of a concept, neither can it become adequately known to us through the medium of description. Botany without designation of types is like geography without position.

In biology a species is a coherent or continuous group of organisms. In such a group the individual organisms have a common origin and may be arranged in connected series of imperceptible gradations with reference to any one character, except in cases of sexual differentiation and alternation of generations, where the coherence of specific groups is maintained by facts of life-history. A species is not constituted by any antecedent determination of the amount of difference it must present; it subsists in virtue of the fact that it has diverged and become disconnected in nature from other groups of organisms, however similar these may be.

For nomenclatorial purposes a species is a group of individuals which has been designated by a scientific (preferably a Latin adjective) name, the first individual to which the name was applied constituting the type of the species. The importance of preserving type specimens with special care is now recognized throughout the scientific world, and where specific types are lacking, naturalists are endeavoring to supply their place by specimens collected in the original localities. This may be taken as a general admission of the obvious fact that purely descriptive methods are generally insufficient for scientific accuracy and need to be supplemented by actual specimens if correct identifications are to be permanently assured.

For purposes of reference and citation specific names which appeared previous to the 'Species Plantarum' of Linnæus are not regarded in botanical nomenclature. In reality Linnæus revived rather than originated the binomial system of nomenclature, but his works embody the results of the first extensive and fairly consistent attempt at the scientific application of the nomenclatorial practice now universally followed.

The method of types applied to genera involves a similar readjustment of views. Under the analytic method of concepts a genus has been defined as a sub-division of a family, but the method of types is synthetic and places the emphasis on the connection with nature by building the genus up from below.

A genus of organisms is a species without close affinities, or a group of mutually related species. Here again the natural arrangement must have reference to the gaps in nature rather than to the logical balance of formal characters.

A generic name is established in taxonomy when it has been applied to a recognizable species. Unless the discoverer of the genus designates a type species in the same publication in which he bestows the name, the first species referred to the genus should serve as its nomenclatorial type.

The generic taxonomy of plants may be treated as beginning with Tournefort's 'Institutiones' (1700).

O. F. COOK.

WASHINGTON, D. C.

SCIENTIFIC BOOKS.

Memoirs presented to the Cambridge Philosophical Society on the occasion of the jubilee of SIR GEORGE GABRIEL STOKES, Bart., Hon. LL.D., Hon. Sc.D., Lucasian Professor. Cambridge, at the University Press, 1900; New York, The Macmillan Co. 4to. Pp. xxviii + 447, with 25 plates. Price, $6.50.

The celebration of the fiftieth anniversary of the Lucasian professorship of Sir George Gabriel Stokes at the University of Cambridge, on June 1 and 2, 1899, brought together a large number of distinguished naturalists, if one may use this convenient term to include astronomers, chemists, geodesists, geologists, mathematicians, physicians, physicists and zoologists. It was one of those occasions which illustrate the essential unity of science by a spontaneous tribute of homage to an eminent specialist from workers in widely divergent fields. During the week following the

celebration the Cambridge Philosophical Society held a special memorial meeting at which a number of mathematico-physical memoirs were presented. These now appear in print for the first time in the volume whose title-page is quoted above. A note on the page following the title-page states that "These Memoirs are also issued as Volume XVIII. of the *Transactions* of the Cambridge Philosophical Society." The book contains also the 'Order of Proceedings at the formal celebration by the University of Cambridge of the Jubilee of Sir George Gabriel Stokes, Bart., Lucasian Professor, 1849–1899'; and 'The Rede Lecture: *La théorie des ondes lumineuses: son influence sur la physique moderne*,' delivered by Professor Alfred Cornu on June 1, 1899. An excellent portrait of Sir George appears as a frontispiece, and the volume is supplemented by twenty-five plates illustrating the different memoirs and by an index.

The semi-popular lecture by Professor Cornu, in addition to giving an admirable summary of the century's progress in physical optics, presents the conclusions of a special study of the work of Newton in this field. To the general reader as well as to the specialist this eloquent address cannot fail to prove interesting and instructive; and the scientific world must applaud the sentiment expressed in the author's closing words:

"Que l'Université de Cambridge soit fière de sa chaire Lucasienne de Physique mathématique, car, depuis Sir Isaac Newton jusqu'à Sir George Stokes, elle contribue pour une part glorieuse aux progrès de la Philosophie naturelle."

The memoirs proper of the volume are twenty-two in number and by as many different authors. They appertain to a wide variety of subjects and are in general strictly technical in character. They are appropriately not too prolix, however; the briefest occupying only 3 and the longest only 56 pages. Pure and applied mathematics are about equally represented, though some of the papers are a little difficult to classify. The titles and authors of the memoirs are as follows:

I. 'On the analytical representation of a uniform branch of a monogenic function,' by G. Mittag-Leffler.

II. 'Application of the partition analysis to the study of the properties of any system of consecutive integers,' by Major P. A. MacMahon.

III. 'On the integrals of systems of differential equations,' by A. R. Forsyth.

IV. 'Ueber die Bedeutung der Constante b des van der Waals'schen Gesetzes,' von L. Boltzmann und Dr. Mache, in Wien.

V. 'On the solution of a pair of simultaneous differential equations which occur in the lunar theory,' by Ernest W. Brown.

VI. 'The periodogram of magnetic declination as obtained from the records of the Greenwich Observatory during the years 1871–1895 (Plates I. II.),' by Arthur Schuster.

VII. 'Experiments on the oscillatory discharge of an air condenser, with a determination of 'v',' by Oliver J. Lodge and R. T. Glazebrook.

VIII. 'The geometry of Kepler and Newton,' by Dr. C. Taylor.

IX. 'Sur les groupes continus,' par H. Poincaré.

X. 'Contact transformations and optics,' by E. O. Lovett.

XI. 'On a class of groups of finite order,' by W. Burnside.

XII. 'On Green's function for a circular disc, with applications to electrostatic problems,' by E. W. Hobson.

XIII. 'Demonstration of Green's formula for electric density near the vertex of a right cone,' by H. M. Macdonald.

XIV. 'On the effects of dilution, temperature and other circumstances on the absorption spectra of solution of dydimium and erbium salts' (Plates III.–XXIII.), by G. D. Liveing.

XV. 'The Echelon Spectroscope,' by A. A. Michelson.

XVI. 'On minimal surfaces,' by H. W. Richmond.

XVII. 'On quartic surfaces which admit of integrals of the first kind of total differentials,' by Arthur Berry.

XVIII. 'An electromagnetic illustration of the theory of selective absorption of light by a gas,' by Horace Lamb.

XIX. 'The propagation of waves of elastic displacement along a helical wire,' by A. E. H. Love.

XX. 'On the construction of a model showing the 27 lines on a cubic surface,' by H. M. Taylor. (Plates XXIV., XXV.)

XXI. 'On the dynamics of a system of electrons or ions: and on the influence of a magnetic field on optical phenomena,' by J. Larmor.

XXII. 'On the theory of functions of several complex variables,' by H. F. Baker.

The pure mathematician will find much of interest especially in Nos. I.–III., VIII.–XI., XVI., XVII., XX., and XXII. of these papers; while the mathematical physicist can hardly fail to discover something instructive in his lines. Together they fitly commemorate the jubilee of one who has rendered signal service in the development of both branches of mathematical science.

Scientific Papers. By PETER GUTHRIE TAIT, M.A., Sec. R. S. E., Honorary Fellow of Peterhouse, Cambridge, Professor of Natural Philosophy in the University of Edinburgh. Vol. II. Cambridge, at the University Press, 1900; New York, The Macmillan Company. 4to. Pp. 1–500. Price, $6.50.

Papers on Mechanical and Physical Subjects. By OSBORNE REYNOLDS, F.R.S., Mem. Inst. C. E., LL.D., Professor of Engineering in the Owens College and Honorary Fellow of Queens College, Cambridge. Reprinted from various transactions and journals. Vol. I., 1869–1882. Cambridge, at the University Press, 1900; New York, the Macmillan Company. Royal 8vo. Pp. xv + 416. Price, $5.00.

In these days of open and easy avenues to publication, when the papers of a fertile author are almost certain to be widely scattered in transactions and periodicals, it is a good sign to see authors and publishers alike willing to undertake the labor and expense of republication in collected form. Especially welcome—perhaps one should say essential—are such collected works to the student of the present and coming generation, for the task of finding out what has already been done in a science is generally one of the most formidable preliminaries to progress.

In the republication of the well-known scientific papers of Lord Kelvin, Sir George Gabriel Stokes and George Green, and in the more recently collected papers of Maxwell, Cayley, Adams, Lord Rayleigh and others, the University of Cambridge has set an example in the work of 'University extension' of which the academic world may well take note. Probably no more effective method of advancing knowledge could be adopted.

Volume II. of the papers of Professor Tait contains numbers LXI. to CXXXIII. They relate to a large variety of topics, ranging from the kinetic theory of gases down through addresses and reviews to notes and brief abstracts. Often, however, these notes and abstracts are full of interest and suggestion, and they serve, as Lord Rayleigh has remarked with reference to his similar republications, 'to relieve the general severity.' Nos. LIX., Report on some of the physical properties of fresh and sea water; LXVIII.–LXXXI., On the kinetic theory of gases; LXXXVIII., On impact; and CXII., On the path of a rotating spherical projectile, are the longer papers of the collection. The last cited paper will be found of special interest to the lovers of golf who may happen to possess the essential but rather rare fondness for mathematical physics. As might be expected, many of the papers refer to quaternions and their applications. Here and there also a biographical notice, like those of Listing, Kirchhoff, Sir William R. Hamilton and Rankine, gives an unexpected interest to the miscellany; and the student of the mathematico-physical sciences is delighted and instructed at every turn of a page. We may not always agree with the author, but we never find him dull.

The papers of Professor Reynolds are reprinted after the same fashion as those of Professor Tait. They are 40 in number and refer to a variety of subjects. Many of them are of great practical interest to the engineering profession; for example, those with reference to the screw propulsion and the steering of ships, the efficiency of belts, the theory of rolling friction, the action of rain and oil in calming the sea, etc. The longest paper, No. 33, is the important experimental and theoretical investigation on certain dimensional properties of matter in the gaseous state, previously pub-

lished in the *Philosophical Transactions*, Part II., 1879. Unlike the volume of papers of Professor Tait, noticed above, this volume of the papers of Professor Reynolds has both a table of contents and an index.

Every one interested in the progress and in the diffusion of science will hope that the 'liberality of the Syndics of the University Press,' under whose auspices these and similar volumes have appeared, will continue to challenge admiration and commendation by the republication of additional collections.

R. S. W.

Kleiner Leitfaden der praktischen Physik. By F. Kohlrausch. Leipzig, B. G. Teubner. 1900.

Even the teachers of physics in America are so familiar with the original 'Leitfaden' that a review of this abridgment may well be essentially a comparison. The term Leitfaden (leading strings) expresses so well what is necesssary in a laboratory that it is to be regretted that we have no English equivalent. As the preface of the smaller book indicates, the larger later editions of the original have become at once a book of instructions and of reference, and has suffered as do all books which grow in that way. The new material is seldom well combined and coordinated with the old. In the new book the author has commenced all over again and distributed the matter consistently.

It is called a *smaller* guide and yet it is necessary to make a detailed comparison in order to discover that some thirty-four paragraphs have been either omitted or considerably condensed and simplified. It is, however, still a very respectable university course in physical laboratory work, and any student who thoroughly masters it will be found well equipped for advanced work. It in no sense can be called an elementary manual. It does not involve mathematics higher than algebra and simple geometry and trigonometry, logarithms and sines, cosines, etc., are assumed. More diagrams and illustrations are used than heretofore and this seems to be a real improvement. A picture book is undesirable, but well chosen diagrams and diagrammatic sketches are a great help to the beginner. This has long been recognized in light and electricity and should be judiciously extended.

Condensation is too often opposed to simplification, but in this case little or nothing of the original clearness seems to be lost in the rearrangement. Nevertheless some good hard thinking and strict attention will be required if the student is to get full benefit.

A chapter on the C. G. S. system of units is placed at the very beginning, and is necessarily very brief, and, although very important, may well be used as matter for reference from time to time as the units arise rather than to be learned at the outset.

Considered from the point of view of the teacher in the general physical laboratory, this book may well supplant the earlier treatise and relegate it to the shelf with other books of reference, and to the advanced special laboratories. It is perhaps well to warn those less familiar with the subject and with German idiom that many words which are identical with the English are used in a different sense; *e. g.*, hydrometer, in English is equivalent of araeometer, but Kohlrausch applies it to the communicating tubes used for densities of liquids. In fact in the chapter on the absolute units it would be essential that a student have the technical English equivalents, and even then some of the German units seem to be superfluous repetitions, and it should be always left clearly impressed upon the mind that 'work,' for example, is always work and always measured in the same unit no matter how the work may be accomplished; and similarly with other units.

The sections on light and especially on electricity and magnetism are very good and complete. The diagrams in the electrical measurements leave nothing to be desired and make one regret that the author did not see fit to illustrate the other subjects with the same liberality and good judgment.

A few useful tables and a good alphabetical index contribute largely to the usefulness of the book, which will be welcomed by every laboratory instructor in physics in college or university.

W. Hallock.