

$$(p + dp)(v - dv) = K.$$

Now $v - dv$ in place of $v + dv$ is just the sort of error we have constantly to warn the freshman against. The increment dv may be negative, but should not be written as $-dv$. The author finds the correct result $dp/dv = -p/v$ incorrectly from an incorrect equation. On page 67 there is this choice bit: "At this point (such as P) there is a sudden change of direction; it is therefore called a *point of inflection*." A fine definition! How could the author have made more errors in so short a sentence! On page 86 we find: "It must not be supposed, however, that the series obtained by differentiating a convergent series term by term is also convergent. Thus the series

$$1 + x + x^{1 \cdot 2} + x^{1 \cdot 2 \cdot 3} + x^{1 \cdot 2 \cdot 3 \cdot 4} + \dots$$

is convergent for $|x| < 1$, but the series

$$1 + 2x + 6x^5 + \dots,$$

obtained by differentiation, is divergent for all values of x ." Now if there is any one fact better known or more fundamental than that a power series which converges is differentiable term by term and yields a convergent series, we fail to know what it is. This sort of mistake can arise only when ignorance is blatant enough to talk about matters of which it is so completely ignorant that it does not even recognize its ignorance. No author can wholly avoid errors, but here they are too many and too gross for any charitable inference.

But this book is intended for chemists, and in justice it should be judged chiefly upon what it does for them, what it gives them that they need, what it spares them that for them would be superfluous. Here we must admit that we think the work a great success. To the mathematician, the physicist or the electrical engineer the total omission of all reference to the circular functions and their inverses would seem incomprehensible. But the chemist has no need of oscillating functions; his phenomena run one way. The restraint that the author has exhibited in leaving entirely aside the trigonometric functions is therefore highly commendable. Again, the author uses differentials in differentiating and

gives a tolerably full account of partial differentiation, of the total or exact differential, and of circuit integrals. These matters are of great importance to the chemist. Moreover, though his work is chiefly elementary calculus, it somewhat justifies the more general title *Higher Mathematics* by the introduction of methods of interpolation, extrapolation, approximation formulas and the like, and it finds place on almost every page to appeal to the chemist by selecting exclusively for its applications problems which actually arise in that subject.

The titles of the chapters will give an idea of the scope of the text. Functions and limits, rate of change of a function, differentiation of algebraic functions, maximum and minimum values of a function, exponential and logarithmic functions, partial differentiation, interpolation and extrapolation, the indefinite integral (two chapters), definite integrals, application of the definite integral, differential equations (two chapters), and appendices containing the theory of quadratic equations, the solutions of systems of linear equations by determinants, approximation formulas, and a tabulation of the exponential and natural logarithmic functions. As has been stated, everywhere are found detailed and vital applications to chemistry, to which the list of entries in the index bears ample witness. The student who masters the text will do so with the fullest appreciation of its use to him and will attain a knowledge sufficient for most of his needs, albeit if he wishes to read such highly mathematical works as Gibbs's papers he must pursue his studies somewhat further. For the class for whom it is designed the book is far more useful than the ordinary text on calculus.

EDWIN BIDWELL WILSON

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Allgemeine Biologie. Vierte umgearbeitete und erweiterte Auflage. Von OSCAR HERTWIG. Jena, Gustav Fischer. 1912. Pp. 787, mit 478, teils farbigen, Abbildungen in Text.

The appearance of a fourth edition of this

standard work so soon after the publication of the third (1909) is convincing evidence of its usefulness. Indeed there is no other recent work which deals with such a wealth of material of general biological significance; and there are few biologists who possess Professor Hertwig's facility for clear and forcible presentation. The book is thoroughly readable. Each edition has been an improvement over the preceding, and the present is no exception, through elimination in a few places, but mainly by the addition of entire new sections, and by incorporation of later results in many places throughout. Thus the new matter of the present edition includes the action of β and γ rays on animal and plant tissues, results of tissue culture methods, and the subject of sex-determination. The subjects of chondriosomes, chemotherapy, dimorphism of spermatozoa, heterochromosomes, graft hybrids, hormones, secondary sexual characters and inheritance of acquired characters have been thoroughly revised and brought up to date. These additions and revisions are those noted in the preface, but the revision runs pretty well through the book.

A great merit of the book is that the author, though zoologist, by no means limits himself to animals in the discussion of biological principles, but makes free use of botanical results throughout. His botanical illustrations are often very illuminative, and the constant combination of animal and plant material serves to emphasize the conception of general biology as treatment of the phenomena of life common to animals and plants.

Professor Hertwig still opposes the prevalent view that the problems of biology are fundamentally problems of physics and chemistry. Even if we were to assume, he asserts, that at some remote time the science of chemistry should be so developed as to reveal the structure of all possible albuminous molecules and their derivatives, and that it provided methods by means of which we could ascertain what kinds of albumen and other organic molecules were present in the cell and in what quantities, we should not thereby gain insight into the essence of the living cell and of proto-

plasm. And why? Because the cell is not "living albumen," as has sometimes been said, or a mixture of innumerable albuminous molecules, but an organism composed of determinately arranged vital units, which are again complexes of albuminous molecules and therefore endowed with properties as different from the properties of the simple albumen molecule as the latter from the constituent atoms.

It is perhaps presumptuous, even in so seasoned and honored a veteran as Professor Hertwig, to venture to lay down the limitations of chemical research with reference to biology, and the bounds of the insight that future advance may yield into biological problems, for a reason that will appeal only to those biologists who still use "vital units" in thinking and conceive they know their properties. In any event, such a point of view has its obvious limitations, and they are felt in the treatment of many subjects in the book. On the other hand, this exclusively biological attitude is often of the greatest value in the criticism of premature or narrow generalizations of bio-chemists; and in several places Professor Hertwig's broad outlook on the biological field more than compensates for underestimation of the chemical side.

The treatment of a few subjects still remains rather antiquated. For instance, in the chapter entitled "*Untersuchungen der einzelnen Reizarten*" there is not a single citation more recent than 1891. And in this connection it is surely a serious defect in a work on general biology that the field of animal behavior should be entirely neglected. Another illustration of antiquated treatment occurs in the discussion concerning "*Befruchtungsbedürftigkeit der Zellen*," where the whole discussion, so far as infusoria are concerned, is based on Maupas' work, while the more recent work of Calkins, Woodruff and Jennings, is not even cited. But in most subjects such neglect of recent work is not so obvious, though piety towards pioneers is always observed, as is fitting.

The theoretical foundation of the whole treatment remains as before; if it is sometimes unduly prominent, or even, as it seems to the

reviewer, strained in many places, it nevertheless has an important function in the arrangement of material, and inherent interest of its own as the matured expression of opinion of one of the makers of modern biology; but one can not say that it has promise as a working program; it represents the biological conceptions of the nineteenth rather than of the twentieth century.

The book is full of interest, and may be profitably consulted by working biologists of all grades and laymen alike.

F. R. L.

Chemical Phenomena in Life. By FREDERICK CZAPEK, M.D., Ph.D., Professor of Plant Physiology in the University of Prague. New York and London, Harper and Brothers. 1911. Pp. ix+151.

We have before us bearing the above title an extremely interesting and valuable little book included in Harper's "Library of Living Thought." This book should prove to be of great interest to all those interested in the chemistry of life. And I take it that there are no students to-day interested in biology who are not insensibly drawn into the consideration of those varied chemical phenomena so highly characteristic of living things. To the botanist who is familiar with Czapek's "Biochemie der Pflanzen" in the German this little book (really a condensation of that great work) comes with particular interest. It was indeed a most difficult task, as the author admits, when it was attempted to put in condensed and rather *popular* form the subject matter with which he has busied himself for so many years. But it seems that this has been accomplished in a most admirable manner. However, it must not be supposed that this little volume is easy to read and understand; it is far from being adapted to the beginner in biology. The author states in the preface that "a *fair* knowledge of physics and chemistry, both organic and physical, is required, besides the great number of biological facts which must be remembered when we try to obtain a satisfactory survey of the general physiology of the plant." Consequently this

book will be of most value to those who have had a university training which included the above requirements.

With Czapek's well-known contributions to this field of botany all that is necessary to do to portray the value and scope of this book is to indicate the chapter heads as follows: Biology and Chemistry; Protoplasm and Its Chemical Properties; Protoplasm and Colloid-chemistry; the Outer Protoplasmic Membrane and Its Chemical Functions; Chemical Phenomena in Cytoplasm and Nucleus of Living Cells; Chemical Reactions in Living Cells; Velocity of Reactions in Living Cells; Catalysis and the Enzymes; Chemical Actions on Protoplasm and its Counter-actions; Chemical Adaptation and Inheritance.

Certainly every student of botany should have a copy of this book, and should read it again and again, not only for the considerable amount of subject matter here precipitated from a mass of bewildering details, but also because of the broadening of the point of view that is certain to result from its careful study.

RAYMOND J. POOL

THE UNIVERSITY OF NEBRASKA

STANDARDIZATION OF THE ACCOUNTS OF LEARNED SOCIETIES

THE United States is now supporting somewhere between 100 and 200 societies of which the object is the extension of learning, the promotion of science and common action in some field of intellectual endeavor. In a country so rich and so generous as the United States, it is not difficult to obtain support for such enterprises, and new ones are added every year. Still many of them find it hard to make both ends meet; a few are able to accumulate a permanent fund.

The accounts of these societies are almost all reported, and in most cases printed, every year; and it might be supposed that institutions founded for the inculcation of truth, exactness and efficiency would give to their supporters a detailed, analytic statement of receipts and expenditures. This is, however, far from being the case. The accounts of the societies are in general brief and far from self-