The late Professor Sylvester.

THE sympathetic allusion to the death of James Joseph Sylvester, made by the President at the monthly meeting in March, must have come, not as a reminder merely, but even as a surprise to many members of the Institute. Sylvester's name stands so high in the roll of distinguished mathematicians, his active connection with the science of life contingencies ceased so many years ago, that we of the present generation need make no apology if we have almost forgotten that connection. Yet for ten years Sylvester was actuary of a Life Office; for nearly forty years he was an Honorary Member of our Institute; and, therefore, though we are unable to attempt any critical account of his life's work and of its influence, yet it would scarcely be fitting if no reference to his long and brilliant career were made in the pages of this *Journal*.

Born in 1814, Sylvester read for the Mathematical Tripos at Cambridge, and was Second Wrangler in 1837. On account of his religious scruples—for he was always a staunch Jew—he was unable to take his degree or to compete for a fellowship. He accordingly left Cambridge at once, and accepted the Professorship of Natural Philosophy at University College, London. Almost immediately he commenced the long series of contributions to mathematical literature which have made his name so famous in the scientific world. At first, probably on account of the position he occupied, it seemed that his attention would be directed towards Physics; for among his earliest papers were "The Analytical Development of Fresnel's Optical Theory of Crystals", and "The Motion and Rest of Fluids" (*Philosophical Magazine*, 1837–8). But very soon the real bent of his genius, which was towards Pure Mathematics, asserted itself. In rapid succession, he produced a series of brilliant papers on Sturm's Functions, Invariants, Elimination, &c., which were published, for the most part, in the *Philosophical Magazine* and the *British Association Reports*, and led to the ready recognition of his talents by the Royal Society, of which he was elected a Fellow in 1839.

He left London in 1844 to become Professor of Mathematics at Virginia. But his absence from England was very brief. He returned in 1845, and for a time discontinued the work of teaching, in which he had hitherto been engaged. It was at this stage of his career that Sylvester's connection with our profession

commenced. He was the first actuary of the Equity and Law, and for some years he was also Consulting Actuary to the Law Reversionary Interest Society. Moreover, he found leisure to study law, and was called at the Inner Temple in 1850, though he never practised. In 1848 the Actuaryship of the Royal Exchange Assurance became vacant, and Sylvester desired the post; but when he found that the late J. A. Higham, then next in rank in the office though only 28 years of age, was a candidate, he withdrew on the ground that he would not compete with one who had been his own pupil.

Sylvester's solitary contribution to the *Journal* is an elegant little note "On Multiplication by aid of a Table of Single Entry", published in 1854 (*J.I.A.*, iv, 236). As evidence of his influence in actuarial matters, it is a fact of interest that the table of whole-life with-profit premiums which he calculated for the Equity and Law over fifty years ago is still in use in that office. Sylvester, however, was not happy in his occupation during this period. He had no great love for actuarial and legal work, and he gladly relinquished it in 1855, when he was appointed Professor of Mathematics at the Royal Military Academy, Woolwich. He threw himself into his new, and more congenial, duties with characteristic enthusiasm, and, by the experience he gained at Woolwich, he was soon enabled to render a distinct public service. A committee was appointed to enquire into the working of institutions like the Royal Military Academy, and Sylvester, who was invited to give evidence, fearlessly recommended several drastic reforms, which were eventually adopted. It is a curious irony that, by the adoption of one of his own suggestions, he was compelled to resign his position at Woolwich in 1870, after fifteen years' service, on a totally inadequate pension. Fortunately, his claims to more generous treatment were brought before the notice of the House of Commons, and were gracefully recognized by Mr. Gladstone on behalf of the Government.

Mathematicians will probably agree that his fifteen years at Woolwich constituted the period of Sylvester's greatest intellectual activity. It was in 1864 that he read before the Royal Society his famous "Algebraical Researches", which were an epoch-making discovery in the Theory of Equations. To this succeeded a host of masterly contributions, on almost every branch of mathematics, to almost every important scientific journal of Europe. The most interesting of these to actuaries will probably

be the article on the Theory of Probabilities (*Phil. Trans.* 1865). What is especially admirable in all Sylvester's writings at this period is his evident enthusiasm for his subject. Indeed, his love for mathematical science and its methods, his belief in the value of these methods as a mental training, were alike unbounded. It may, perhaps, be of interest in this connection to recall his famous passage of arms with Huxley. The latter, in a lecture "On the Educational Value of the Natural History Sciences", had said, "I do not question for a moment that, while the "Mathematician is busy with deductions *from* general propo- "sitions, the Biologist is more especially occupied with "observation, comparison, and those processes which lead *to* "general propositions. . . . The Mathematician deals with "two properties of objects only, number and extension, and all "the inductions he wants have been formed and furnished ages "ago. *He is occupied now with nothing but deduction and "verification.*" The last sentence was not long left unchallenged. At the meeting of the British Association, at Exeter, in 1869, Sylvester, who was President of the Mathematical and Physical Section, devoted his opening address to "A Plea for the Mathematician", which was really a vigorous reply to Huxley. In a passage of great eloquence, he maintained that "mathematical analysis is constantly invoking the aid of new "principles, new ideas, and new methods, not capable of being "defined by any form of words, but springing direct from the "inherent powers and activity of the human mind, and from "continually renewed introspection of that inner world of thought "of which the phenomena are as varied, and require as close "attention to discern, as those of the outer physical world— "to which the inner one in each individual man may, I think, be "conceived to stand in somewhat the same general relation of "correspondence as a shadow to the object from which it is "projected, or as the hollow palm of one hand to the close fist "which it grasps of the other: that it is unceasingly calling "forth the faculties of observation and comparison, that one of "its principal weapons is induction, that it has frequent recourse "to experimental trial and verification, and that it affords a "boundless scope for the exercise of the highest efforts of "imagination and invention." Huxley made no reply, other than a kindly reference to "the artillery of our eminent friend", in a letter addressed to Tyndall, in 1870,* and, indeed, no reply

* Now published as a preface to Huxley's *Lay Sermons, Essays, and Reviews.*

seems possible to one who has any conception of the work of a mathematical genius of the order to which Sylvester belonged.

During some six or seven years after his retirement from Woolwich, Sylvester was without a professorship. His leisure, however, was not unfruitful. He continued his mathematical researches with undiminished zeal, and took up some branches, *e.g.*, Spherical Harmonics, to which he had hitherto contributed but little. He also began to take a more active interest in public affairs, more especially in educational matters. In 1872 he contested the vacancy on the London School Board, created by the resignation of Huxley, by whom, it is gratifying to note, his candidature was cordially supported.

In 1877, Sylvester again left England, this time to become Professor of Mathematics at the new Johns Hopkins University, Baltimore. The importance of his work there can hardly be exaggerated. He practically originated the study of mathematics in the United States. He founded, and was the first editor of, the American *Journal of Mathematics,* and he succeeded very quickly in gathering round him a band of enthusiastic students, many of whom are now among the leaders of scientific thought in their country. While at Baltimore, Sylvester always strove to bring the men with whom he came in contact into closer sympathy with England. At the University celebrations in honour of Washington's birthday, he delivered an address on Education, in which he deplored the fact that so many American students went to the German Universities rather than to Oxford or Cambridge. He attributed this, rightly or wrongly, to the religious exclusiveness of the English Universities,* and made an eloquent plea for the removal of these disabilities, from which, forty years before, he had himself suffered at Cambridge.

Only a few more years passed before this plea was answered in a manner that must have given Sylvester the keenest satisfaction. In 1883, he was elected Savilian Professor of Geometry at Oxford, and had thus at last the gratification of filling, at that University, the position corresponding to that held at Cambridge by his distinguished friend Cayley.

Unfortunately, the mathematical world was not much longer destined to enjoy the full measure of his power. His general health became less robust, and, with advancing age, his eyesight

* Our readers will remember that this address was delivered nearly twenty years ago, when, *e.g.*, it was practically impossible for any person not a member of the Church of England to become a Fellow of his College.

partially failed. He was released from the active duties of his professorship in 1892, a deputy being appointed, and came to London, where he spent most of his time at the Athenæum Club. A few months before the end, he appeared to recover somewhat, and actually resumed his mathematical researches. But this rally was not of long duration. He was seized with paralysis towards the close of February, and passed away peacefully in London on March 15, 1897.

This is not the place to dwell upon Sylvester's character or disposition—on the gentleness of heart that lay beneath the rugged exterior of his manner. But, in closing this brief and necessarily imperfect sketch of his career, it would be ungenerous not again to refer to his absolutely unselfish devotion to his work. It is to men like Sylvester that the world owes most, men who, single-hearted, resolute, self-less, pursue their labours for the sake of Truth alone. It is by the hand of such as he that Science may hope to win from the unknown her brightest gems of knowledge.

A. L.