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

was awarded posthumously to the late Professor J. Playfair McMurrich in recognition of his distinguished work in anatomy. Dr. Wilfred Bovey received the Lorne Pierce medal, and the Tyrrell medal was presented to Dr. E. Z. Massicotte. A unique social feature of the meeting was the operetta-dinner held in the ballroom of the Mount Royal Hotel, at which the fellows and their wives were the guests of the City of Montreal. This fanciful dinner-play was written by the president of the society, Dr. Morin, as a reconstitution of the feasts given by the "seigneurs" of olden times. Parodical rhymes on gastronomical subjects adapted to the music of well-known operas of the French repertory were sung by artists in cook's and maid's costumes, as the several dishes of the dinner were served. At the concluding general meeting, Dr. H. M. Tory was elected the new president of the society.

Section III (Chemical, Mathematical and Physical Sciences) was held under the presidency of Professor S. Beatty, who delivered the presidential address on "Generalization as a Principle of Mathematics." Three new members were elected to this section, Professor H. N. Brocklesby, Professor M. F. Crawford and Professor G. Herzberg. In all, 120 papers were presented and the section divided into the three subdivisions to facilitate the giving of the papers during the time of the meeting. Space permits reference to only a few papers read. Professor E. F. Burton spoke on a number of papers contributed by his co-workers, among which special mention should be made of the recent results obtained by Johns, Wilhelm and Grayson Smith on the flow and viscosity of liquid helium, in which it was proved by using glass capillaries ranging from 0.025 cm to 010036 cm in diameter and with lengths varying from 2 cm to 26 cm that normal laminar flow was obtained for He I with a viscosity of the order of 10^{-5} c.g.s. units, while for He II, the flow could be expressed as the sum of a laminar flow plus an additional pressure-independent flow. The laminar portion obeyed Poiseuille's law and gave a viscosity of the order of 10^{-5} c.g.s. units. The new electron microscope constructed by A. Prebus and J. Hillier and photographs obtained with it indicating high resolving power were described by Dr. Burton. Among the papers presented by Professor J. A. Gray, one in collaboration with J. S. Marshall and A. G. Wood contained results on the scattering of β rays using metallic foils, which were in contradictions to those obtained by other observers using expansion chamber methods. Dr. D. C. Rose described an electromagnetic pick-up device used with a cathode ray oscillograph for investigating vibrations in aeroplanes during flight. A new method of observing the Raman effect in small amounts of liquid with short exposure times was presented by Professor M. F. Crawford and H. L. Walsh. A description of the methods now being used to determine the upper earth structure from data obtained by registering the seismic waves from rock bursts occurring in mines was given by Dr. E. A. Hodgson. Other papers on field results of geophysical investigations were given by Dr. A. A. Brant, Professor L. Gilchrist and Professor D. A. Keys. The results of an analysis of meteorological data by A. Thomson showed that the average winter temperature was 4° F. warmer in Manitoba and Saskatchewan for the period of 1919–38 than for the period 1884–1903, which was explained by the increase in the temperature of the air masses moving in from the Arctic circle.

Among the fifteen papers presented by Professor O. Maass and his associates, particular interest was taken in those dealing with the measurements of viscosity, opalescence, specific heat, density and solubility relations of various liquids and vapors in the critical temperature region. The influence of intense mechanical stirring on the temperature at which the disappearance of the meniscus takes place shows that a wide range of overall density gives identical critical temperatures. Professor E. W. Steacie presented eight papers dealing with various aspects of photosensitized decomposition. Professor R. H. Clark and his collaborators contributed fourteen papers, among which special mention may be made of the results obtained on activators of zymase. The plant hormones activate live yeast but have little accelerating effect on zymin. Another paper of interest was on the mechanism of the flotation of galena in the presence of xanthate which is applied in the mining industry in Canada. Professor H. Hibbert spoke on the results obtained in his laboratory carried out with various collaborators in lignin and other wood products.

In the mathematical and astronomical section, M. S. McPhail and Professor R. J. Jeffery spoke on "Stieltjes Integrals," with applications to fractional integrals. The profiles of hydrogen line in the spectrum of H. D. 190073 by C. S. Beals and an investigation into the hydrogen line contours in the spectra of solar type stars by K. O. Wright were given by Dr. W. E. Harper. Dr. A. V. Douglas, D. C. West and D. E. Guignard described an investigation on the profiles of hydrogen lines in two class B stars.

Professor J. A. Gray was elected president of the section and Professor J. K. Robertson secretary.

In Section IV (Geological Sciences) the presidential address by Dr. M. E. Wilson outlined the development of ideas about the Canadian Precambrian and discussed certain Precambrian problems. Eighteen papers were presented. Two papers dealt with Sudbury, one by Dr. H. C. Cooke, in which some new ideas about the general geology of the district were given, and the other by Dr. A. B. Yates, concerned with the ore deposition. Dr. H. C. Gunning and J. W. Ambrose outlined the results of five years detailed investigation of the so-called Timiskaming-Keewatin contact in Rouyn-

Harricanaw Area, Quebec. The whole succession of volcanic and sedimentary rocks is apparently conformable, and the investigations show the need for complete revision of our conceptions of Archean stratigraphy and structure in this part of the Canadian shield.

The paleontological papers included descriptions of a Helderber fauna from the eastern townships of Quebec by Dr. T. H. Clark, some species of Neo-Triassic ammonites by Dr. L. H. McLearn. Dr. J. T. Wilson presented an interesting paper on the eskers northeast of Great Slave Lake, N.W.T. The information was gained chiefly from the study of aerial photographs.

Dr. H. W. Fairbairn presented a paper on the fracture hypothesis of quartz orientation in tectonites. Dr. M. B. Baker discussed the floor of the Paleozoic rocks in Canada.

The presidential address of Section V (Biological Sciences) was delivered by Dr. J. M. Swaine, of Ottawa, on "Scientific Research as the Key to Progress in Agriculture."

The program comprised seventy-two papers, of which nineteen came before the medical subsection and twenty-nine were botanical.

Dr. N. H. Grace reported upon the relative physiological activity of the members of a series of naphthyl acids when applied to plant cuttings, showing that those with an even number of carbon atoms in the side chain are the more active. Drs. E. Gordon Young and R. W. Begg found certain small proportions of copper, calcium, magnesium and iron to be required in bacterial culture media. Factors affecting stomatal movement in the dark were described by J. H. Whyte. That increased permeability of the host accompanies increased susceptibility to parasites and diseases in plants was shown by F. S. Thatcher. The importance of boron for normal cell division, enlargement and maturation in plants was described by J. G. Coulson and R. O. Lachance, while studies related to hardiness of plants were reported by Messrs. J. Levitt and D. Siminovitch. R. B. Thomson discussed the structure of the pollen cone of Austrotaxus and its phylogenetic significance, showing it to be a highly specialized derivative of the usual conifer type, and C. N. Haldenby described the distribution and origin of horizontal resin canals in Coniferae. A series of papers by Frère Marie-Victorin was devoted to various taxonomic and distributional studies of the plants of Quebec and of Cuba, interesting contributions to the problem of relic floras being made, particularly in papers by Mm. Rousseau and Gauthier.

In the field of genetics, a definite relationship between sterility and chromosome segregation with translocations was demonstrated in wheat crosses by W. P. Thompson and the actual causes of failure of seed-setting in certain intergeneric cereal crosses were described in another paper by the same investigator. F. H. Peto gave an account of the production of fertile amphibolypoid plants from sterile hybrids of Triticum species and *A. glaucum* by temperature and colchicine treatments, with cytological studies of the processes involved. Certain chromosome mutations in oats were shown by H. G. F. Sander to involve loss of all or parts of one chromosome and studies on the chromosomes of Trillium by G. B. Wilson and H. B. Newcombe gave data which can not readily be fitted to any existing theory of crossing over but suggest a new partial hypothesis.

Features of the morphology of the circulatory system of Amia, particularly in relation to an air-breathing mechanism, were described by V. C. Wynne-Edwards, and the presence of a vessel of portal nature connecting the hypothalamus in the frog was reported by E. Horne Craigie. The latter also demonstrated wide and important differences in the vascular richness of hypothalamic centers in the rat. Various studies on the white whale were reported by V. D. Vladykov, who also discussed sexual dimorphism in the trout populations. An account of differential growth rates and of regeneration in the hind limb of the frog was offered by A. Emerson Warren. A study of temperature relations of the numerous species of midges (Chironomidae) occurring in a lake was described by R. B. Miller.

B. P. Babkin and associates showed that ergosterol and parathyroid hormone effect gastric secretion in the dog chiefly by depressing its nervous phase. Early cessation of growth in rats on a rich fat diet was found by R. G. Sinclair and traced to the masking or suppression of synthesis of essential fatty acids. The effect of guaiacols on the respiratory passages was described by E. M. Boyd. Authentic notochordal tissue in a dermoid cyst of the ovary was reported by J. L. Riopelle. The structure and development of certain renal tumors led P. Masson to believe that the metanephros is not mesodermal but is derived from the neural crest; while his associate, P. Simard, found a constant neuro-insular complex in the mammalian apparatus. Drs. A. Scott and A. M. Fisher gave an account of the effects of certain chemicals in activating insulin and showed by moving picture film that each insulin crystal has two parallel square surfaces relatively close together, connected by four oblique quadrilateral surfaces. James Craigie showed that the Guarinieri inclusion bodies are probably not intracellular colonies of a virus. The chemotactic attraction of staphylococci for leucocytes from mouse spleen was found by J. W. Stevenson and G. B. Reed to vary inversely with their pathogenicity, while Alma Howard reported an inverse relationship between chiasma frequency in chromosomes and susceptibility to mammary gland carcinoma in mice.