

philosophy, the publication of which in the near future is promised.

That he was a great genius does not seem to be doubted by his biographer, Mr. E. S. Stevens, who declares that he was not only a great geologist, but also a great philosopher; that he was "the greatest scientist America has produced," that "he has left little to be accomplished," and that he has "taken his place beside Copernicus, Galileo, Newton and Darwin."

And what is the 'diuturnal motion of the earth' upon the conception and alleged proof of which so much claim to distinction is made to rest? No very clear account of it is to be found anywhere in the book, but it is obviously intended to mean a slow, progressive movement of the pole of the earth's axis of revolution in a spiral line around the earth's surface. Maps are given showing six lines of polar transmission across the Eastern and the Western hemispheres, and the period occupied in passing through one 'curl' of the spiral is assumed to be extremely great. This movement of the position of the earth's axis would necessarily produce great climatic changes, but in addition to this it is alleged that there would be a shifting of the superficial strata or crust of the earth relative to the interior, and upon this hypothesis is founded an explanation of existing geological phenomena, which, in the judgment of the biographer, 'transforms the patchwork of geology into a complete science.'

Among numerous illustrations of the author's fitness for discussing problems involving physical and dynamical laws, in which the book abounds, the following may be quoted: "Heat we claim to be material; it is substance and gravitates towards the center of the earth, constantly keeping an equilibrium between the interior forces and the external atmosphere, with its stratified fields of electricity and magnetism; but when that gravitated heat comes in contact with sedimentary deposits, containing a superabundance of compound substances, as vapors, gases and ethers, and liberates these through the action of the chemical processes in that great laboratory of nature, they must find their outlet through established chimneys, as volcanoes, or otherwise make new openings for their ascent to the upper air; and only in

events like this would we be willing to attribute the phenomena called earthquakes to internal forces."

Speaking of Galileo the author says, "He discovered that the vibrations of all pendulums, even of different lengths were performed in equal time. * * * He also ascertained the beating of the pulse from this fact and counted it by the vibrations of a pendulum. * * * He discovered the thermometer, an instrument by which is measured the expansion or condensive heat of the atmosphere."

The author shows considerable familiarity with the literature of science, from which extensive quotations are made, often having little relation to the subject under discussion.

There is left with the reader a feeling of regret that those who have the means to contribute to the advancement of science by the issue of such expensive publications as this should not have sought competent advice from recognized scientific authority before going to the printer and book binder.

T. C. M.

Elements of the Differential Calculus. By JAMES MCMAHON, A.M., Professor of Mathematics in Cornell University, and VIRGIL SNYDER, Ph.D., Instructor in Mathematics in Cornell University. New York, Cincinnati, Chicago. The American Book Company. 1898. Pp. xiv + 337.

We have examined this book with pleasure. It was evidently composed in the light. Pedagogical and scientific qualities are united in a degree seldom attained in elementary textbooks. Sound argument, genuine demonstration, logical concatenation, are seen to be, in general, more consistent, than is commonly supposed, with required simplicity and clearness. The claims of the logician, on the one hand, and of the didactician, on the other, are adjusted with notable good judgment and skill. Illustrative solutions are numerous and the volume contains a plenty of suitable exercises for the reader, but the book is by no means a mere 'quarry of examples.' Even less, if possible, is it intended to be a guide to the mere practician. On the contrary, the treatment aims first of all at being scientific. The modern

spirit prevails, a theory is presented, it is the understanding which is addressed throughout, and the student, if he be fit, will not easily escape the conviction, which not every elementary presentation of the calculus is good enough to produce, that he is dealing with a logically coherent body of doctrine, whose applications, moreover, yield absolutely valid results.

A good book points the way to its own improvement. We may, therefore, venture in course of the following remarks to indicate some respects in which what is well done may, in a second edition, be done perhaps even better.

Being confined to the differential calculus, the work possesses, on that account, some peculiar merits but fails, on the same account, to gain what many in recent years have come to regard as the very considerable advantages of presenting differentiation and integration simultaneously. Knowledge of some algebraic matters treated in the brief introductory chapter might, of course, have been defensibly presupposed; but as a precaution such preliminary review seems justified and would, perhaps, be even more acceptable were it more comprehensive. However, a certain fragmentariness and discontinuity of thought could have been avoided if the discussion of continuity, here begun, had been reserved for the next chapter where the discussion is resumed after an interval of twenty pages. From a statement of the properties which a function must possess if it is to be continuous in a given interval, the reader is left to infer what is meant by continuity 'at' and in the 'vicinity' of a point or a value. If the notion of continuity is very important, it is equally elusive, and as the beginner best learns what the idea is by learning what it is not, the authors' discussion, which is good, would have been enhanced, we believe, by a somewhat minute examination of at least several examples of discontinuity. The just observation, p. 11, that the 'essence' (of the infinitesimal) "lies in its power of decreasing numerically, having zero for its limit, and not in the smallness of any of the constant values it may pass through," seems to impose a restriction on the statement of theorem 2 on the following page and to invalidate the proof there given; for, of course, the sum of a finite num-

ber of infinitesimals may be constant, zero, while to speak of the 'largest' of the infinitesimals does not go to the 'essence' of the matter. The necessity of the word finite in the theorem is happily shown by examples, though definition of the term finite has not at this stage been attempted. The definition, later given, of finite number as being one which 'is neither infinite nor zero,' is like that given by G. Cantor, not only negative (which is but a trifling objection) but also unavailable so long as the notion of the infinite is not formed. The infinite has, it is true, been defined as a variable but not as a constant. As constants, nevertheless, capable, moreover, of being 'given,' some infinites must be regarded, if, as in comparison of variables, the phrase 'infinite limit,' is to be recognized as legitimate, unless indeed one be prepared to reconstruct the idea of limit.

The notion of derivative, being attached by definition to that of continuous function, while it assumes the cardinal theorem that every function having a derivative is continuous, is, besides, not unlikely to prove a little bewildering to the student when a few pages later he is informed, without explanation, that some continuous functions do not possess derivatives. And being directed to "show that a function is not differentiable at a discontinuity," the student has only to reply that the function being discontinuous at a point is not continuous there, which is scarcely the answer expected. However, the imperfections noted relate mainly to minutiae, they are histological imperfections and do not greatly mar the presentation as a whole, which, designed for the novice, is primarily concerned with the more obvious anatomy of the subject.

The chapter on fundamental principles is perhaps the best in the book, though some others, as those on expansion of functions and indeterminate forms, are specially worthy of praise. While no list of 'higher plane curves' has been inserted, there is a chapter on curve tracing and still another, unusually long but luminous, devoted to asymptotes. In dealing with the vexed and vexing question of the differential and the differential notation, the convenient though logically extraneous notion of 'rates,' is employed as sole medium of explanation. It

would be interesting to have the term envelope, here presented in the usual way, so defined as to exclude all curves, such as the node locus, which are not properly tangent to curves of the family.

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G. V. de Lapouge: l'Aryen: Son rôle social. Paris. 1899. 8vo. Pp. xx + 569.

The thesis of this work is that the tall, blond dolichocephalic race of the north of Europe has constituted the progressive and socially dominant element among the so-called Aryan peoples from prehistoric times to the present. In connection with the author's earlier work *les Selections sociales* (Paris, 1896), it is the best presentation of the results of the new school of anthropologists of which Lapouge and Otto Ammon are the leaders. If the results derived from the data now available are confirmed by wider investigation, they will obviously be of great significance for students of psychology, history and sociology, as well as anthropology. Further investigations ought now to be carried forward by individuals or institutions that have the means to prosecute them on an adequate scale.

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BOOKS RECEIVED.

Mesures électriques. E. VIGNERON et P. LETHEULE. Paris, Gauthier-Villars. 1900. Pp. 179. 2 fr., 50c.

Produits aromatiques. G. F. JAUBERT. Paris, Gauthier-Villars. 1900. Pp. 169.

La constitution du monde. CLÉMENTCE ROYER. Paris, Schleicher Frères. 1900. Pp. xxii + 796.

Logic. ST. GEORGE STOCK. Oxford, B. H. Blackwell. 1900. Pp. xi + 440.

A First Book in Organic Evolution. D. KERFOOT SHUTE. Chicago Open Court Publishing Co. 1899. Pp. xvi + 285.

The Amateurs' Practical Garden Book. C. E. MUNN and L. H. BAILEY. New York and London, The Macmillan Company. 1900. Pp. vi + 250. \$1.00.

Physiology. BUEL B. COLTON. Boston, D. C. Heath & Co. 1900. Pp. xiii + 386. 90 cts.

Syllabus of Elementary Physiology. ULYSSES O. COX. Mankato, Minn., Free Press Printing Co. 1899. Pp. viii + 167.

SCIENTIFIC JOURNALS AND ARTICLES.

The Journal of Geology, Jan.-Feb., 1900. Vol. 8, No. 1. 'Suggestions Regarding the Classification of the Igneous Rocks,' by William H. Hobbs. The article sets forth the present condition of the nomenclature and classification and offers many valuable suggestions, which if followed will certainly assist in extricating the science of petrology from the burden of names and complication of systems under which its students are now laboring. The importance of chemical composition in determining the classification of rocks and the use of diagrams to show the relations is emphasized.

'Dentition of some Devonian Fishes,' by C. R. Eastman. The dental characters of some species of the genera *Dinichthys*, *Clododus* and *Dipterus*, with comparative notes and illustrations of some types are discussed.

'Ancient Alpine Glaciers of the Sierra Costa Mountains in California,' by Oscar H. Hershey. The author describes in detail the characters of several of the ancient glaciers of this mountain range, and concludes from their study that they were probably of late Wisconsin age, and that they existed under the same climatic conditions as at present, but at an elevation of about 3000 feet higher than now.

'An Attempt to Test the Nebular Hypothesis by the Relation of Masses and Momenta,' by T. C. Chamberlin. In a comparison of the moment of momentum of the nebular system with moment of momentum of the present system, on the basis of purely mechanical laws, susceptible of mathematical computation, making every concession in favor of the Laplacian hypothesis, the nebular moment of momentum is 213 times larger than the present moment of momentum of the system, where the dynamic law would require them to be equal. Besides this very great discrepancy which is hard to explain on the Laplacian hypothesis, there are individual discrepancies among the planets of even greater significance. These range from 141 to 1 for the Jovian nebula to 1208 to 1 for the terrestrial nebula, with very great irregularity in the distribution from Mercury to Neptune. In the relation of the ratios of planetary masses to their momenta, it appears that Jupiter carried away one tenth of one per cent. of the nebular