We can also understand why certain eggs can develop without fertilization or show natural parthenogenesis, while others require fertilization. The naturally parthenogenetic eggs are those in which the nuclein synthesis can be started without the addition of an outside agency. In analogy with the experience on seeds, we may assume that the acid formed in them after they have left the ovary is sufficient to bring about the necessary hydrolytic process or processes; either directly or through the activation of enzyme. Such eggs must also contain the necessary prerequisite for the normal occurrence of the process of oxidation. In the eggs which require fertilization we must probably discriminate between two groups, one for which the hydrolysis is sufficient to start the nuclein synthesis, *e. g.*, starfish, *Thalassema, Polynoë;* the second group for which in addition provisions are to be made for the processes of oxidation, by treating these eggs with hypertonic sea-water containing oxygen, *e. g.*, sea-urchin, and *Lottia.*

I am of the opinion that this mechanism of nuclein synthesis is the thread by which we can find a rational way through the maze of the otherwise bewildering mechanisms, characteristic of living matter; on one hand, the phenomena of growth, on the other, those of self-preservation.

I will illustrate this by one example. It can be proved that the nucleus itself or one of its constituents acts as a catalyzer in the synthesis of nuclein in the unfertilized egg. This follows from the fact that the velocity of the nuclein synthesis in the fertilized egg increases in proportion with the number of nuclei already present in the egg. If the mass of the original fertilization nucleus is m, the mass of nucleins increases during the first segmentation period to $2m$, during the next to $4m$, and so on, increasing with the exponent of 2; while the duration of the various periods of segmentation differs little and these differences have no relation to the mass of the nuclear material formed during the period. This behavior of a chemical reaction is characteristic for such catalytic processes in which one of the products of the reaction is itself a catalyzer for the reaction. We must therefore conclude that the nuclei themselves or one of their constituents are the catalyzer for the nuclein synthesis or one phase of it. It is possible that the nucleus catalyzes only the phenomena of oxidation, and in as much as oxidations are the conditio sine qua non of nuclein synthesis, this would explain the autocatalytic effect of the nuclei upon this reaction. A number of years ago I pointed out that the nucleus seems to act as the main (though possibly not the only) oxidizing agency of the cell. This influence of the nucleus upon the nuclein synthesis, and the rôle of this synthesis upon the preservation and continuation of living matter, explains one of the most mystifying characteristics of the latter, namely, the phenomenon of automatic reproduction of cells.

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SCIENTIFIC BOOKS

Introduction to Infinitesimal Analysis: Functions of One Real Variable. By OSWALD VEBLEN and N. J. LENNES. New York, John Wiley & Sons. 1907. Pp. vii + 227. Cloth, $2.00.

Elements of the Infinitesimal Calculus. By G. H. CHANDLER, M.A. Third Edition. New York, John Wiley & Sons. 1907. Pp. vi + 319.

Differential and Integral Calculus with Examples and Applications. By GEORGE A. OSBORNE, S.B. Revised edition. Boston, D. C. Heath & Co. 1907. Pp. xii + 388.

Advanced Algebra. By ARTHUR SCHULTZE, Ph.D. New York, The Macmillan Company. 1906. Pp. xiv + 562.

College Algebra. By Charles H. Ashton and Walter R. Marsh. New York, Charles Scribner's Sons. 1907. Pp. ix + 279.

For more than a century after the inventions of analytical geometry and the calculus, mathematicians and physicists may be said to have fairly rioted in applications of these instruments to geometric, mechanical and physical problems without concerning themselves about the nicer questions of fundamental principles, cogency and precision. The efforts of Euler, Lacroix and others to systematize results served to reveal in a surprising way the need of improving foundations. Constructive work was not arrested by that disclosure. On the contrary, new doctrines continued to spring up and old ones to expand and flourish. But a new spirit began to manifest itself. Mathematics became increasingly critical as its towering edifices more and more challenged attention to their foundations. Already manifest in the work of Gauss and Lagrange, the new tendency, under the powerful impulse and leadership of Cauchy, rapidly developed into a powerful movement. It was the foundations of the calculus that were first overhauled, and, while its instrumental efficacy was greatly improved, the calculus was advanced from the level of a tool to the rank and dignity of a science. Accordingly every genuine university to-day offers two courses in the calculus: an elementary course designed to equip the student with the calculus viewed as an instrument for making rough investigations, and an advanced course designed to acquaint him with the intimate structure of the subtlest of the sciences and to qualify him to use the calculus in the finest and exactest thinking. The work of Messrs. Veblen and Lennes deals with the calculus in the latter conception of it. Their work has but a single English rival, viz., "The Theory of Functions of Real Variables," by Professor James Pierpont, which appeared in 1906. Prior to the appearance of the latter work, an American or English student of the modern critical calculus had to depend upon such foreign works as Jordan's "Cours d'Analyse" and Stolz's "Allgemeine Arithmetik." The aim of such critical work being precision and logical perfection, it tends at first to be prolix and only at last succeeds in becoming concise. The most conspicuous among the merits of the work by Messrs. Veblen and Lennes is the union of conciseness with rigor. This union was effected by means of two principles of economy. One of these is the happy definition of the all-important notion of the limit of a function in terms of the notion of "value approached." The other consists in the systematic employment throughout of a recently established theorem in the modern doctrine of assemblages (ensembles, manifolds, sets), namely, the Borel theorem, so called after its discoverer. The value of the book might be improved by the introduction of more numerous illustrative examples.

The books by Professor Chandler and Professor Osborne, as designed for the beginner, have numerous English rivals. Professor Chandler in this third edition of his book has made some changes to bring the treatment and content into fuller accord with modern demands both of rigor and of utility. The basis is laid in the doctrine of limits. The differential notation is introduced at an early stage, and, everywhere throughout, the reader finds the abstract notions and processes illuminated by simple applications to concrete problems, chiefly of geometry. The closing chapters afford an excellent introduction to differential equations and mechanical integration. Taken all in all, it is one of the more substantial books for the student of engineering, for whom it is primarily designed. It is not one of those emasculated, merely "practician," works that some teachers and students of engineering seem to crave.

By introducing a chapter on series, by rearranging the order of topics, by the earlier geometric illustration of the notion of derivative, and by the incorporation of physical and mechanical applications, Professor Osborne has amply justified the revision of his well-known book, though his decision to give several (not obviously equivalent) definitions of the differential instead of one can hardly fail to annoy the instructor and confuse the pupil.

The book contains too little theory and about three times too many examples. The work demands too much finger work and too little thought.

The algebras by Professor Schultze and by Messrs. Ashton and Marsh cover the material usually presented to high school pupils and college freshmen. Both works are well suited to prepare the student for the examinations held by the College Entrance Examination Board. Messrs. Ashton and Marsh's book begins with the theory of radicals, the preceding matter being presented for review by numerous well-chosen examples. Both works deal admirably with graphs, determinants and the theory of equations. Neither one aspires to the rigor of the superb work of Professor Fine, but both of them are likely to be regarded, whether correctly or not, as more teachable.

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Metabolism and Practical Medicine. By CARL VON NOORDEN; Anglo-American issue under the editorship of WALKER HALL. Vols. I. and II. Chicago, W. T. Keener & Company.

This work is a translation of the first volume of v. Noorden's "Handbuch der Pathologie des Staffwechsels," the most exhaustive treatise that has yet appeared on the subject of metabolism. The German original (two volumes) is the joint product of the following contributors: v. Noorden, A. Czerny, C. Dapper, Fr. Kraus, O. Loewi, Magnus-Levy, M. Mathes, L. Mohr, C. Neuberg, H. Solomon, Ad. Schmidt, Fr. Steinitz, H. Strauss, and W. Weintraud.

The original of the first volume of the translation comprises 479 pages written by Magnus-Levy. It treats of normal metabolism in all its different phases, and is a very readable piece of metabolism literature. In addition it is a veritable mine of numberless detailed facts and corresponding references to the original literature. It should prove exceedingly valuable to the investigator who wishes to look up definite facts with the minimum waste of time. In some important particulars, as, for example, with regard to the factors which determine the percentage composition of human urine the volume is already more or less obsolete. This is, however, not the fault of the author. His manuscript must have been finished in 1904, and as he says in another connection: "Die Fragen, deren Lösung wir dank der eifrigen Arbeit der verschiedenen Schulen in wohl nicht zu ferner zeit erhoffen dürfen, sind eigentlich zahlreicher, wie die bereits gewonnenen Aufschlüsse und Ergebnisse."

The second volume (of the translation) deals with metabolism in starvation, in overfeeding, in fevers, and in diseases of the digestive tract, respiration, the liver, the blood and the kidneys.

Three of these chapters, namely the first two and the last one, are v. Noorden's, and are written in his usual clear, critical, yet somewhat dogmatic style. These chapters constitute excellent résumés of what is yet known concerning the subjects treated. They abound in concrete instances drawn from the author's experience as a clinician—instances which show how a mastery of even the present limited knowledge of the laws of metabolism is indispensable for the correct diagnosis and the dietetic treatment of many cases coming under the care of every physician.

Of the other chapters in this volume those on fevers (Kraus) and on diseases of the liver (Weintraud) are the most interesting. A part of the matter here introduced, as, for example, Ehrlich's "parallelism" between the process of assimilation and the action of toxins, is perhaps of too hypothetical a nature to merit the extensive discussion it has received. Some of the data presented, notably with regard to the urinary constituents, are of very doubtful value. But taken as a whole these chapters are instructive and suggestive alike to physiologists and to pathologists who are interested in the problems of metabolism.

It is to be regretted that the scholarly character of this valuable work should have suffered at the hands of the translators. They have evidently done their part in great haste, with little regard for English style, and sometimes without even bringing out the correct