ment support of science and for the democratic process itself?

Ludwig von Bertalanffy bases his book on his Heinz Werner Lectures at Clark University in 1966. Here we find a biologist widely learned in the literature of controversy that has been generated by the moving frontiers between biology and psychology. And what he offers is an exercise in rhetoric on behalf of the organicist position in biology, especially its opposition to behaviorist psychology. He argues for "a new conception of man" based on man's faculties of symbolic expression, a program to which he finds the supple capabilities of general systems theory well adapted. The author expressly states that he offers an essay in the sociology of knowledge, in terms not of the diffusion of understanding in the population but of the social uses (and misuses) of science and technology. He identifies the stimulus-response model in psychology with the "robot model" of man, for which Arthur Koestler has coined the epithet the "ratomorphic view of man." He claims that reductionist psychology is to blame for manipulative use of the mass media and also assigns it the blame for a widespread breakdown in human values. There is great merit in his insistence upon man's symbol-creating powers as the basis for a new theory of mind, as Suzanne Langer has also recently argued in *Mind: An Essay on Human Feeling*. But it is rhetoric and no more to castigate behaviorist psychology as an instrument of mind control which must be set aside in favor of this more genial conception of man. Bertalanffy is one of the few writers of our time who could give an authoritative account of the failings of behaviorism while pointing out promising avenues for the future. That is of course not the task the polemicist sets himself. He is out to reassure his converts, not to enlarge their numbers.

Bertalanffy asserts that "hard science" (which he does not define other than to say it is conventional) cannot fathom the true nature of man, which will require an organismal approach. Again it is the aim of his rhetoric to belittle the physical sciences as lacking in the systems approach and thus being unequal to problems of emergent order in living systems (without a bow to the physics of fluids, crystallography, or stereochemistry). Bertalanffy has been an exponent of the biology of organized systems for 30 years, and he writes with pardonable pique that too many exponents of this approach in the present day speak of it as a recent invention. Cuvier's law of correlation was a systems concept, or one might cite T. H. Huxley's remark to the International Medical Congress in 1881 that "the body is a machine of the nature of an army, not that of a watch or of a hydraulic apparatus." The idea that organisms were "more" than the sum of their parts derives from German idealist philosophy of the last decade of the 18th century, and it exercised wide influence during the 19th century, in the cell theory and in experimental embryology. Bertalanffy takes legitimate delight in pointing out that we know the vocabulary of the genetic code but not its grammar, that general theories of history will have greater value than the specialties from whose exponents they elicit anxiety reactions, and that science may in time be humanized. He elicits a sympathetic response, for the direction of his argument is enlightened and liberal. But the periods of the university lecture hall are rarely suited to the requirements of the lay audience, and so it is with this volume. Those most likely to enjoy it are humanists concerned about the limitations of scientism, which is Bertalanffy's real target in this engaging polemic.

PHILIP C. RITTERBUSH
Office of Academic Programs, Smithsonian Institution, Washington, D.C.

Behavior as a Continuous Process

The Dynamics of Behavior Development. An Epigenetic View. ZING-YANG KUO. Random House, New York, 1967. xiv + 240 pp. Paper, $2.45.

Zing-Yang Kuo is known to psychologists for his pioneering work on the development of behavior in the chick embryo. The importance of this work, conducted in the 1930's, is adequately reflected by the extent to which it is known today. The major contribution of Kuo's early work was not only in providing a technique for studying prenatal behavior in the chick but also in emphasizing the fact that behavioral development is a continuous process and that behavior at one stage of development can be an important determinant of behavior at later stages.

In *The Dynamics of Behavior Development* Kuo again emphasizes the importance of looking at behavioral development as a continuous process and expresses his feelings about some of the developments which have occurred in the behavioral sciences over the past 40 years. To the reviewer, many of the issues raised, such as the nature-nurture controversy, are ones which are no longer the major problems of the behavioral scientist. The criticisms leveled by Kuo frequently miss their mark. For example, Kuo's remarks on ethology apply to the early writings of the ethologists, especially Lorenz, and no attention is given to the more current ethological positions. Similarly, much of Kuo's book is a rehash of controversies that have been resolved or at least put aside in our current thinking about behavioral development.

This is not to say that all old issues are dead issues; but their revival serves little purpose unless something new is added. In my opinion Kuo's book adds very little, and the ideas proposed, if carried out to the extreme that Kuo would like, would result in the abolition of the science of behavior. Thus, to regard behavior as a continuous process from fertilization through death would seem to have its merits. But to accept the position that everything that occurs at a given point in time is equally important in influencing everything that is to occur in the future would necessitate exchanging hypotheses for chaos. As a specific example, in responding to criticism concerning the extent to which movements in the chick embryo influence later behavior, Kuo contends not only that prenatal movements influence later pecking but that such movements are the basis for all later behavior in the chick's repertoire. To adopt such a position is what the younger generation would call a copout. Everything influences everything, so no postulated relationship can possibly be wrong. In conjunction with this argument Kuo writes (pp. 100–101), "Moreover, I have not observed any single embryonic activity in the bird which is performed the same way twice." It would seem that this is an overzealous statement in support of his position or that Kuo has amazing powers of discrimination. If the statement is true, however, what are the ground rules for the classification of behavioral units on which the science of behavior can proceed? What good are the meth-

odological control and the strict experimental procedures that Kuo insists upon?

Kuo's book postulates two "new" theories, the theory of behavioral gradients and the theory of behavioral potentials. The theory of behavioral gradients maintains, in effect, that the organism responds as a whole unit in all behavior it exhibits; there are no local reactions. There are only visible and invisible portions of a reaction, labeled by Kuo as explicit and implicit gradients. There is no difference in importance between explicit and implicit gradients; both contribute equally to the total behavior pattern. Again, it would seem that to consider this position as valid in its extreme would lead to chaos, despite the fact that there are undoubtedly many contributors to a behavioral reaction that are not obvious or easily assessed. The theory of behavioral potentials is subtitled a new solution to the problem of the nature-nurture relationship. Behavioral potentials are "the enormous possibilities or potentiality of behavior patterns that each neonate possesses within the limits or range of the normal morphological structure of its species." Kuo contends that one of the major tasks of the behavioral epigeneticist is to strive to create new behavioral phenotypes by manipulation of the environment, with the only limitation being the behavioral potential of the organism. Creating behavioral neophenotypes will somehow make it possible to control the evolution of the organism in the future "independent of somatic changes and, therefore, without any need for changes in genotypes." How such a process might operate seems quite mystical, and I am unable to comprehend the author's conceptualization of how evolution works.

In developing his position on behavioral potential Kuo does, however, raise one important concept which is largely ignored in modern experimentation, and that is the concept of the importance of the environmental context as a determinant of the behavior observed. This is a point to which many give lip service but which few seriously consider. We seem to be content to allow our experiments and our results to be situation-bound, accepting the fact that our phenomena depend to an unknown degree on the experimental situation being studied. Indeed, experimental procedures dictate that we keep all other things constant in our manipulations of one or a few experimental variables. The outcome of this position is, curiously enough, that a well-controlled experiment has less generalizability than does a sloppy one in which all other things are not held constant. Kuo's position seems somewhat different from my own, but the emphasis he places on environmental context is an aspect of his argument with which I heartily agree.

ERNST W. HANSEN
Institute of Animal Behavior,
Rutgers University,
Newark, New Jersey

Glacial Drift

Einführung in die Geschiebeforschung. KURT HUCKE. Edited and enlarged by EHRHARD VOIGT. Nederlandse Geologische Vereniging, Odenzaal, 1967. 132 pp., illus.; 50 plates. D.M. 15.

The Quaternary Period of northwestern Europe is distinguished by glaciers which radiated from the Scandinavian shield and advanced across the Netherlands and the North Sea into eastern Great Britain and across the Baltic to cover large parts of northern Germany, Poland, and northern U.S.S.R. The geology in many parts of northwestern Europe reflects these conditions; the principal Quaternary deposits are stratified and nonstratified glacial and interglacial sediments including many gravels and boulders. Kurt Hucke undertook a long and searching examination of the rocks in such sediments from many parts of northwestern Europe so as to analyze their lithologies and fossils. Much of the present book, an interesting compendium on these rocks and their geologic origin, was in manuscript form at the time of Hucke's death in 1963, and the task of completing the study was undertaken by Ehrhard Voigt of the Hamburg Geologische Staatsinstitut, who greatly enlarged the original manuscript. The book is introduced with a memorial to Hucke by his colleague W. F. Anderson, who aided in its publication.

The book contains useful introductory sections discussing *Geschiebe,* which in this report includes the gravel-sized material transported as part of the bed load of a stream or by ice, or both, techniques and work methods for studying the gravels, and the geological framework of northwestern Europe. The principal part is a detailed chronostratigraphic account, divided into periods, of the lithologies and fossils of the gravels, starting with the Precambrian and extending to the Quaternary. This knowledgeable account brings together information about many aspects of the stratigraphy of northwestern Europe. This information is effectively summarized in tables of stratigraphic correlation for each period which will be an excellent aid for those not thoroughly versed in the stratigraphic terminology of northwestern Europe. The text is well illustrated with geologic maps and 24 halftones of lithologic types, handsomely complemented by 50 photographic plates of fossils, arranged stratigraphically, which constitute a handy atlas of fossils. The extensive bibliography and careful index greatly enhance the study. Geologists will find this book provides a valuable compilation of lithologic types and fossils from northwestern Europe.

JUNE R. P. ROSS
Department of Biology,
Western Washington State College,
Bellingham

Reactions

Chemical Kinetics. G. PANNETIER and P. SOUCHAY. Translated from the French edition (Paris, 1964) by H. D. Gesser and H. H. Emond. Elsevier, New York, 1967. xvi + 455 pp., illus. $17.

This book is clearly written, at a level appropriate for students taking a first course in reaction kinetics. It has an unusually wide coverage of all kinds of reactions. The first 296 pages deal with homogeneous reactions and the next 125 with a wide variety of heterogeneous processes. An interesting list of not-too-difficult problems will challenge the serious student. There is wide and satisfactory coverage of the methods and instruments used in the measurement of reaction rates. The authors make no use of statistical mechanics. For example, partition functions and quantum mechanics are not mentioned, although interesting three-dimensional potential energy surfaces for a number of reactions are given. Absolute reaction-rate theory is formulated only in its thermodynamic form, and collision theory is derived with the use of kinetic theory. This book is a useful beginning text in chemical kinetics but should be followed by a more advanced course for physical chemists.

HENRY EYRING
Institute for the Study of Rate Processes, University of Utah,
Salt Lake City