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SELECTED MATHEMATICAL REVIEWS

related to the paper in this section by
GERALD L. ALEXANDERSON

MR2216541 (2007a:01013) 01A70 (01A60)

Parshall, Karen Hunger

James Joseph Sylvester.

Jewish mathematician in a Victorian world.
Johns Hopkins University Press, *Baltimore, MD*, 2006. xiv+461 *pp*.
ISBN 0-8018-8291-5

Karen Parshall's biography of James Sylvester (1814–1897) is an important and impressively documented contribution to the history of nineteenth-century mathematics. Drawing on Sylvester's correspondence and various other sources, she takes us year by year through his mathematical career, documenting the twists and turns of his research, his sometimes rocky relations with institutional authorities, his interactions with foreign colleagues and his work with educational commissions, mathematics journals and scientific societies. The book is a companion volume to the critical edition of selected correspondence of Sylvester published by Parshall in 1998 [*James Joseph Sylvester*, Oxford Univ. Press, New York, 1998; MR1674190 (99k:01072)], and substantially extends her several journal articles devoted to Sylvester and his mathematics. It also contains readable accounts of such topics as the emergence of the actuarial profession and the movement for popular education in nineteenth-century Britain.

Sylvester seems to have held little back in his letters and even in his published research, leaving a record that reveals an unusually detailed picture of the subjective world of the working mathematician. Temperamental, combative, obsessed with priority, subject to alternating moods of despondency and grandiosity, he sought to build a national and international reputation. (In the index under the heading "depressions of Sylvester" there are twelve entries.) A colorful and sometimes eccentric figure, he invented an arcane mathematical vocabulary and wrote a book setting out an abstruse and technical system for the writing of poetry.

Sylvester's most important mathematical work was carried out with Arthur Cayley (1821–1895) and concerned the theory of algebraic invariance. The fundamental object of study is the quantic or form, a homogeneous polynomial in n variables. There is an appealing concrete quality to the theory, concerned as it is with a tangible domain of objects subject to formal laws and principles of generation. If one compares the results of Sylvester and Cayley with what is found, say, in George Peacock's *Treatise on algebra* [Deighton, Cambridge, 1842], it is apparent what a leap forward the theory of invariants was. On the other hand, the British theory was very much rooted in the contemporary development of the subject. Explicit calculation of the invariants and covariants of quantics constituted an approach to higher algebra that stood in contrast to the more abstract and structural algebra that became common in the twentieth century. Although it is clear that one would be rewarded by a study of many of Sylvester's results, it is not altogether easy to follow him into his invariant mathematical world. The textbook of reference for the subject was written by Edwin B. Elliot in 1895 [*An introduction to the algebra of*

quantics, Clarendon, Oxford, 1895; second edition, London, 1913; JFM 44.0155.05], a fact that indicates how much the Cayley-Sylvester theory of forms is part of the history of algebra. Sylvester himself never wavered in his belief in the novelty and importance of his mathematical work, proclaiming proudly in a public address in 1869 that the theory of invariants had "led to a complete revolution in the whole aspect of modern analysis ... whose consequences will continue to be felt until mathematics are largely forgotten" (p. 204).

Sylvester was without question a fascinating figure within the intellectual culture of Victorian science. As an algebraist he displayed a decidedly inductive and experimental turn of mind. He responded sharply to Thomas Huxley's philosophical characterization of mathematics as a subject concerned only with deduction. He compared the objects studied by the algebraist to the specimens investigated by the biologist or the fossils uncovered by the geologist. In his mathematical research he often generalized from a few examples, was continually revising and correcting his published work and displayed a liberal conception of proof. One of his forays involved an elaboration of similarities between the laws of matrices and the laws of Newtonian mechanics, on which topic he wrote "as motion is operation in the world of pure space, so operation is motion in the world of pure order" (p. 288). Another line of inquiry had him attempting to link invariant algebra and the atomic theory of chemistry.

The subtitle of the book, "Jewish mathematician in a Victorian world", highlights a central fact of Sylvester's career, his ineligibility until late in his life for a position at Cambridge or Oxford Universities. Two thirds of Sylvester's graduating class at Cambridge went on to become Anglican clergymen. A pledge of allegiance to the articles of faith of the Church of England was required in order to graduate, receive a fellowship and, most important, be granted a professorship. As a Jew, Sylvester was subject to various forms of intolerance in England and the United States. A leading theme of this biography concerns how he struggled in a self-conscious way to become a professional research mathematician. The modern social conception of the professional scientist was just then taking hold in Victorian England. Parshall suggests that within the cultural milieu of his times Sylvester's Jewishness manifested itself in his drive for recognition, his emphasis on research and his strong international outlook.

From MathSciNet, March 2008

Craig G. Fraser

MR1674190 (99k:01072) 01A70 (01A55, 01A75)

Parshall, Karen Hunger

James Joseph Sylvester. (English summary)

Life and work in letters.

The Clarendon Press, *Oxford University Press, New York*, 1998. xviii+321 *pp.*
ISBN 0-19-850391-1

The volume under review is a long-overdue corrective to the legends that have grown up around Sylvester. Here he appears in his own words and those of his correspondents (some in French and German, not translated), abundantly commented by the editor, in a selection comprising about 12% of the 1200 letters that have

been preserved. Only those who have looked at all 1200 letters can judge the editor's selection, but each of the letters included in the volume illustrates a significant episode in Sylvester's life or works.

The letters are arranged chronologically and divided into six sections corresponding to different phases of Sylvester's career. Each section is introduced with a survey of the events and work illustrated in the letters in that section. From the mathematical point of view the letters to and from Cayley, Hermite, and others will be of most interest (including an interesting comment in an 1878 letter to Cayley, No. 89 in this collection, that Sylvester had never heard of theta functions). For those with an interest in the history of invariant theory (in which the editor of these letters is the foremost authority), there is a wealth of source material here. And, of course, there are all the famous clashes that Sylvester had with bureaucrats in both America and Britain over a variety of issues. (After leaving Virginia he sought a position at Columbia University, with a recommendation from one of America's leading scientists, Joseph Henry. In a wonderful irony, as reported in a later letter to Henry (letter No. 6), the selection committee informed him that his rejection was in no way connected with the fact that he was British, only the fact that he was Jewish. His appreciation for this irony is shown in his comment to Henry that he would have to "endure this disappointment with Christian fortitude".)

The book is very well edited and contains a generous bibliography and index. For those with an interest in Sylvester or the mathematics he created, it is well worth its price.

From MathSciNet, March 2008

R. L. Cooke