

result from Gordan's researches, which are indubitably correct. This supposed consequence must have arisen from a misapprehension, on the part of M. de Bruno, of the nature of Professor Cayley's rectification of the error of reasoning contained in his second memoir on Quantics, which had led to results discordant with Gordan's. Thus error breeds error, unless and until the pernicious brood is stamped out for good and all under the iron heel of rigid demonstration. In the early part of this year Mr. Halsted, a fellow of John's Hopkins University, called my attention to this passage in M. de Bruno's book; and all I could say in reply was that 'the extrinsic evidence in support of the independence of the equations which had been impugned rendered it in my mind as certain as any fact in nature could be, but that to reduce it to an exact demonstration transcended, I thought, the powers of the human understanding.'

In 1883 Sylvester was made Savilian professor of geometry at Oxford, the first Cambridge man so honored since the appointment of Wallis in 1649.

To greet the new environment, he created a new subject for his researches—Reciprocants, which has inspired, among others, J. Hammond, of Oxford; McMahon, of Woolwich; A. R. Forsyth, of Cambridge; Leudesdorf, Elliott and Halphen.

Sylvester never solved exercise problems such as are proposed in the *Educational Times*, though he made them all his life long down to his latest years. For example, unsolved problems by him will be found even in Vol. LXII. and Vol. LXIII. of the *Educational Times* reprints (1895). If at the time of meeting his own problem he met also a neat solution he would communicate them together, but he never solved any. In the meagre notices that have been given of Sylvester the strangest errors abound. Thus C. S. Pierce, in the *Post*, March 16th, speaks of his accepting, 'with much diffidence,' a

word whose meaning he never knew; and gives 1862 as the date of his retirement from Woolwich, which is eight years wrong, as this forced retirement was July 31, 1870, after his 55th birthday. Cajori, in his inadequate account (*History of Mathematics*, p. 326), puts the studying of law before the professorship at University College and the professorship at the University of Virginia, both of which it followed. Effect must follow cause. And strange, that of the few things he ascribes to Sylvester, he should have hit upon something not his, 'the discovery of the partial differential equations satisfied by the invariants and covariants of binary quantics.' But Sylvester has explicitly said in Section VI. of his 'Calculus of Forms': 'I alluded to the partial differential equations by which every invariant may be defined. M. Aronhold, as I collect from private information, was the first to think of the application of this method to the subject; but it was Mr. Cayley who communicated to me the equations which define the invariants of functions of two variables.'

Surely he needs nothing but his very own, this marvellous man who gave so lavishly to every one devoted to mathematics, or, indeed, to the highest advance of human thought in any form.

GEORGE BRUCE HALSTED,
UNIVERSITY OF TEXAS.

THE GREAT FAULT AND ACCOMPANYING
SANDSTONE DIKES OF UTE PASS, COLO-
RADO.*

THREE year years ago Whitman Cross first directed the attention of geologists to the fact that dike-like masses of sandstone occur in the granite of the Pike's Peak massif, forming a belt about one mile wide extending north-northwest from the vicinity of Green Mountain Falls, in Ute Pass,

*Abstract of a paper read before the Boston Society of Natural History, January 20, 1897.

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planatory notes concerning the value and authenticity of the manuscripts and concerning the interpretation of particular passages, as well as disquisitions on the institutions referred to in the laws, will appear in the second volume, which will also contain a glossary. Doubtless this second volume will be of more general interest than the first.

All that we can do at present is to note two features which distinguish this edition from its predecessors. In the first place, Dr. Liebermann prints in parallel columns, besides the Latin version taken from the *Quadripartitus* and a German translation, the full Anglo-Saxon texts of various ancient manuscripts; and he gives in footnotes many variant readings from other manuscripts. The result is that we have in this edition much fuller and better texts, and the various collections of laws are dated with more accuracy. In the second place, he provides us with a much more satisfactory translation than that which we find in the editions of Thorpe and Schmid. An admirable innovation in the translation is the addition in brackets of explanatory words which make the meaning clearer. Owing to the brevity of the text and to the bewildering use of Anglo-Saxon pronouns, the literal translations of Thorpe and Schmid are often meaningless. Dr. Liebermann has rightly regarded it as the proper function of an editor to remedy this defect.

In conclusion, two or three trifling criticisms may be ventured. It is remarkable that this first part of the work has been published without any preliminary explanations of its scope, the signification of the different kinds of type used, etc. Probably these explanations will appear later in the form of an Introduction to precede the whole work. Meanwhile the publisher's prospectus which has been distributed would be helpful if it were bound with this *Lieferung*. The general appearance of the pages is attractive, but the rubrics are not printed in a form of type that easily catches the eye. Finally, the wisdom of placing Ine's laws after Alfred's, as they stand in the manuscripts, may be questioned; much may be said in favor of the chronological order adopted by Schmid.

CHARLES GROSS.

The "Opus Majus" of Roger Bacon. Edited, with Introduction and Analytical Table, by JOHN HENRY BRIDGES, Fellow of the Royal College of Physicians, sometime Fellow of Oriel College. (Oxford: Clarendon Press. 1897. Two vols., pp. clxxxvii, 404. 568.)

THIS edition of the *Opus Majus* is certainly somewhat superior to that of Samuel Jebb, M.D. (London, 1733; Venice, 1750). It contains the seventh part, on moral philosophy, which Jebb omitted; and it separates as an appendix to the main work that section *De Multiplicatione Specierum*, which is really the third part of the *Opus Tertium*, but which Jebb interpolated between the fifth and sixth parts of the *Opus Majus* (pp. 358-444 of ed. of 1733). The new edition is provided with a full analytical table of contents, which is extremely convenient, and has a

tolerable index besides, while Jebb gave but a meagre index and no table of contents nor any running titles other than that of the whole work.

Having acknowledged the relative convenience of the new edition, we find nothing more to praise. One cannot read far in the introduction without recognizing in it a splendid example of that cool, calm, and collected ignorance which does not know the difference between cramming and learning; and before we turn the very first leaf of text and notes, we begin to lose confidence in the minute accuracy of the edition:

But nothing better can be hoped for until a complete Vatican MS. is found. Roger Bacon never published any book. He was continually rewriting, and in doing so lapsing into negligences which required him to rewrite again a part of what he had rewritten. It seems, unless he lies, which would be a gratuitous hypothesis, that he did send to Pope Clement IV. (in Rome) a complete copy of the *Opus Majus*. But lest it should be lost in transportation (see his words in *Eng. Hist. Rev.*, XII. 507),¹ he sends along with it a brief synopsis of its contents. The inference would seem to be that the copy sent was the only copy; and other remarks of Bacon support this supposition. If that one copy could be found, it would solve the difficulty. But is any competent man likely to risk his reputation by undertaking the manifestly impossible task of producing a perfect text as long as every old MS. is a rough draught and every consecutive one is a late patchwork? As to Bacon's other works, there is no reason to suppose that any of them (unless the letters to John of Paris, if they are genuine) was ever completed.

Dr. Jebb's edition of the *Opus Majus* was by no means excellent, judged by the standards of his day. Brewer's publication of the *Opus Tertium*, the *Opus Majus*, and the *Compendium Studii* was so welcome that nobody seem inclined to look the gift-horse in the mouth. It would not bear severe criticism. But that Dr. Bridges is the most surpassingly careless of all the poor friar's editors, with little palaeographical skill, is demonstrated in the *Athenaeum* of September 15 and October 16, 1897, and in the *English Historical Review* of January, 1898.

Those reviewers take the ground that the publication had better not have been made at all. This is going too far: for if Gasquet's recent search in the Vatican did not bring to light a complete MS. of the *Opus Majus*, and his statement that he has found "other interesting and important material" cannot give us much hope that he did (although the *Saturday Review* for September 18 positively asserts that the MS. originally sent by Bacon to the Pope is still in the Vatican), then it is unlikely that a satisfactory text can soon be established. In any case, the present publication can only increase the interest that will be felt in any other which should really throw a better light upon that abortive renaissance of physical science which took place in the first half of the thirteenth cen-

¹ The same matter is expressed in other words in Cap. XXI. of the *Opus Tertium*, which appears to be a first draught of the epistle ultimately condensed as printed in the *English Historical Review*; although no doubt Bacon subsequently determined to make a separate work of it.

tury, and of which Roger Bacon, lifted out of obscurity by the accidental circumstance of his correspondence with Clement IV., is the best-known representative. It is desirable that any further revelations concerning that interesting movement should be made in a form which should be agreeable reading to the largest possible number of physicists. Now, physicists in our days are quite out of the habit of reading Latin; and therefore we would venture to suggest that a translation of any long works should accompany the text, on alternate pages.

A Bibliography of British Municipal History, including Gilds and Parliamentary Representation. [Harvard Historical Studies, V.] By CHARLES GROSS, Ph.D., Assistant Professor of History, Harvard University. (New York, London and Bombay: Longmans, Green and Co. 1897. Pp. xxxiv, 461.)

No more timely book has of late appeared than this handsome volume. How very urgent has been the need of such a guide is suggested by the fact that among the thousands of writings noticed in it there cannot be found one scientific treatise devoted to the general constitutional history of English boroughs. Nay, there does not appear to exist a satisfactory institutional account of any single borough, much less of any town or county, in Great Britain. Important contributions have, of course, been made, notably in the general constitutional works of Gneist, Hegel and Stubbs; while here and there a valuable essay or monograph deals in a competent way with some special phase or feature of town life or organization.

For the first time in Dr. Gross's book we have a scientific bibliography of British municipal history prepared primarily for the student and not for the book-buyer. It "comprises books, pamphlets, magazine articles, and papers of learned societies" relating to the "governmental or constitutional history of the boroughs of Great Britain, including gilds and parliamentary representation. Town histories which do not deal with any of these topics, purely topographical works, and parish histories are omitted." The literature thus left out is of vast extent. Turner, for example, announces a "hand-book for buyers and sellers" under title of *Ten Thousand Yorkshire Books*; while Dr. Gross points out that in Vol. III. of Hyett and Bazeley's *Manual of Gloucestershire Literature* 337 octavo pages are devoted to Bristol alone.

The *Bibliography* comprises in all its divisions 3092 numbers, some of them of course indicating extensive sets or collections. In the more important cases the author, often at the cost of much time and labor, has indicated the character of the work or given a concise analysis of its contents, while conscientiously marking those which he has not been able personally to examine. The aid in this way afforded the student is frequently of the most painstaking and useful kind; as for instance (pp. 35-38) in listing the principal cases in the law reports relating to municipal questions; or throughout the book in giving page references to the public records, parliamentary reports and other papers.