Fig. 4, are very different from those shown in Fig. 5. The latter figure plainly does not come from observations in the open lake. This can not fall to 4° by December 1; nor can the surface maintain a temperature of nearly 30° in July. The discussion of the thermocline shows that the authors' interests are primarily elsewhere than with temperatures.

But such matters do not detract from the general value of the book, both for students and as a contribution to limnology.

A word must be said of the illustrations which, in general, are extraordinarily good. Sometimes photography is pushed too far. Not a few photographs of insects, etc., are from objects so dark that they do not show necessary detail. In such cases a drawing would do much better service. But a great many of the photographs, such as Fig. 61—duck-meat—and Fig. 207 really illustrate the subject and tell the student in the study what he ought to see in the field.

E. A. Birge

Individuality in Organisms. By Charles Manning Child, Professor of Zoology in the University of Chicago. The University of Chicago Press, 1915. Pp. 213. $1.25 net.

What is the nature of the unity and order which characterize the organic individual? Upon the basis of fifteen years of experimental and analytical investigation Professor Child in his recent book on "Individuality in Organisms" attempts to give an answer to this important problem.

In the first chapter of the book the writer makes clear that he is dealing with the problem of physiological individuality exclusively without metaphysical assumptions. Current hypotheses of the individual are found either to ignore the problem of the unity and order within the organism, or they carry with them vitalistic implications. His criticism of these hypotheses in chapter two forms one of the most readable portions of the book.

In place of current "corpuscular" theories of the individual which postulate "a mysterious, self-determined organization in the protoplasm, cell or cell-mass," Professor Child would substitute a dynamic conception of the individual. Physiological unity and order in his opinion are to be interpreted not in terms of a hypothetical organization and the transportation of chemical substances within the organism, but in terms of differences in the rate of reaction and of transmitted change. The basis of individuality lies in "spatial quantitative differences in the action of external factors on protoplasm." He finds experimentally that the head of the animal and the growing tip of the plant are centers of more active metabolism while posteriorly or basally processes are less intense. This evidence has led him to his doctrine of metabolic gradients, proof of the existence of which is advanced in chapter three.

Concluding that "the organic individual is fundamentally a dynamic relation of dominance and subordination, associated with and resulting from the establishment of a metabolic gradient or gradients," Dr. Child in subsequent chapters presents evidence of dominance within the organism and discusses the limitations of its range. Dominance in the individual is determined primarily, not by means of the transportation of chemical substances from one organ to another, but through the transmission of impulses just as in the nervous system. Subsequent to organic differentiation in ontogeny, however, integration of the organism may be partly effected through the transportation of chemical substances.

The bearings of the hypothesis upon the problems of differentiation, reproduction, heredity and evolution are suggested and briefly discussed in the concluding chapter of the book.

The claims of the author for his hypothesis are modest. It is certainly not too much to say that it has already proved its value as "a basis for the synthesis and ordering of many facts in various fields which heretofore have seemed to have little or nothing in common" and that it has brought "certain aspects of biology within hailing distance of physico-chemical conceptions." Adverse criticism has been largely forestalled by the objections which Dr. Child has himself raised and an-

swered, and by his resourcefulness in experimental verification.

The theory seems less satisfactory in its application to the phenomena of gametic reproduction than to the processes of regeneration. Pushed to its logical extreme in its application to ontogenesis the process of individuation postulated by Child appears to be one of complete epigenesis and the organization which develops to be due exclusively to external factors. In order to meet the insuperable difficulties which would be raised against a consistent theory of epigenesis, Dr. Child assumes that as a result of the influence of external conditions through many generations and through the inheritance of the acquired modifications, reproductive cells or cell-masses have come to possess "a fundamental reaction system" which constitutes a basis of preformation and conditions their development and their reaction to external stimuli. In this way it is possible to understand why under similar external conditions the ontogenesis of different species varies so greatly. Moreover, the "fundamental reaction systems" may be further modified through their intra-individual environment.

In order to meet the difficulty of understanding how a "reaction system" involving primarily only quantitative dynamic differences determines specific qualitative differences which appear in ontogeny, Dr. Child is led to assume primary differences in the specific constitution of the protoplasm of different eggs or cell-masses. But, since "systems" suggest spatial localization and the "specific constitution of protoplasm" implies chemical differentiation, does it not seem as if the basis of individuality postulated by Dr. Child is essentially like that assumed in the hypotheses which Dr. Child repudiates? On the whole, however, Dr. Child's hypothesis of individuality appears to be the best supported and the most consistent mechanistic hypothesis which has been advanced.

As the product of the mature thought of an independent and resourceful investigator "Individuality in Organisms" will take a permanent place in biological literature.

H. V. NEAL

PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES

THE tenth number of Volume 2 of the *Proceedings of the National Academy of Sciences* contains the following articles:

Preliminary Results on the Color of Nebulæ: F. H. Seares, Mount Wilson Solar Observatory, Carnegie Institution of Washington. Photographs of a Messier 51, 94, 99 show that the nebular condensations have large negative color indices. The knots of nebulosity are bluer than the bluest of the neighboring stars. The spectral character of the outlying regions differs from that of the central nucleus. In the case of the planetary nebula N. G. C. 3242 no important differences of this sort are revealed.

The Action of Alkali in the Production of Lipolytically Active Protein: K. George Falk, Harriman Research Laboratory, Roosevelt Hospital, New York. The author discusses: Inactivation of the enzymes by acid, by alkali, by alcohols, by acetone, by salts and by heat; nature of the chemical changes involved in the inactivations; and activation of proteins by alkali.

The Excretion of Acids by Roots: A. R. Haas, Laboratory of Plant Physiology, Harvard University. The author finds that no acid other than carbonic was excreted from the roots of corn seedlings. Similar results were obtained for wheat seedlings.

Spectrographic Observations of Relative Motions in the Planetary Nebulæ: W. W. Campbell and J. H. Moore, Lick Observatory, University of California. Further observations indicating the probability of the hypothesis that the so-called ring nebulæ are in reality not ring forms, but ellipsoidal shells. Tentative conclusions are also drawn as to the probable masses of the nebulæ.

New Determinations of Permeability: S. C. Brooks, Laboratory of Plant Physiology, Harvard University. The determinations have been made by a new independent method and by improved older methods. The results agree in showing that living protoplasms are normally permeable to the salts studied, but salts of pure solutions may alter permeability, some causing an increase of permeability while