

collected. In addition to those on myriapods and arachnids, the first of the insect volumes includes papers on Alaskan Coleoptera, Lepidoptera, Neuroptera, Orthoptera, Homoptera, and various minor groups. Special interest attaches to the chapter by Prof. Kincaid on the metamorphoses of Alaskan Coleoptera, in the course of which the author points out that the prevalent idea as to 'the extreme difficulty of rearing adult beetles from their larval condition is to a great extent founded on error.

The second of the two volumes on insects (ix.) is devoted to the Diptera and Hymenoptera, the article on the former being written by Mr. W. Coquillett, and the one on the latter group by Mr. W. H. Ashmead. In addition to these are three minor papers on certain sections of the aforesaid groups. A sample of the excellent results of Prof. Kincaid's energetic collecting is afforded by the case of the Hymenoptera, in which group less than thirty species were known from Alaska previous to the expedition, while the number now recorded is no less than 335, 201 of these being regarded as new to science. Of Diptera, 2423 specimens, representing 276 species, were collected, out of which one genus and 63 species are described as new.

As regards the volume on crustaceans, the great bulk of this is occupied by Miss Rathbun's elaborate and exhaustive memoir on the decapod section, Miss Richardson contributing a short account of the isopods, while Messrs. Holmes and Cole are severally responsible for the amphipods and pycnogonids, or sea-spiders. Miss Rathbun has treated her portion of this extensive subject from a very broad standpoint, discussing the crabs and shrimps not only of the Alaskan seas, but of the western coast of America generally, from the Arctic Circle to southern California. The decapod fauna of the North Pacific has proved very rich in individuals, if not in species. Among the more abundant types are the hermit-crabs, of which many species have local centres of distribution, where they attain their maximum development, both as regards size and numbers. In certain localities this crowding of crustacean life has been specially favourable to the development of parasitism. The decapods form the staple food of many kinds of fishes, and certain species are commonly used by fishermen as bait, or caught for the table. In many cases the northern limits of the species are determined by the winter line of floating ice in Bering Sea.

As regards the other groups, it must suffice to say that while Mr. Holmes restricts himself to the amphipods collected during the expedition, the isopods and pycnogonids of the whole western coast, from Alaska to California, are discussed. It is perhaps this variation in the mode in which the different groups are treated that constitutes the main ground for criticism in regard to the general plan of this magnificent and valuable work. Both editor and contributors are to be congratulated upon the results of their labours, so far as these are at present before the public, while the thanks of the scientific world are especially due to Mr. Harriman, as the generous provider of the means whereby this important addition to knowledge has been rendered possible.

R. L.

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THE THEORY OF DETERMINANTS.

The Theory of Determinants. By R. F. Scott, M.A. Second edition. Revised by G. B. Mathews, M.A., F.R.S. Pp. xi+288. (Cambridge: University Press, 1904.) Price 9s. net.

THIS well known treatise has been revised and enlarged in several respects. For instance (chapter xi.), the theory of linear equations is more complete than in the first edition, and Bezout's method of elimination is explained, as well as Sylvester's.

An introductory chapter has been inserted, containing an elementary account of three-rowed determinants; this should prove a considerable help to beginners. As a whole, the new edition is probably easier reading than the first; but even now the style seems rather too condensed for the average reader, and illustrations of general theorems by special cases are somewhat scarce.

A chapter (x.) on infinite determinants has been added; this appears to be based on the work of von Koch and Cazzaniga, but as some investigations have been abbreviated, occasional difficulties may be encountered at a first reading. Thus von Koch's proof that a normal determinant converges (art. 5) would be clearer if reproduced in full, and the convergence-test employed here¹ might be explained at greater length. The investigations of arts. 6 and 10 assume that certain infinite sequences (a_{ik} and C_{ik}) have upper limits; von Koch establishes this property by comparison with infinite products.

Semi-normal determinants are defined, in art. 11, after Cazzaniga; von Koch's definition would give a more elegant form to the theory without loss of generality. The two rules for multiplying semi-normals are stated in art. 12; but C is not proved to be equal to AB, and the statement (p. 128) "the series c_{ik} is absolutely convergent" must not be taken to refer to $\sum c_{ik}$. Some examples like Cazzaniga's would emphasise the contrast between these rules and the four rules of art. 10 (for multiplying normal determinants).

On several grounds it is regrettable that chapter x. is not more complete. No proof is given that the value of a normal determinant is the same, wherever the origin may be taken on the principal diagonal; and various analogies with finite determinants are omitted.

A new chapter (vii.) has been inserted, containing the simpler theorems on *Elementartheiler* of determinants; this term is translated literally *elementary divisors*, although several English writers have used *invariant-factors* as the equivalent. The treatment follows Dr. Muth's book very closely; we have explained elsewhere (*Bulletin Amer. Math. Soc.*, vol. vii. p. 308) that some changes in Dr. Muth's order might make the work more readable. But, in default of any English text-book, we must welcome this chapter as a useful introduction to the subject.

Frobenius's calculus of bilinear forms is explained

¹ "A sequence A_n converges if $\lim_{n \rightarrow \infty} (A_{n+p} - A_n) = 0$, for all positive integral values of p ." In this test, p must be free to vary with n ; for instance, if A_n is $\log n$, and p is fixed, the limit is zero, although the sequence diverges.

in arts. 1-9 of chapter xiv., but more use might have been made of the method. Applications may be found in the theory of orthogonal substitutions (xiv., 19, 24) and in "the equation of secular inequalities" (xi., 19). The expression given in xiv., 7, does not correctly represent the square-root of a bilinear form; in fact $[\chi(x)]^2 - x$ is not divisible by $\psi(x)$, the last equation on p. 185 being wrong. The right value will be found in Muth's book (pp. 37, 38); see also *Proc. Camb. Phil. Soc.*, vol. xi. p. 81.

The reduction of a quadratic form to squares (xiv., 10) may prove misleading, for it is natural to suppose that the reducing substitution belongs to the same unitary type as those in the article quoted (vii., 10). But this inference is not usually correct; thus $2x^2 + 2xy + 2y^2$, which has the matrix $\begin{pmatrix} 2, & 1 \\ 1, & 2 \end{pmatrix}$, cannot be reduced to the form $\lambda(ax+by)^2 + \mu(cx+dy)^2$, where λ, μ, a, b, c, d are integers. It is remarkable that a corresponding reduction is possible for an alternate form; this contrast might be mentioned. We are surprised that Weierstrass's theorem on equivalence of bilinear forms is not stated, although Kronecker's theorem (xiv., 8, 9) is proved; the latter can hardly be appreciated without the former.

Instead of the bibliographical list which closed the first edition, Mr. Mathews has given a brief historical note. It would have been better to add some references in the course of the text, for, even with a bibliography at hand, it is often difficult to identify the original sources from which extracts have been taken.

T. J. I'A. B.

A MANUAL OF MEDICINE.

A Manual of Medicine. Edited by W. H. Allchin, M.D., London, F.R.C.P. Vol. v. Pp. xii+687. Plates ii.; charts and diagrams. (London: Macmillan and Co., Ltd., 1903.) Price 10s. net.

THE volume before us is the fifth of Dr. Allchin's manual of medicine, and is devoted to diseases of the digestive system, the liver, the peritoneum, the vessels of the abdomen, the kidneys, and the ductless glands.

The volume begins with two short articles by the editor upon the normal anatomy of the alimentary canal and the physiology of digestion. These articles seem to be well up to date, and in the former due importance is attached to the surface anatomy of the parts, so important to the clinician. It is, however, rather to be regretted that in the physiology of digestion no mention is made of the recent work upon pancreatic secretion. These articles are immediately followed by one on food and diet by Dr. R. Hutchinson. In twenty pages, only the merest outlines of this subject could be discussed, and the value of articles so condensed is open to question; the principles, however, of dietetics and the chemical composition of the most important food-stuffs and food preparations are given. A useful note upon the bacteria of the alimentary canal, with some suggestions concerning the therapeutic use and actions of so-called intestinal antiseptics, is written by Dr. Lazarus Barlow.

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The following eighty pages are devoted to diseases of the mouth, tongue, pharynx and œsophagus, an account of these being supplied by Dr. Bertram Abrahams. These diseases are treated in a comprehensive and systematic manner. We would draw special attention in this connection to the parts of the article devoted to throat complications of acute infectious diseases and the differential diagnosis of acute sore throat. The practitioner will find these sections exceedingly useful. The next section of the work treats of diseases of the stomach and intestines, this section occupying practically 200 pages and being written by the editor. Interpolated in the above is a short account by Dr. Bertrand Dawson of the physical examination of the stomach and intestines. This includes the ordinary clinical methods and the examination by the Röntgen rays and by so-called gastro-diaphany, and also directions for the chemical examination of the gastric contents after the administration of test meals. The reviewer cannot, however, find any directions for the chemical or microscopic examination of the fæces, which might well have been incorporated. In view of recent work upon the subject, a short article by the editor upon diseases of the pancreas will be of interest.

A hundred odd pages are devoted to diseases of the liver, this subject being introduced by a general article upon the morbid anatomy of the liver by Dr. Barlow. Hepatic abscess and perihepatitis are dealt with by Dr. Crombie; degenerations, new growths and gall-stones by Dr. Hebb.

The next section of the book treats of diseases of the peritoneum, and it is also introduced by a short note on the general anatomy of the peritoneum. The consideration of retro-peritoneal suppuration and tumours and sub-phrenic abscess concludes this monograph, for which Dr. Hale White is responsible. Dr. Bryant writes a short account of the diseases of the abdominal blood-vessels, and the volume concludes by an article by Dr. Bradford upon diseases of the kidneys, and one by Drs. Sydney Coupland and Bertram Abrahams upon diseases of the ductless glands.

It will be seen from the above remarks, which amount to little more than an elaborated table of contents, that the volume before us deals very fully with the diseases of the abdominal organs. In conclusion, we may add that this last addition to Dr. Allchin's manual of medicine maintains the standard of its predecessors, and is likely to be of much value to the professional reader. Its usefulness is enhanced by a complete and accurate index.

F. W. T.

OUR BOOK SHELF.

The Racing World and its Inhabitants. Edited by A. E. T. Watson. Pp. vii+309; illustrated. (London: Macmillan and Co., Ltd., 1904.) Price 12s. 6d. net.

THIS volume, which consists of a reprint of a series of articles contributed by various writers to the *Badminton Magazine*, is essentially a work written by racing men for racing men, and as such seems admirably adapted for its purpose. An important feature is that each article is written by one who has