The investigators believed that being able to measure individual differences in the ability to encode and decode nonverbal behavior would provide some answers concerning the way in which peoples' expectations influence behavior. The Profile of Nonverbal Sensitivity (PONS test) was designed to measure such decoding ability, and the first third of the volume is devoted to a careful description of the development and structure of the test.

The PONS test is a 45-minute film in which a young woman is shown encoding 20 different emotional situations. Each emotional situation is shown 11 different times in 2-minute segments that isolate one of three visual channels (face, body, entire figure) or two auditory channels edited to be content-free or six combinations of these visual and auditory channels. The 20 emotional situations represent positive-negative and dominant-submissive dimensions of behavior. Each of the 220 segments is followed by a pause long enough for the viewer to pick one of two alternative descriptions of what the encoder is doing. The isolation of channels makes it possible not only to describe encoders as more or less accurate but also to derive a "profile" of different decoding abilities.

The first six chapters provide detailed descriptions of the construction of the PONS test and of seven shorter versions of the test that were developed for specific studies. Results are presented bearing on the internal consistency of the PONS (which is high) and the stability of the scores over time (which is modest). The researchers describe the reliability of the test as "reaching the level obtained by standardized group-administered tests of intelligence" (p. 362), a finding likely to satisfy some potential users and to dismay others. The limitations of using a single encoder and posed emotional expressions are recognized, albeit minimized, by the authors. No rationale is offered for the selection of positive-negative and dominant-submissive dimensions of emotion, although the structure of the test with regard to these dimensions is carefully described. Validation is difficult when developing a test of something for which no other good measure exists. The authors show considerable care and statistical sophistication in establishing that the pattern of results presented in the volume constitutes evidence of construct validity for the PONS test.

The test has been given to more than 7000 people in over 200 groups in the United States and other, mainly English-speaking, countries. The last two-thirds of the book presents findings relating the nonverbal sensitivity of these decoders to their gender, age, culture, cognitive ability, personality attributes, various psychological and physical impairments, and occupation. A chapter is devoted to the original question whether nonverbal sensitivity is a mediator of expectancy effects; regrettably few relationships were found and the question remains unanswered. Considering this body of data as findings that validate the PONS test, the results are informative. As findings that add to a fundamental understanding of nonverbal communication, they fall short. This failing arises from the notably atheoretical approach taken to the development of the test and to the selection of samples on which the results are based. The absence of guiding conceptualizations occasionally draws the authors close to the logical fallacy of assuming that identical patterns of correlations reflect identical underlying psychological processes. The determinedly empirical approach presented in the volume makes the interpretation of findings difficult for both the authors and the reader.

In general, the researchers have been thorough and careful in the statistical extraction of relationships from their diverse data. Particularly helpful is their consistent reporting of effect sizes in addition to statistical significance. This provides the reader with useful information on what relationships are large enough to warrant further investigation. In sum, the book provides a complete account of a measure of decoding ability and is a gold mine of suggestive hypotheses that others might pursue. In so doing, they would be well advised to seek answers to the questions raised by the findings in this program of research.

CLARA MAYO

Department of Psychology,
Boston University,
Boston, Massachusetts 02215

Developmental Genetics

Genetic Mosaics and Cell Differentiation. W. J. GEHRING, Ed. Springer-Verlag, New York, 1978. xii, 316 pp., illus. $39. Results and Problems in Cell Differentiation, vol. 9.

Genetic mosaics are individuals made of cells of more than one genotype. They have been utilized most extensively in *Drosophila* and the mouse for developmental studies. This volume of ten papers on the subject of genetic mosaics does not have any strong common