free the writer uses a dissecting microscope equipped with a foot-focussing device. This machine was described in SCIENCE[1] and is now for sale by the Spencer Lens Company of Buffalo, N. Y. However, even with a good hand lens leaf characters, such as vernation, general shape, type of base and apex, kind of margin and venation, can usually be made out. In addition, the buds may inclose flowers far enough along so that floral characters such as number and type of sepals, petals, stamens and pistils can be ascertained. In many cases unknown species can actually be run through the keys of manuals based on floral and leaf characters.

In grasses the sheath tube of a large vigorous culm can be split longitudinally and the incipient inflorescence exposed. The type of inflorescence can be determined, in most cases the florets of a spikelet can be counted and many of their characters can be made out.

In many instances these undeveloped, concealed characters in woody plants and grasses are definite enough to actually allow for identifying the plant in ordinary manuals. However, in most cases their greatest value will probably be in helping decide between several possibilities or in allowing for a positive check on what otherwise might be an uncertain identification.

H. D. HARRINGTON

COLORADO STATE COLLEGE

CYSTINE AND METHIONINE REQUIREMENTS FOR GROWTH AND LACTATION

RECENT studies have shown that the sulfur-containing amino acids promote lactation in rats when fed with rations in which the protein is derived from casein or alfalfa leaf meal. Since these proteins are deficient for growth in their combined contents of cystine and methionine, it does not necessarily follow that cystine and methionine should be regarded as lactation stimulants merely because they promote lactation when fed with these proteins.

We have recently determined the growth and lactation responses in rats fed alfalfa leaf meal proteins supplemented with various levels of cystine. We have also determined the growth and lactation responses to cystine and methionine when fed with peanut meal protein. Cystine does not significantly improve the growth- and lactation-promoting properties of peanut meal protein. Methionine improves both properties. Our results indicate that the combined requirements for cystine and methionine and the conditions governing the interchangeability of cystine and methionine are of essentially similar orders for growth and lactation.

J. R. HAAG

L. D. WRIGHT

OREGON STATE AGRICULTURAL COLLEGE

SCIENTIFIC BOOKS

THE THEORY OF NUMBERS

An Introduction to the Theory of Numbers. By G. H. HARDY and E. M. WRIGHT. The Oxford University Press. Octavo: xvi + 403 pp. $8.00.

MATHEMATICS undergoes continuous revitalization through two main currents of thought: the one flowing from the inexhaustible supply of simple conundrums concerning the positive integers; the other flowing out of new conceptual ideas necessary for the comprehension of natural laws. For example, to quote Cajori,[1] "in the study of the right triangle there arose questions of puzzling subtlety. Thus, given a number equal to the side of an isosceles right triangle, to find the number the hypotenuse is equal to. . . . The problem may have been attacked again and again. . . . In some such manner arose the theory of irrational quantities"—as a byproduct of the attempt to solve an arithmetic problem without rational solution. Similarly the imposing edifice of Euclidean geometry grew out of the physical concepts based on exact spatial measurement.

In the fascinating volume by G. H. Hardy and E. M. Wright under review here we find a remarkably happy and varied selection of important arithmetic problems treated with consummate clarity and distinction. The book will appeal to the many non-professional devotees of number theory and to professional mathematicians generally. As a basis for an attractive and profitable first course on the theory of numbers one could not find a better text. The title is the same as that of a well-known volume by our great American number-theorist, L. E. Dickson. But there is little overlapping, and no real confusion will be caused.

It will enhance the value of the work to mathematicians that one of the two distinguished authors (Hardy) has not only contributed greatly to the advancement of the subject on the side of the so-called "analytic theory of numbers" but also has long been one of the most inspiring mathematical figures in the world. We recall too his close association with the short-lived genius, Ramanujan of India, with the lamented Landau of Göttingen and with his remarkably gifted colleague Littlewood at Cambridge, all of whom have done so much for number theory.

Although the pages of the book treat a large variety

[1] H. D. Harrington and R. W. Poulter, SCIENCE, 79: 368–369, April 20, 1934.

[1] "History of Mathematics," second edition, pp. 56–57.

of topics, nevertheless it is truly stated by the authors in the preface that "in the first eighteen chapters we assume nothing that is not commonly taught in schools, and any intelligent university student should find them comparatively easy reading. The last six are more difficult, and in them we presuppose a little more, but nothing beyond the content of the simpler university courses." The authors have discussed the distribution of primes, Farey series, the geometry of numbers of Minkowski, irrational numbers, the theory of congruences, Fermat's theorem and related topics, decimal representation of numbers, continued fractions, approximation of irrationals by rationals, algebraic integers, Diophantine equations, the familiar arithmetical functions, partitions, representation of numbers by two or four squares, Kronecker's theorem in one or more dimensions. In every case the discussion given is on an elementary level so far as technical knowledge is presupposed, but on a genuinely professional level as far as insight and thoroughness are concerned.

A valuable feature of the book is the bibliographic material in small print at the end of each chapter, which furnishes an excellent orientation in the relevant literature.

It is much to be hoped that other mathematical works having the appeal of the book by Hardy and Wright will soon be written; and that a much wider public than at present will come to realize how through such works the highest artistic and intellectual enjoyment may be obtained, only to be compared with that to be derived from literature, art and music.

GEORGE D. BIRKHOFF

THE PRINCIPLES OF INSECT PHYSIOLOGY

The Principles of Insect Physiology. By V. B. WIGGLESWORTH, London School of Hygiene and Tropical Medicine. 434 pp., 316 illustrations. London, Methuen and Company, Ltd. 1939. 30 shillings net. New York, E. P. Dutton and Company.

WITH the appearance of "The Principles of Insect Physiology" the subject of entomology acquires a new dignity and the right to claim a place in the higher ranks of biological science. Too long we have been fed with mere "wonders" and "marvels" of insect life. The numerous citations given in the present work show, however, that during the last few decades many serious workers, unproclaimed to the general public, have been diligently searching for the underlying causes and principles of the much-heralded wonders and marvels, with the result that we now have a full-fledged text on insect physiology. The author of the book, himself a leading investigator in this field, has brought together in admirable form the gist of what may now be regarded as a sound basis for the scientific study of insect functions and behavior. The book should be welcomed particularly by all teachers and students of entomology, since it is well recognized that further advance in economic entomology must depend largely on an understanding of insect physiology.

Unfortunately it is not possible for most entomologists to be trained physiologists, but the style of "The Principles of Insect Physiology" is such that the text can be read and understood by any entomologist whether or not he has been schooled in physiological technique and terminology. The treatment is informative rather than discussional, and the book is not a manual of laboratory practice. The subject-matter is divided into 15 chapters under the following headings: Development in the Egg; Integument; Growth, Muscular System and Locomotion; Nervous System; Vision; Mechanical and Chemical Senses; Behaviour; Respiration; Circulatory System and Associated Tissues; Digestion and Nutrition; Excretion; Metabolism; Water and Temperature; Reproductive System. Each chapter is accompanied by a list of references, cited by numbers in the text, varying from 48 to 265 for single chapters, a total of over 2,000 with a few repetitions. The 316 illustrations are entirely line drawings, and thus give a pleasing uniformity to the general appearance of the pages. Anatomy and histology are given briefly wherever necessary for the elucidation of the subject-matter, and in many cases the up-to-date information on these subjects contributes much to the value of the book.

R. E. SNODGRASS

SOCIETIES AND MEETINGS

THE ROYAL SOCIETY OF CANADA

THE annual meeting of the Royal Society of Canada was held at the invitation of the University of Montreal in the new Botanical Building from May 22 to 24. A large attendance of fellows from all parts of Canada had an opportunity of seeing this splendid new development of a Botanical Garden in Montreal with its research laboratories, greenhouses and large park still in the process of completion as a works project financed by civic and government authorities and under the direction of Frère Marie-Victorin, of the University of Montreal.

The presidential address was delivered by Dr. Victor Morin, who spoke on "La Chanson Française a travers les siecles," with interpretations of songs by the *Quatuor des Alouettes.* This address was preceded by the introduction of new fellows and by the presentation of medals awarded by the society. The Flavelle Medal