experimental or traumatic stimulation, or by repeated cases of identically similar lesions, are definitely indicated to be concerned with the given functions. The general motor and sensory (somæsthetic) *areas* are known with practical certainty, and experiments have enabled us to subdivide them for different parts of the body; and the areas concerned more than any others with the four special sense organs are generally accepted, though not given definite boundaries. But to go much further, our knowledge will have to advance past the stage, not yet reached, when cerebral tumors may be positively diagnosed both as to existence and especially as to exact position, and when positive interpretations may be made of the varied symptoms accompanying many of the smaller brain lesions.

Further, purely histological studies of cerebral localization are practically worthless as to the existence of "centers." The function of an organ or part of an organ must be previously known, for function can not be inferred from anatomy. With microscopic anatomy especially, one would be more helpless than, for example, he would be with a steam engine or its parts, unknown and seen for the first time. Just as the leaves of a tree are not exactly alike, so are no two gyri, of the same or of different cerebra, exactly alike as to contour, depth of sulci or thickness of pallium. These superficial differences are as marked as internal or structural differences. If analyzed far enough, no two sections of a gyrus will be found identical and, by carefully comparing sections of adjacent gyri, differences of structure are easily distinguishable. All gyri peculiarly situated, and therefore peculiarly shaped, show peculiar structural differences. If a well-defined difference of function of a whole or a part of an organ is positively known, functional significance may then be assumed and attributed to the structural differences, and such assumptions may or may not be correct as the history of the study of many organs shows. Many of the differences in number, size and lamination of the cell bodies, and therefore of the axones, of the various gyri may be more truly explained as due to different intracranial physical conditions present during the processes of growth. The existence of the gyri and their superficial differences are explained in this way.

The execution of the book is fine. The paper is good, the print neat and clear, and the reproduction of the illustrations is excellent.

The intent of a book of this kind is to aid the student in making a more detailed study of the nervous system than is expected with the ordinary text-books of anatomy. Dr. Santee will agree that in making such advanced studies, the student should be urged in every possible way to consult frequently the literature of the subject, yet, no bibliography is given nor is there given an index of authors consulted during the preparation of the book.

IRVING HARDESTY

BERKELEY, CALIFORNIA

Introduction to Higher Algebra. By MAXIME BÔCHER, Professor of Mathematics in Harvard University. Prepared for publication with the cooperation of Mr. E. P. R. DUVAL, Instructor in Mathematics in the University of Wisconsin. New York, The Macmillan Company. 1907. Pp. xi + 321.

Analytic geometry is one of the most useful solvents of algebraic difficulties. Among other important solvents of compounds of higher algebra are the group theory, the differential calculus, and the theory of numbers. In the present work analytic geometry is so frequently employed that a good elementary knowledge of this subject is an indispensable prerequisite. Group theory is used very much less frequently and the necessary concepts of this subject are developed very briefly but clearly. The Galois theory of algebraic equations and the explicit theory of congruences are entirely omitted and invariants are treated very briefly. The omission of such important matters seems justified by the title, as it is not intended to be a compendium, but really an introduction to higher algebra.

The reader should, however, not get the impression that he is dealing with a work which is like other so-called higher algebras published in this country. On the contrary, Professor Bôcher's book bears closer resemblance to Weber's "Lehrbuch der Algebra" or Serret's "Cours d'algèbre supérieure" even if it is much less comprehensive than these classic works. It exhibits the same masterly grasp and improvements in the presentation of fundamental matters. For instance, the theory of linear dependence is treated here in a more complete and satisfactory manner than in any other text-book. Another special feature of this work is the thorough treatment of quadratic forms, culminating in the important but not easily accessible theory of elementary divisors.

The book is intended "for students who have had two or three years' training in the elements of higher mathematics, particularly in analytic geometry and the calculus," and is based upon the courses of the author's lectures delivered at Harvard University. The mode of treatment is in accord with the modern tendency not to be satisfied with results which are true "in general"; that is, which are true except in some isolated cases. In using such results it is always necessary first to inquire whether the case to which we desire to apply them is not really one of the exceptional ones, and hence they are very much less desirable than the theorems which have no exceptions. This mode of treatment is a consequence of the effort to actually prove things instead of being content with some more or less plausible intuitions which so often pass for proofs. The scope and contents of the work may be inferred from the following list of the headings of its twenty-two chapters; Polynomials and their most fundamental properties, a few properties of determinants, the theory of linear dependence, linear equations, some theorems concerning the rank of a matrix, linear transformations and the combination of matrices, first principles and illustrations of invariants, bilinear forms, geometric introduction to quadratic forms, quadratic forms, real quadratic forms, the system of a quadratic form and one or more linear forms, pairs of quadratic forms, some properties of polynomials in general, factors and common factors of polynomials in one variable and of binary forms, factors of polynomials in two or more variables, general theorems on integral rational invariants, symmetric polynomials, polynomials symmetric in pairs of variables, elementary divisors and the equivalence of λ-matrices, the equivalence and classification of pairs of bilinear forms and of collineations, the equivalence and classification of pairs of quadratic forms.

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SCIENTIFIC JOURNALS AND ARTICLES

The Journal of Experimental Zoology, Vol. V., No. 2 (December, 1907), contains the following papers: "Regeneration of Compound Eyes in Crustacea," by Mary Isabelle Steele. The small hermit crab (*Eupagurus longicarpus*), the shrimp (*Palæmonetes vulgaris*) and the sand shrimp (*Crangon vulgaris*) were used for experiment material. Each individual had either a part or the whole of one or both eyes removed. Results obtained after removing part of the eye show: that hermit crabs may regenerate a perfect eye even after the destruction of as much as half the optic ganglion; that *Palæmonetes* does not regenerate an eye if the optic ganglion has been at all injured; and that *Crangon* regenerates an eye much more slowly than either of the other species, and only after little or no injury to the optic ganglion. After removal of the eye so that the entire optic ganglion is destroyed, the hermit crabs and *Crangon* may regenerate an antenna-like organ in place of the excised eye. *Palæmonetes* does not show any sort of true regeneration unless the optic ganglion has been left intact. The results of the whole series of experiments tend to show that the regeneration which takes place from any level is largely influenced by the presence or absence of the whole or a part of the optic ganglion. "On Some Phenomena of Coalescence and Regeneration in Sponges," by H. V. Wilson. Cells of siliceous sponges (*Microciona*) when separated by pressure from the skeleton are able to recombine, forming a plasmodial mass which differentiates anew