edition of Hume's " Nests and Eggs of Indian Birds." Mr. Oates prepared and published the first four volumes of the " Catalogue of Birds' Eggs," and had considerable manuscript for the final volume, when his death in 1911 brought the work to a close for a time. After considerable unavoidable delay Mr. Ogilvie-Grant has finally completed the undertaking with the present volume, which covers nineteen families of passerine birds, beginning with the white-eyes (*Zosteropidæ*) and ending with the crow-shrikes (*Striperidæ*). It treats of 1,117 species and over 19,000 specimens.

The nomenclature and systematic arrangement—as in previous volumes—follows that of Sharpe's " Hand-list," and in all cases reference is made to that work and to the " Catalogue of Birds," where the species was known when the latter work was published. There is also reference to the other more important works, especially those having figures of eggs. The descriptions appear to be carefully drawn with average measurements as well as mention of unusual or peculiar sizes and markings. The plates are beautifully executed and as the species treated are all of small size it has been possible to include something over four hundred figures. Altogether this is a highly successful completion of a notable undertaking.

F. H. KNOWLTON

Abhandlungen und Vorträge zur Geschichte der Naturwissenschaften. Vol. II. By Professor Dr. EDMUND O. VON LIPPMANN. Published by Veit and Co., Leipzig. 1913. Large 8vo. 491 pp.

Those scientific readers who enjoyed Professor Lippmann's " Essays and Addresses on the History of the Natural Sciences," which appeared in 1906, will welcome the appearance of this second companion volume.

Since the time of Kopp, whose monumental " Geschichte der Chemie " was printed just 70 years ago, no one in Germany has delved so deeply as Lippmann in the abstruse field of ancient chemical science, and certainly no one has better understood how to arouse an interest in matters which might seem to the general reader to lack importance.

The 32 papers in Vol. I. of the " Abhandlungen " dealt with such themes as the scientific and chemical knowledge contained in the works of Pliny, Dioscorides, Albiruni and Shakespeare; alchemistic poetry; the history of freezing mixtures, gunpowder, glass and the thermometer; biographical essays upon Marggraf, Achard, Mitscherlich, Leonardo da Vinci, Francis Bacon, Descartes and Robert Mayer; an account of two unpublished letters of Liebig; an address concerning Goethe's " Theory of Colors "; and other papers too numerous to mention.

In the new collection of " Abhandlungen und Vorträge," which has just been published, we note the same range and variety of subjects as were treated in the first volume. There are in all 36 additional papers in which we find discussed such topics as the chemical and scientific knowledge of the ancient Egyptians and Greeks and of the middle ages, as shown by the Ebers Papyrus, by the works of Plato and Aristotle and by the thirteenth-century " Régime du Corps " of Aldebrandino di Siena; the history of the water bath, the specific gravity spindle and the autoclave; the history of lead-soldering and of distillation and of the uses of petroleum as a fuel and of sugar as a preservative; the derivation and history of the terms " caput mortuum," alcohol, gas and potash; biographical papers upon Jean Ray, upon Alexander von Humboldt as the precursor of the theory of isomerism, and upon Liebig's relationship to Robert Mayer and the theory of conservation of energy; critical interpretations of obscure passages in Aristotle's Meteorology and in Goethe's Faust; and many other papers equally interesting and important. The pages of the book, as of the previous volume, are enlivened with anecdotes and curious bits of folklore, and it is difficult to recall another work of the kind which combines equally so much instruction and entertainment.

In these two volumes of the " Abhandlungen und Vorträge " additional surprises and pleasures are in store for those who have come to marvel at the many-sidedness of Professor

Lippmann's achievements. There are many who know the results of his practical work as director of the large sugar refinery at Halle, and of his researches in the laboratory, as comprised in his exhaustive two-volume treatise "Die Chemie der Zuckerarten," but there are fewer, perhaps, who know what he has done during leisure hours in the study along historical and cultural lines, as exemplified in his masterful book "Die Geschichte des Zuckers" and in these two volumes of scientific papers and essays. To be technologist, chemist, historian and scholar, and all surpassingly well, is a record of accomplishment such as few men have realized. Adapting a phrase from that ancient "father of science," Aristotle, of whose works Professor Lippmann is such an enthusiastic commentator, we may say: it is a record of accomplishment, "four-square and truly good."

C. A. Browne

SCIENTIFIC JOURNALS AND ARTICLES

The July number (Vol. 14, No. 3) of the *Transactions of the American Mathematical Society* contains the following papers:

L. E. Dickson: ''Proof of the finiteness of modular covariants.''

R. D. Carmichael: ''On transcendentally transcendental functions.''

M. Fréchet: ''Sur les classes V normales.''

G. R. Clements: ''Implicit functions defined by equations with vanishing Jacobian.''

Dunham Jackson: ''On the approximate representation of an indefinite integral and the degree of convergence of related Fourier series.''

L. P. Eisenhart: ''Certain continuous deformations of surfaces applicable to the quadrics.''

The concluding (July) number of volume 19 of the *Bulletin of the American Mathematical Society* contains: Report of the April meeting of the Society, by F. N. Cole; Report of the twenty-third regular meeting of the San Francisco Section, by W. A. Manning; "The total variation in the isoperimetric problem with variable end points," by A. R. Crathorne; "A note on graphical integration of a function of a complex variable," by S. D. Killam; "The unification of vectorial nota-

tion," by E. B. Wilson; "Shorter Notices": Kowalewski's Grundzüge der Differential- und Integralrechnung, by R. L. Borger; Vivanti-Cahen's Fonctions polyédriques et modulaires, by G. A. Miller; Markoff-Liebmann's Wahrscheinlichkeitsrechnung, Carvallo's Calcul des Probabilités et ses Applications, and King's Elements of Statistical Method, by A. C. Lunn; "Notes"; "New Publications"; Twenty-second Annual List of Published Papers; Index of Volume XIX.

THE RUTHERFORD ATOM

To explain the observations made by Geiger and Marsden[1] on the scattering of α particles through large angles by metal foils, Rutherford[2] suggested that in such cases the deflection of each ray was due to an intimate encounter with a single atom of the matter traversed. It was necessary to assume that the positive charge is highly concentrated in a very small volume at the center, surrounded by an equal amount of negative electricity distributed throughout the remainder of the volume of the atom. To compare the theory with experiment, suppose we consider the effect of allowing a narrow pencil of α rays to strike a thin metal foil from a direction perpendicular to its surface. The probable number of reflected or deflected rays which may be expected each second to strike any given square centimeter of a spherical screen whose center of curvature is the point of bombardment, was shown by Rutherford to be, according to his theory,

$$P = \frac{Qnt}{4r^2}\left(\frac{NeE}{mu^2}\right)^2 \mathrm{cosec}^4\frac{\phi}{2},$$

where:

Q = number of α rays striking the foil per second;

nt = number of atoms in the foil per unit area;

r = radius of the spherical screen;

ϕ = angle between the radius vector to the area and the direction of the striking beam of rays; or the angle of deflection;

Ne = central charge of the bombarded atom;

[1] *Proc. Roy. Soc.*, 82A: 495, 1909; 83A: 492, 1910; *Manchester Lit. and Phil. Soc. Proc.*, 1910.

[2] *Phil. Mag.*, 21: 669, 1911.