fore, the method of the master is not to be followed in the college." Concerning nominations to professorships, he maintains without question the superiority of the method by which the name goes to the Governing Board only after the faculty has been fully consulted and its official approval secured. "A college faculty would seldom be willing to call a new member into itself without the express approval of the president. It is also true that no worthy president should be willing to bear a nomination to the Board of Trust without the approval of the faculty." This method, in his opinion, awakens and maintains enthusiasm, and tends to promote in the various members of the faculty a sense of individual responsibility, which it is very desirable that they should feel. All this is so thoroughly sensible, so completely in accord with the known facts of human nature, that one wonders why so many colleges suffer their efficiency to be lessened and their reputations injured by the friction and discontent to which the opposite practice inevitably tends. Dr. Thwing quotes with approval from a private letter of ex-President Dwight of Yale the suggestion that college presidents generally have too much power. "Coöperation and devotion" are his words for the proper relation between president and faculty; not authority and obedience.

Since our author came from the ranks of the clergy himself, it is interesting to find that he recognizes with no regret the decline of the old-time clerical predominance in college management. Yet he has no fault to find with it in the past. It grew naturally out of conditions then obtaining, and is naturally passing away now that the conditions have changed. Lawyers and merchants are taking the places of clergymen on the Boards of Trust because the material development of the college constantly increases the number of problems with which lawyers and merchants are most competent to deal. For the teaching force, too, the men best trained for the work demanded are now to be found largely outside the clerical profession. And in both these lines the college can now command outside that profession the services of men who, in moral character and influence, stand fully as high as the clergymen themselves. Therefore, "the day of the clergyman active as a clergyman in the management of the American college is passing away. All that the clergyman represents as a Christian, as a moralist, as a scholar, as a philanthropist, of course, has not passed away and cannot pass away."

President Thwing is of course in harmony —all educators are now in harmony—with the general principle of student election in making up the course of study. He does not share, however, the apparent superstition of some that mere freedom of choice has power in itself to insure the best choice. By a careful study of recent statistics from Harvard University he shows that the average choice of the students represented has some very good features: "Harvard College, like every American college, is graduating men of richer attainments than the college of the earlier time. The graduate approaches nearer the type of the gentleman of culture. Knowledge is more affluent; the appreciation of the . . . more adequate and more common." But on the other hand, . . . college is making scholars ra-

ther than thinkers. It is good to make a scholar; it is better to make a thinker. American life needs scholars much; American life needs thinkers more." And on another page: "The American community is, on the whole, honest, and the American community is, on the whole, intelligent, but the American community cannot think." To secure from the college its share in the work of amelioration, "Two things may at least be said: first, far greater care should be exercised in the choice of teachers in order to secure those who are able to train thinkers; and, secondly, proper urging should be given to men, on the part of advisers and counsellors, to take severer and more thought-provoking courses." President Thwing's position is, then, that the power of election should exist untrammelled by any mandatory interference, but should be exercised under the influence of friendly advice. No doubt such a programme will suit the average parent, anxious for good results, far better than election absolutely without guidance.

We have touched but a few of the important points discussed. The relation between the faculty and the governing board, the investment of permanent funds, the freedom of teaching, the proper attitude toward fraternities, the inadequate equipment for medical and legal education in America, exemption of college property from taxation, and various other questions are sensibly and suggestively considered. If one closes the book with the feeling that there is any important omission, this will certainly be the subject of intercollegiate athletics. It would be easy to show that this is a subject touching sharply upon almost every other phase of college life. It is the subject which brings the college before the people in the daily press more often than all others combined. We can hardly believe that Western Reserve University has been so happily unique in its experience as not to have met with any serious problems in this branch of administration. If so, there are college faculties all over the land which would be delighted to sit at the feet of its President long enough to learn how smooth a path over the intercollegiate athletic field of the past ten years was discovered.

This book, the author tells us, "makes its special appeal to a small constituency." Faculties and trustees are doubtless in mind, but among the large body of college alumni it ought certainly to find a ready sale. Surely no man who has ever been a college student could read it without a keen interest. As a guide to intelligent giving, it ought also to find its place on the tables of men of wealth who are looking for suitable fields for philanthropic effort.

A Brief History of Mathematics: An Authorized Translation of Dr. Karl Fink's Geschichte der Elementar-Mathematik. By Wooster Woodruff Beman and David Eugene Smith. Chicago: Open Court Publishing Company. 1900. 8vo, pp. 333.

The original of this work enjoys the sort of reputation that the approval of students in German universities can confer. Whatever that may be worth, it may probably show that readers similarly situated in this country, wanting some information about the history of arithmetic, algebra, geometry, and trigonometry, provided it be

compressed and generalized, may find this translation will answer their purpose; although there is a good deal about old German books of no importance which had better have been replaced by notices of English writings that really had something to do with the development of mathematics, such as those of Shirewood, Bradwardin, Tonstall, Sacrobosco, Dee, Recorde, Digges, Oughtred, Blundevill, etc. Those readers who do not approve of an historian's wasting time in trying to make out how one event led to another, will find less of that sort of thing in this volume than in anything called a history that can easily be brought to mind. Those who are curious to know in what the mathematical interest and value of any works of mathematicians of the past really consisted, must, of course, seek their information elsewhere than in this little manual.

Its admirers praise its "breadth," and in truth it carries this quality to a high pitch —so high that the reader may oftentimes gather quite a false notion, until he becomes accustomed to the way in which Dr. Fink, in common with many another German professor, uses language, after which the same sentences will convey no notion at all. For instance, we read: "The earliest writer giving us information on the arithmetic of the Arabs is Al-Khowarazmi. The borrowing from Hindu arithmetic stands out very clearly." Now, considering that that writer was no "Arab," nor even an Arabian, but a foreigner called from Chorasmia because, within two centuries from the Hejra, the wild tribe of Mohammed had become possessed of such treasures that some sort of accounts had to be kept, and Chorasmia was the country where the art of computation had been most perfected; and considering that what was set forth in his treatise was substantially all the arithmetic the Arabians ever had—to speak of that work as giving us information about "the arithmetic of the Arabs," if it conveys any definite idea, is likely to convey a wrong one. So it is with the sentence that follows. It is true that Brahmagupta represents an earlier stage of development of the same arithmetical art as Al-Khowarazmi; and so does Bhaskara, although he wrote long afterward. But instead of there being any clear borrowing from the Hindus, many facts lead to a strong suspicion that it was in Bactria or some country north of India that the art in question originated and developed. Again, speaking of the celebrated mathematical papyrus, which we now know goes back in substance, as it professes to do, to the Tenth Egyptian dynasty, Dr. Fink says, "as the measure of the area of the isosceles triangle with base a and side b, . . . $\frac{1}{2} ab$ is found, and for the area of [etc.]." These approximate formulæ are used throughout and are evidently considered perfectly correct. The area of the circle follows, with the exceptionally accurate value $\pi = (\frac{16}{9})^2 = 3.1605$." Now, anybody not acquainted with the German professorial style of expression would suppose that the papyrus contained something about an isosceles triangle; but it is not so. There is a figure of a triangular field of which two sides are marked as 4 "che" and 10 "che," intended perhaps for 400 and 1,000 cubits. The figure is not badly drawn, for the shorter marked side is very near 0.4 the longer one, perhaps 0.408 or 0.409. Being so accurate in that respect, it

can hardly have been intended to be isosceles, for the angles at the base differ by about 11°, being 84° and 73°. Multiplying half the base by the side inclined to it by 84° after all made an insignificant error, less than half of one per cent. What is that in the value of a piece of land, presumably agricultural? It is not enough to dig a grave on. Now there was nothing theoretical about the Egyptian of the Tenth Dynasty. A Cincinnati porkpacker could not have a greater contempt for small quantities. He measured his field in a common-sense way. So, likewise, the Egyptian says nothing about the ratio of the circumference of a circle to its diameter, but calculates the area of a circular field by squaring 8-9 of its diameter, which is not a very awkward way of getting a 1 per cent. approximation. What Dr. Fink means by calling 3.1605 an exceptionally accurate value for π must remain a secret, for few of the vast number of evaluations that have been published have been so far from the truth; and if a comparison with equally ancient evaluations is intended, there can be nothing exceptional where there are not instances enough to base a rule upon.

The same sort of "breadth" pervades the modern parts of the book. Thus, on p. 250, we read that "the results of Desargues were more important for theory than for practice. More valuable results were secured by Taylor with a 'linear perspective' (1715)." One would hardly guess from this that Desargues applied his method to stone-cutting quite in the style of Monge, while Brook Taylor's mathematically admirable work (why is its title not printed with capital initials and in italics instead of so as to suggest some optical instrument rather than a book?) involved no application except to drawing. On p. 131, after several pages devoted to the writings of the great Grassmann and to others closely related to his, mention is made of 'Grassmann's Formenlehre,' with no hint that this book, in which a microscope could hardly detect any originality, was by quite another Grassmann. Remarkable English and American contributions to the same branch of mathematics are passed by in silence. The editors ought not to have permitted this. About tables, no notice is taken of the valuable 8-place French logarithmic tables, nor of Mansion's and other tables for finding 12-place logarithms and their anti-logarithms; and, if our memory does not play us false, the statement about Dase conveys a false impression, his name alone being on the title-page of an assigned part of the great factor table, which the book seems to say he did not calculate. The circumstance that he was insane all the time he was making the calculations is interesting enough to insure its not being mentioned by Fink.

There is, to be sure, a conclusive reply to all such criticisms. It is simply that the book is neither intended nor adapted for the use of persons who care particularly to have their information minutely accurate. Readers for whom "breadth" will cover pretty much all other sins, will find it to their taste. There is a good deal of human interest in the history of mathematics; but all such unscientific stuff has been ruthlessly excised by Dr. Fink, no matter what its significance might be for the development of mathematics. So, those who found fault with Cajori's book for being too entertaining ought to find

this one perfectly unexceptionable in that respect.

The translation is excessively literal, in many places too much so to convey the precise meaning of the author. We do not doubt that the accomplished mathematicians who have executed it have in many places improved upon the original, in point of accuracy. They seem to us, however, to have committed a grave mistake in changing the title, albeit they give notice of having done so on their title-page. They justify their step by saying that the author in many places strays so far beyond the bounds of the elements that "the original title is misleading." That may be, but what of it? Is this the logic of modern mathematicians? Because the book is very badly laid out for a history of elementary mathematics, does it necessarily follow that it must be well describable as a history of mathematics in general? Perhaps there is nothing about which the sort of readers to whom the book will most appeal wish more to be informed than the origin and early history of the differential calculus, probably the most important of all those events concerning which the history of mathematics can afford us any satisfactory account. To call a book, however brief, a history of mathematics, without a fuller narrative of that revolution than this book gives, seems a terrible compromise. It was a good idea to append an alphabetical list of mathematicians with brief notices of them, had it only been longer; and as it is, to look it over and see who is in it and who is not in it, will supply a little of the amusement which the body of the work sternly refuses to bend to. There is a satisfactory index.

On the whole, the volume will probably prove one of the most useful of the meritorious series to which it belongs; although, had the translators been willing to take the trouble to produce a history of their own, they would have earned a larger measure of gratitude from American readers.

The Antarctic Regions. By Dr. Karl Fricker. The Macmillan Co. 1900. 8vo, pp. xii, 292. Plates and maps.

The interest in the Antarctic which has of late years been stimulated by the persistent efforts of Murray and Neumayer, has taken definite shape in several schemes of exploration, some of which have recently terminated, while the more important ones are at the point of organization. It was appropriate, therefore, that an effort should be made to gather in one volume the facts about the Antarctic region hitherto scattered in numerous records of exploration, both as regards the history of discovery in the Antarctic, and the geological and geographical facts, in a broad sense, which have been collected by the various expeditions. The translation from the German has been well done by Mr. A. Sonnenschein, and the illustrations were reproduced from the originals, chiefly in Dumont d'Urville's 'Atlas Pittoresque,' but also including some original, hitherto unpublished, sketches of icebergs, made on the *Challenger* expedition, and kindly furnished by Sir John

Murray. The history of discovery occupies about one hundred pages, and somewhat more space is given to a minute description of each locality of which anything is known, drawn from all available sources. The climate, the ice, the fauna, and flora are successively taken up, and followed by a short chapter on the future of Antarctic discovery, more particularly addressed to German readers, and a bibliography of the more important literature and maps; with a good index to the whole work.

The compilation has been done in a solid, German fashion, which inspires confidence in its fulness and accuracy, and with a praiseworthy impartiality, not altogether easy in a field where international emulation at one time was very keen. The local descriptions, faithfully made, are rather dry reading, except for those especially interested in the region; for them, this part of the work will be valuable for reference. Throughout, the paucity of our knowledge of any part of the area concerned is the most striking feature of the compilation. The chapter on the climate is interesting and fresh, while that on the ice will convey to the average reader a strong impression of the discrepancies between the conditions of the Arctic and Antarctic regions.

The chapter on the fauna and flora is the least satisfactory of any, this being a subject with which the author is unfamiliar. Much of interest might have been added to it by a synopsis of the recent discussion, in which Hedley, Gregory, and others have taken part, based on the known distribution of animals in Australasia and South America. This has shown a valid basis for an hypothesis of a former greater land area in Antarctica, and a probable connection between the continents at a time when conditions favorable to animal life prevailed where now all is desolation. The little that is known reveals the presence in the South Polar region of land, or a congeries of islands, covered with a deep mantle of unbroken ice, near the periphery of which a few nunataks and volcanic cones barely thrust their summits above the surface. By the breaking off of the ice, here and there, a ragged cliff is revealed or a spit of glacial gravel is laid bare. The snowy slopes near the volcanic vents are sometimes sullied by a rain of cinders. Otherwise all is white, still, and frigid. There are no land animals or birds, no plants but a few mosses or lichens. Seals frequent the bays, finback whales, useless for oil or baleen, occasionally traverse the passages between the floes, and penguins abound on the more level ice near the water.

The relatively even and uniform character of the land thus buried in eternal ice is indicated by the very remarkable uniformity of the square-cut table-like bergs which are released from the margin of the ice sheet, and of the ice cliffs which the bergs leave behind them, towering as an impregnable wall without break or modification, in some cases for hundreds of miles. The structure of the ice is such that, in melting, the bergs preserve more or less of this level uniformity, contrasting strongly with those which are thrown off from the Arctic shores of Greenland.

The character of uniformity is not confined to the bergs. Excepting a few projections stretching out toward the most adjacent continental lands, the periphery of this