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THE GREAT EXTENT OF FORESTS in the State of New York, and their devastation, that has been going on continuously, have led to repeated endeavors to protect them from unlawful cutting-down and wasteful practices. For this purpose the New York State Forestry Association was founded in 1885, and did much to get the well-known forestry law passed by the Legislature. Since that time, however, the association has failed to show a vigorous life. At present renewed endeavors are being made to establish the association as a working body for the purpose of disseminating knowledge on the importance of forests, and for promoting measures to secure their proper protection. The New York Academy of Sciences devoted its meeting last Monday to this subject; and the proposed steps, which were explained by Professor Southwick of the New York State Forestry Association, found general indorsement in the discussion following Professor Southwick's remarks. The object is one of great economic importance to the State, and, as Dr. H. Nicholas Jarchow, the first speaker of the evening, remarked, the forests forming a portion of the public domain ought to be a source of considerable income instead of causing expense. He continued, "It would be very advantageous to establish a forestry school in or near the Adirondacks. Its cost would not be large, especially if adjoining States, having much the same climate and varieties of trees, would combine to support a school. Moreover, the labors of the students would nearly pay expenses, and, once graduated, there would be a demand for their services from all parts of the country. Congress has made a national recommendation on the subject; but Congress is slow to act, and the States should provide for themselves in the matter. Trained foresters would take an honest pride in their work, and put their hearts in it. They would save valuable lumber, prevent great thefts of timber, and break up the present state of affairs, with all its disadvantages." Experience has shown that the last act of the Legislature, although a step in the right direction, has not the desired effect: therefore all measures taken for inducing the Legislature to organize a good forestry board, with ample means for carrying on its important work, and attempts to spread an intelligent knowledge of the importance of forests and of their economic value, must be highly welcomed. The New York Academy of Sciences has done well to bring the subject once more before the public, and it is to be hoped that the meeting will be of help to the attempted re-organization of the State Forestry Association.

BOOK-REVIEWS.

A Short Account of the History of Mathematics. By WALTER W. R. BALL. London and New York, Macmillan. 12°. $2.60.

MR. BALL, who is a fellow and assistant tutor of Trinity College, Cambridge, offers in this compact volume a transcript of his lectures delivered in the spring of the present year on the history of mathematics. While technical and exact enough to be of value to the specialist in mathematics as a handy book of reference, it is so clearly and familiarly written, that it is the best work on this subject for the general reader that we know of.

The region of mathematics is a *terra incognita* to most persons, even those who consider themselves possessed of a good general education; and this, despite the fact that mathematics as a mental discipline is unsurpassed, and is unrivalled for the beauty and grandeur of its results. Having for its foundation the two universal and necessary forms of perception, space and time, mathematics developed, naturally enough, in the early stages of reflective thought. To trace the growth of its conceptions in clearness and perspicuity, and to follow up the increasingly complex and varied forms of symbolism, is the work of the history of the science, and Mr. Ball's treatment of it is eminently successful.

After a summary notice of what we may call the prehistoric period of the science, mathematics as understood and taught by the Egyptians and Phœnicians, the author makes a tripartite division of the subject, — mathematics under Greek influence, the mathematics of the middle ages and the renaissance, and modern mathematics. Of the first period, Pythagoras, Euclid, Archimedes, and Ptolemy are the most important representatives. The *quadrivium* of the mediæval schools is traced back to the division of knowledge adopted by the Pythagorians, — numbers absolute, or arithmetic; numbers applied, or music; magnitudes at rest, or geometry; magnitudes in motion, or astronomy. In a chapter on 'Systems of Numeration,' after the prominent names in this first period have been discussed in chronological order, Mr. Ball gives an interesting account of the early methods of counting, and the introduction of the abacus. In his mention of the use of this instrument, we should have been glad to find a more extended notice of the form of it in use among the Chinese, and some further explanation of the very complicated computations which they perform by its aid with great celerity and accuracy.

In the second period, most of the mathematicians were astronomers; but the period includes the introduction of Arabian mathematical works and the results of Arabian thought into Europe. In reference to this, Mr. Ball says, "It was from Spain, and not from Arabia, that Arabian mathematics came into western Europe. The Moors had established their rule in Spain in 747, and by the tenth or eleventh century had attained a high degree of civilization. Though their political relations with the caliphs at Bagdad were somewhat unfriendly, they gave a ready welcome to the works of the great Arabian mathematicians. In this way the Arab transla-

tions of Euclid, Archimedes, Ptolemy, and perhaps of other Greek writers, together with the works of the Arabian algebraists, were read and commented on at the three great Moorish universities or schools of Granada, Cordova, and Seville. It seems probable that these works represent the extent of Moorish learning; but, as all knowledge was jealously guarded from any Christians, it is impossible to speak with certainty either on this point or on that of the time when the Arab books were first introduced into Spain" (p. 157).

A good summary of the condition of mathematical knowledge at the close of the renaissance is given at p. 228: "By the beginning of the seventeenth century we may say that the fundamental principles of arithmetic, algebra, theory of equations, and trigonometry had been laid down, and the outlines of the subjects as we know them had been traced. It must, however, be remembered that there were no good elementary text-books on these subjects; and a knowledge of them was thus confined to those who could extract it from the ponderous treatises in which it lay buried. Though much of the modern algebraical and trigonometrical notation had been introduced, it was not familiar to mathematicians, nor was it even universally accepted; and it was not until the end of the seventeenth century that the language of the subject was definitely fixed. . . . If we turn to applied mathematics, we find, on the other hand, that the science of statics had made but little advance in the eighteen centuries that had elapsed since the time of Archimedes, while the foundations of dynamics were only laid by Galileo at the close of the sixteenth century. In fact, it was not until the time of Newton that the science of mechanics was placed on a satisfactory basis. The fundamental conceptions of mechanics are difficult, but the ignorance of the principles of the subject shown by the mathematicians of this time is greater than would have been anticipated from their knowledge of pure mathematics. With this exception, we may say that the principles of analytical geometry and of the infinitesimal calculus were needed before there was likely to be much further progress. The former was employed by Descartes in 1637; the latter was invented by Newton (and possibly independently by Leibnitz) some thirty or forty years later: and their introduction may be taken as marking the commencement of the period of the modern mathematics."

That which follows is more familiar, and the feature of Mr. Ball's chapters on the modern period is his full and clear analysis of Newton's contributions to mathematical science. Descartes, Pascal, Barrow, Huygens, Newton, Leibnitz, the Bernoullis, Euler, Lagrange, Laplace, Legendre, Poisson, and others less important, are treated in turn and with excellent judgment. Their successors are very briefly mentioned, and no attempt is made to follow out in detail the researches of Abel, Gauss, Sir William Rowan Hamilton, Henry J. S. Smith, Weierstrass, Cayley, Sylvester, and Klein. But from this history, or historical sketch, the intelligent reader can gain a very complete view of the progress of mathematical science from its beginnings until its contemporary differentiation into numerous specialties, — each of them important and difficult enough to detain for a lifetime a brilliant mind, — all of which are fruitful in their applications to the various phases of modern science and modern industry.

A Brief History of Greek Philosophy. By B. C. BURT. Boston, Ginn. 12°. $1.25.

THIS work had its origin, the author tells us, in a series of articles in a religious newspaper, but has been expanded so as to cover the whole history of Greek speculation from Thales to Proclus. The result is a volume of three hundred pages, in which the leading doctrines of the various schools are concisely yet for the most part clearly presented. Mr. Burt's style is plainer than that of most writers of the school to which he belongs; and his readers will seldom have any difficulty in understanding what he says, except where the theories he is trying to explain are themselves obscure. The main fault in the book, according to our view, is the author's Hegelianism. This leads him not only to look in the ancient thinkers for anticipations of his own views, but also to give too much attention to some theories of the earlier philosophers and of the Neo-Platonists which can only be regarded as products of imagination. What we want to learn about the ancient philosophers is their contributions to the real philosophies of the world; while their visionary theories, which they themselves in many cases put forth as only conjectural, ought to be passed over in silence, or with a bare mention. In the main, however, Mr. Burt has confined himself to the best portions of Greek thought, the great names of Socrates, Plato, and Aristotle necessarily occupying the foremost place, yet without excluding what is most important in the works of others. The exposition of Aristotle is excellent, though the treatise on 'Politics' is accorded rather too much attention; but the account of Plato is hardly so satisfactory. The author's view of the periods of Greek thought is essentially that now commonly held. The first period was that of naturalism, or the attempt to explain the physical world; the second, that of rationalism, or the endeavor to understand human nature and discover the basis of morals; while in the third or Neo-Platonic period theological speculation held the leading place. Of these different phases of thought, the second is so much the most important that the exposition of it rightly occupies the greater part of the volume; yet the others receive all the notice that is necessary in so compendious a treatise. Mr. Burt is careful also to trace the connection of each period with the preceding one, and also of one individual thinker with another, thus exhibiting the course of philosophical development. On the whole, the book is well adapted to its purpose, and will undoubtedly be useful to young students, in college and elsewhere, for whom it is more especially intended.

Paradoxes of a Philistine. By WILLIAM S. WALSH. Philadelphia, Lippincott. 16°. $1.

THIS volume consists of a number of short essays, most of which had previously appeared in certain periodicals. The author remarks that the word 'paradox' "is usually held to be a synonyme for flippant smartness," but that it really means a proposition that seems absurd but is nevertheless true in fact. His own paradoxes, however, hardly answer to either of these definitions; for only a perverted intelligence could regard the mass of them as true, and, though they are flippant enough, we fail to see any 'smartness' in them. The book is a continuous sneer at men of genius and at intellectual and moral superiority of every kind. Mr. Walsh maintains that "men are more nearly equal than we suppose," and that "there is no such great difference between a genius and a dunce." "The great historian, the great poet, the great statesman, the great philosopher, . . . are as fallible and as foolish . . . as you and I are. The intellectual feats that they perform only happen to be more difficult to the average man, that is all." He endeavors to sustain this view by citing examples of follies and sins committed by men of genius; but most of the men he refers to were not geniuses at all, but commonplace men who followed the profession of literature. The author adopts a cynical tone throughout, which adds to the disagreeableness of what he says. Moreover, there is hardly any thing of a different character in the book, except some fantastic remarks on 'The Sense of Pre-existence,' and a few pages about 'Mother Goose.' Mr. Walsh says that he has collected these papers into a volume, "because the author likes them," and the world will probably be willing to grant him the exclusive enjoyment of them.

The Critical Period of American History. By JOHN FISKE. New York, Houghton, Mifflin, & Co. 12°. $2.

THIS book consists of lectures delivered first in the Old South Meeting-House at Boston, and afterwards in other cities. It relates to the time between the close of the revolutionary war and the adoption of the Federal Constitution, which Mr. Fiske justly regards as the most important period in our national history. Our popular historians are apt to give altogether too much attention to wars and other stirring events, and too little to the quieter but more influential movements of political and constitutional reform. Mr. Fiske, however, has a much better idea of the historian's duty, and has accordingly given us a much better book than most of his predecessors have done. His philosophical studies have given him the comprehensiveness that good historical writing requires, and have fitted him to trace with clearness the chain of causes and effects which is the fundamental fact in historical development. His style, too, with its clear and easy flow, is well fitted for the