

tabular summary of the behavior of the most important indicators toward the more common acids and bases.

On the whole, the book is likely to prove useful in the laboratory for reference, as it is carefully compiled and brings into a compact and systematized form a great mass of scattered detail. Although 75 per cent. of the indicators and test papers recorded would probably never be used by the average chemist, yet, in special cases, where the ordinary indicators fail, it may prove a great convenience to have at hand such a compilation from which a suitable one may be selected. The educational value of the book, however, might in many cases be increased by the use of graphic formulas, especially in several of the syntheses which the author represents merely by equations.

The book is of a convenient size and attractive in form, the subject-matter is well arranged, printed on good paper with very clear type, but the proof-reading has been only fairly well done.

M. T. B.

Zur Analyse der Unterschiedsempfindlichkeit. By LILLIE J. MARTIN und G. E. MÜLLER. Leipzig, J. A. Barth. 1899. Pp. vii + 233. M. 7.50.

It is a psychological sign of the times that this work on the perception of weight does not in the least concern itself with Weber's law, but leaves that issue entirely aside in order to consider the psychological and physiological elements in the process. Instead of looking for the bare statistical result of a large number of judgments, it asks *how* a judgment is carried out. Accepting as a fundamental answer the theory of Müller and Schumann—according to which the process consists in lifting with equal muscular force the two objects to be compared, and inferring their relative weights from their resulting movements—accepting this theory without serious discussion, the authors seek for minor factors in the process. Their method is two-fold: to collect introspective observations made during the experiments, and to vary the conditions and contrast the statistical results. By these methods they have detected the following factors:

First, fatigue and its opposite, namely, excita-

tion or 'Bahnung.' It may happen that lifting the first of a pair of weights fatigues the motor centers; if so the energy of the second lift will involuntarily be less than that of the first, and the second weight will seem heavier than it is. In other conditions of the neuro-muscular system, lifting the first weight does not fatigue but stimulates; the second lift is then more energetic than the first, and the second weight feels correspondingly lighter. This theory—for it is not so well established as the other points made by the authors—is advanced in explanation of the 'time-error.'

Many judgments, though purporting to consist in the comparison of two given weights, were found to be something quite different. Often they were based on 'side-comparisons.' The actual comparison was not between the two weights given to be compared, but between one of them and the corresponding weight of the preceding pair. Though this seems an indirect and far-fetched manner of judging, it is often more readily adopted than the direct comparison. And in other cases no genuine comparison at all takes place, but the judgment is based on an *impression of the absolute weight* of one of the lifted objects. After growing accustomed to the series of weights used in an experiment and getting one's movements adjusted to the average run of those weights, one often finds that a weight on being lifted feels light, or feels heavy. This feeling is not a definite comparison of the given weight with the average; it is a mere impression, yet often very reliable. The impression is stronger the more the given weight differs from the average; which means that the easiest and most confident and correct judgments are the most apt to be determined by the mere impression, and the least apt to be genuine comparisons. Practice by no means eliminates this way of judging; on the contrary, the best demonstrated effect of practice was to increase the dependence on these impressions.

The impression of absolute weight operates differently in two classes of persons. Those of strong muscles and energetic movements are more subject to the impression of lightness; the less energetic to the impression of heaviness.

A large part of the monograph is occupied with an attempt to follow in detail the combined

effect of these various factors. This is a sort of quantitative analysis, which, though of purely technical interest, would have its value for psychology, could we but be sure of our numerical basis. When unfortunately there are, as in the present instance, three or more variable factors at our disposal, no one of which is a determined function of any other quantity, the field for arbitrary assumption of values is so wide that we have no means of checking our computation.

The real value of the work is that it points out several incidental factors in the process of judging. The more closely actual judgments are studied, the more evident does it become that they do not proceed according to the clean logical schemes which we are prone to devise for them in advance.

R. S. WOODWORTH.

GENERAL.

THE American Museum of Natural History, New York City, proposes to publish a selection of photographs collected by members of the Jesup North Pacific Expedition, provided a sufficient number of subscriptions can be obtained to warrant the undertaking. The photographs are to be reproduced by the heliotype process, in large quarto form. The edition will be limited to 250 copies. It is intended to issue the album in parts of at least 24 plates annually, the whole series to embrace 120 plates. It is contemplated to publish during the first year a series illustrating Indian types from the interior of British Columbia.

THE University of the State of New York has issued Museum Bulletin 24, supplementing the report of the entomologist for 1898, which is a memorial of the life and entomological work of Dr. Lintner. This contains a consolidated index to his whole series of reports and gives a nearly, if not quite, complete list of his scientific contributions during a long series of years. This volume of 316 pages will be sent postpaid to any address for 35 cents. Bulletin 28 is a pamphlet of 202 pages on the plants of North Elba, which will be much appreciated by the frequenters of that beautiful region. Its price postpaid is 20 cents. In University Handbook 16, the State Entomologist explains the scope and public utility of his

field of work. This series of handbooks gives in convenient form information frequently called for regarding the various divisions of the university work, and single copies are mailed free to any address.

BOOKS RECEIVED.

The Nervous System and its Constituent Neurones. LEWELLYS F. BARKER. New York, D. Appleton & Co. 1899. Pp. xxxii + 1122.

Chemistry, its Evolution and Achievements. FERDINAND G. WIECHMANN. New York, Jenkins. 1899. Pp. vii + 176.

The Family of the Sun, Conversations with a Child. EDWARD S. HOLDEN. New York, D. Appleton & Co. 1899. Pp. xxiv + 252. 50c.

Handbook of Practical Hygiene. D. H. BERGEY. Easton, Pa., The Chemical Publishing Co. 1899. Pp. 164.

NOTES ON INORGANIC CHEMISTRY.

THE larger works on descriptive chemistry are full of compounds whose existence is doubtful, and it becomes the sometimes thankless task of the chemists of to-day to go over this old work and verify or prove false the work of earlier observers. An instance of this appears in the last *Journal* of the Chemical Society (London) in the case of the suboxid of phosphorus P_4O . The existence of such a compound, discovered by Le Verrier in 1838 was, indeed, called in question by von Schrötter in 1852, as he considered it merely an impure form of the red ('amorphous') phosphorus, which had not long before been discovered by him. In 1880, however, Goldschmidt and Reinitzer prepared a red substance which resembled Le Verrier's 'suboxid' and the existence of P_4O seemed to be confirmed. But now Chapman and Lidbury have gone over the whole subject, have prepared and analyzed every substance which has been described by different observers as 'suboxid' and come to the conclusion that the supposed suboxid P_4O is identical with red phosphorus in a finally divided and superficially somewhat oxidized and hydrated condition. No compound of definite composition could be found.

THE problem of softening hard waters for industrial purposes is one of the great problems of applied chemistry. Such softening is not merely necessary for boiler waters, but it has