premises are frankly "supernatural" and therefore not susceptible of scientific examination; one believes them, or one doesn't. Yet it has scientific importance for the cultural anthropologist, and especially for the sociologist and medical man, who constantly meet defeat, through the political pressures exerted by the group Fr. Gibbons represents, as they attempt to solve some of the world's most critical problems by a rational approach to population control. Here is warfare of theology against science, on a level affecting the earthly lives of millions of people. What it may be doing to their lives in the next world, I do not consider myself competent to judge.

The discussion of resources by Profs. Black of Harvard and Bradfield of Cornell contains a great deal of useful material and sharpens their criticisms of a number of recent writers who have expressed concern over rapid population increases and reckless destruction of resources. It is unfortunate, it seems to me, that they elected to devote nearly all their attention to food, instead of looking at the total environments in which the food must be produced. Every physical environment consists of an extremely complex, four-dimensional system of dependent variables upon which is imposed a powerful human cultural complex that may include factors as deadly as any lethal gene. Until we begin to organize our thinking in such terms, it is going to be extremely difficult to understand that what is possible at Beltsville may be impossible for many decades in the so-called backward areas, plagued by exploding populations. Dr. Thompson, in his discussion, brings the problem into focus in more of its complexity.

One more point should be noted: a popular estimate of potential agricultural land is uncritically cited (p. 74). Many people consider this too high; E. S. Archibald, director of the Experimental Farms Service, Dominion of Canada, on a recent CBC broadcast, characterized the estimate of 300 million available acres of northern podsol as "fantastic," based on his experience in Canada. I should apply the same word to one billion acres of potential tropical agricultural land, based not on what American soils scientists *might* do with the land, but on what the people of the tropics are doing *to* it, and are likely to continue doing for decades.

WILLIAM VOGT

*Washington, D. C.*

***Theory of Hearing.*** Ernest Glen Wever. New York: John Wiley; London: Chapman & Hall, 1949. 484 pp. $6.00.

Professor Wever's book is an important one for a variety of reasons. As a general source of information on theories of hearing it has no equal in English. The reader, whether expert or naive, will find here adequate summaries of old and new ideas on how we hear, and if he wishes to pursue these matters further, the bibliography will point the way.

A lucid synopsis of the present state of our knowledge on both cochlear anatomy and acoustic neurology is presented. The author shows how advances in understanding have followed "accretion to anatomical knowledge," and he describes for the first time certain of his own measurements on the cochlea of man. In view of this emphasis on anatomy it is strange to find no mention of the acoustic projection to the cerebellum which was convincingly demonstrated some eight years ago.

The author's current concept of the volley theory is expounded in detail, and experimental evidence of many kinds is impressively marshaled in its support. His selection of material from the literature of physiology and psychology, and his willingness, throughout, to take a positive stand on controversial matters will provide considerable stimulation for the initiated among his readers.

In this readable and scholarly work, the substantial advances of the past twenty years march past in orderly fashion. They are reviewed by one of the most prolific workers in the field, who makes here still another contribution to it. As seen through his eyes—and the expanded version of his views of auditory theory is well worth having—"The place and frequency principles have been assigned their respective roles as well as may be on a basis of the evidence now at hand, . . . and it will remain for further experimentation and discussion to determine how reasonable they are and to work out the revisions, large and small, that are found to be necessary."

ROBERT GALAMBOS

*Harvard University*

***Adaptation.*** John Romano, Ed. Ithaca, N. Y.: Cornell Univ. Press, 1949. 113 pp. $2.00.

In dedicating a new department of psychiatry at Strong Memorial Hospital, University of Rochester, Dr. Romano, the psychiatrist-in-chief, called upon a group of distinguished scientists representing biology, physiology, psychology, psychiatry, and social anthropology to participate in a symposium on the general topic of adaptation. This book is a collection of their presentations.

Dr. Romano's modest hope was that with psychiatry setting the stage, his guests might, by a few well-chosen observations from their own special fields, help bridge the gap in scientific thinking between the physical and the social sciences. The present pocket-size volume thus offers a surprisingly rich fare of stimulating comments on the phenomena of adaptation to life on various levels from the protoplasmic molecule to group cultures.

The concept of adaptation is almost as immanent and provocative as was the subject of Rochester's earlier symposium on man's behavior, where love was summed up as the harmony of man with himself and with all things in heaven and earth. On this occasion the treatment is somewhat less speculative. In five concise interpretations it is shown that from the lowliest of bacteria to the highest of animals, individuals and social groups maintain their integrity against the stresses of the world by following the same general principles of change in structure or in pattern of behavior to achieve long or short term adaptations.

In his introduction, Dr. Romano states that modern psychiatry has the responsibility to provide firm ground, especially in methodology, for the development of the social sciences, much as physics and chemistry provide for the biological sciences. Application of strictly scientific methods to such urgent but sensitive problems as infant and

child care, sexual behavior, and family and group situations in school, work, play and worship may, Dr. Romano admits, result in what he mildly terms anxieties and unrest. Fortunately, as a true scientist, he seems willing to let the chips fall where they may, in spite of the dilemma his facts pose—that more psychiatrically gifted clinicians are needed but the funds to support their training must often be obtained from wealth in the hands of the unintelligent and emotional.

The collection is opened with a scholarly presentation by Paul Weiss on "The Biological Basis of Adaptation." He reminds us that throughout evolution the fundamental features of life are the same. There are the same general molecular arrangements, the same methods of energy transfer and biosynthesis, the same mechanisms of growth and activity—all prototypes of mutual adaptedness, of harmony with conditions at every level from the subprotoplasmic world of the enzyme and substrate to the level of the central nervous system, from the molecular ecology of the cell to the group ecology of populations. Pervading all, the one common prerequisite for survival is simple fitness and harmony. And although fitness in general appears to be wholly dependent on the slow process of evolutionary screening, it is comforting to be assured that perfection and precision of fitness can still be achieved by direct on-the-spot adjustments under control of the individual organism. Considering the immensely greater powers for such direct adjustive action given to the human brain as compared to other organic systems, the reviewer agrees with Dr. Weiss that increased wisdom in the use of its powers is our challenge and opportunity.

Homer Smith of New York University discusses "Organism and the Environment." He quotes the familiar "we must view with profound respect the infinite capacity of the human mind to resist the introduction of knowledge" to emphasize that brain cells are intrinsically conservative, that new cortical pathways are acquired only by destroying or inhibiting the old, and that all physiological reactions are simply reactions against disturbance in an attempt to restore protoplasmic comfort. As a physiologist, Dr. Smith sees no reason to look outside demonstrable protoplasmic reactions in order to interpret even the most complex of the functions of the central nervous system. We wish the speaker had stopped there and had not attempted to tackle esoteric questions of religion, theology, and prayer, especially in connection with opinion poll methods. For many scientists of moderately sound insight the prayer "Thy Kingdom come . . . on earth" can hardly be dismissed as a mere unintelligent petition for miraculous intervention. Nor do all scientists agree that man's theological gropings have been his greatest handicap to advance in stature and in ability to live with his fellows.

Speaking for the psychologists, Dr. Liddell of Cornell discusses "Adaptation and Intelligence." Tracing the development of psychosomatic medicine, he reviews many of the early findings on conditioned reflexes in the light of more recent studies on experimentally induced neuroses. The animal ancestry of psychopathological phenomena interests him, although he emphatically denies that any serious investigator would actually identify the experimental neuroses in the mammal with the neurotic process in man. Dr. Liddell's modest conclusion is that workers in the field of animal behavior feel they are contributing to a common cause, with psychiatrists and other interested scientists, in directing more light on the problem of man's behavior.

Lawrence Kubie's discourse on "The Neurotic Potential and Human Adaptation" is refreshingly lucid and pertinent. In developing the case for the neurotic, Dr. Kubie reminds us that under favorable circumstances even neurotic mechanisms may be used to drive activities that are useful and creative. And he emphasizes that, given a change in external situations, an apparently well-adapted but actually neurotic personality may suffer what may seem an inexplicable collapse. The ability to recognize neurotic indications fits in with the whole story of adaptation, for such ability rests on an appreciation of the determining factors in all behavior.

Conduct based on conscious processes is flexible and realistic. Its motivations are influenced by appeals to reason and feeling. The individual has the capacity to learn from experience, and hence is free to grow in wisdom and understanding. His actions show personal responsibility, self-control, and productive enterprise. Behavior determined by unconscious processes, on the other hand, is rigid and inflexible. It cannot be altered by argument or reason, or even by its own success or failure. Since it recognizes no goal it is senselessly and endlessly repetitive. The individual learns nothing. He is enslaved. This kind of behavior is often characterized by extreme nationalism, group hatred, regimentation, and inertia.

As Dr. Kubie points out, there is, of course, no pure culture of one or the other dominant force, but a mixture is always at work in each of us. Where the conscious processes dominate, the behavior is normal and adaptive; where unconscious processes are allowed uninhibited sway, the personality is neurotic and unadaptive. The inescapable conclusion is that if we hope to shape human progress toward flexible and truly adapted living we must attempt in every way possible to extend the area of conscious and purposeful motivation.

The final paper in the collection is by Clyde Kluckhohn of Harvard on "The Limitations of Adaptation and Adjustment as Concepts for Understanding Cultural Behavior." Although Dr. Kluckhohn credits functionalist anthropology with giving the same light to group behavior as psychoanalysis has shed on individual conduct, he denies that cultural phenomena can be explained in terms of simple drives and needs. "Varieties of human temperament obfuscate the neat schemata of the functionalists." Furthermore, the relief-from-tension formula for motivation, he feels, is obviously inadequate, since tensions are frequently deliberately sought, and growth and creativity can come as much if not more from instability as from freedom from stress.

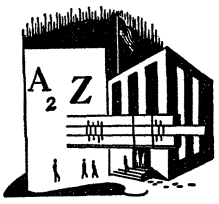
Mowrer's distinction between adaptation and adjustment is stressed. Adaptation is a survival of the fittest through natural selection, and adjustment a continuing

reaction to stimulation which persists as long as stimulus is present and forms a basis upon which habits are developed and modified. Dr. Kluckhohn feels that neglect of these distinctions has caused confusion and that their proper appreciation can materially aid in applying the methods of psychoanalysis, anthropology, and learning theory to a greater understanding or even an occasional prediction of human group behavior.

Unfortunately, culture change seems to involve a ceaseless flux of both internal and external factors, and cultures themselves have a tendency to create just about as many problems for the individual as they solve for him. Society as a whole has certain requirements referable primarily to the group rather than to the biologically derived needs of the individual; this reviewer concurs in the conclusion that in a well-considered plan of social study, culturally created values must be recognized as well as the external and immediately observable environment.

DANA COMAN

*Department of the Army*




***Seismicity of the Earth and Associated Phenomena.*** B. Gutenberg and C. F. Richter. Princeton, N. J.: Princeton Univ. Press, 1949. 273 pp. $10.00.

The objectives stated by the authors of this text on earthquakes are: to evaluate the present relative seismicity of various parts of the earth and to discuss the geography and geological character of the zones and areas of seismic activity. In fulfilling these objectives the authors give the reader a broad summary of the results of a vast amount of geophysical research, particularly their own. Their subject matter and general presentation will appeal to the reader with a casual interest in earth science as well as to the specialists—geophysicists, geologists, and geographers.

The observational basis of the book is the great mass of data compiled from records of seismograph stations throughout the world. Data are more or less available for all significant earthquakes that have occurred since 1904. The authors have taken these data and (1) located epicenters, (2) determined the depth of focus, and (3) evaluated the magnitudes of hundreds of earthquakes. Their results are presented in 154 pages of tables headed as to depth of focus and geographic region of the earthquakes. These tables provide a convenient reference which should be useful in a variety of studies.

A large proportion of the text is devoted to a discussion of the regional distribution of epicenters and their relations to the larger units of geologic structure. The frequency and energy of earthquakes, the interior of the earth, the mechanics of earthquakes, and tsunamis (seismic sea waves) are treated in smaller sections.

Maps showing the regional distribution of epicenters and active volcanoes are numerous and well placed throughout the text and certainly these maps and the data upon which they are based should serve as a basis for the revision of older ideas which have fulfilled their purpose but often appear in new books on the earth.

In view of the importance of the earthquake magnitude scale and the energy computations made with it, it is unfortunate that the discussion of these subjects had to be so brief in the book. It seems that a few more remarks on these computations would have benefited those readers who will not have immediate access to the articles in the journals. One has the feeling that the exact significance of the energy ratios as determined by the authors may be overlooked by many who will see this work. There are several places in this section of the book where the wording is so concise as to detract from the clarity.

The authors explicitly state their intention "to present facts of observation with only a minimum of hypothesis," and one can note that care has been exercised in this regard. Here and there throughout the book, however, appear several of the authors' conclusions which, although some have previously been stated in scientific journals, will undoubtedly prompt discussion and the review of related evidence. Outstanding in this respect one might note the following conclusions: that the Pacific arcuate structures contain thrust planes which dip towards the continents; that the ground displacements in regions of block faulting are always in the same sense; that small shocks are never sufficiently frequent to approximate the energy released in larger shocks and therefore cannot function as a "safety valve" to delay a great earthquake; and that there is a thin "continental" crust under the Atlantic Ocean.

This is a book which conveys a great deal of factual information on earthquakes and enough of the authors' experienced interpretations to make stimulating reading.

ROSS R. HEINRICH

*Saint Louis University*

***Electron Microscopy: Technique and Applications.*** Ralph W. G. Wyckoff. New York: Interscience, 1949. 248 pp. $5.00.

During the past five years Dr. Wyckoff and his colleagues at the National Institutes of Health have contributed significantly to the art of electron microscopy, particularly in the use of metal shadow-casting and surface replicas for the preparation of specimens. This nicely written book is a presentation of their results and contains brief descriptions of the methods used to obtain them.

The history, construction, and adjustment of electron microscopes, together with brief but helpful descriptions of various techniques for preparing specimens, take up only 80 pages. The remaining 58 pages of text describe the results—a selection of 175 of Dr. Wyckoff's superb electron micrographs of specimens ranging from metals and tooth structures to viruses and crystals of large molecules. The interpretation of the pictures is usually made independently of x-ray diffraction, sedimentation, or physiological studies of the material, and in some