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Unpublished Letters of James Joseph Sylvester and Other New Information concerning His Life and Work

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I. — INTRODUCTORY

In yesteryears there were two gloriously inspiring centers of mathematical study in America. One of these was at the University of Chicago, when BOLZA, and MASCHKE and E. H. MOORE were in their prime. The other center was at The Johns Hopkins University, 1876-83, where scholars were

“ Led by soaring-genius'd Sylvester,”

as LANIER has expressed it in his “ Ode to The Johns Hopkins University.” SYLVESTER was “ certainly one of the greatest mathematicians of all time,” but “ it may be doubted whether he will take a place amongst the small band who occupy absolutely the front line ” (MACMAHON, 1898). D. C. GILMAN the president of The Johns Hopkins University refers to “ the extraordinary strength and fertility of SYLVESTER's mind. From every point of view he was a marvel—first and foremost as a mathematician, as all the world has acknowledged; then as a teacher of gifted scholars, not by any means as a drill-master, but an inspirer; then as a man of letters, loving English, French, German, Italian,

Latin, and Greek literature, carrying the *Odyssey* in Greek for his light reading at sea, and working for years to perfect his version of one of the odes of HORACE, *ad Maecenatem* (iii, 29) " C. S. PEIRCE referred to " the great mathematician, SYLVESTER, perhaps the mind most exuberant in original ideas of pure mathematics of any since GAUSS." The editor of his writings stated " that here was a great personality as well as a remarkable mathematician, wide and accurate in thought, deep and sensitive in feeling, and inspired with a great faith in things spiritual... He was however before all an abstract thinker, his admiration was ever for intellectual triumphs, his constant worship was of the things of the mind. This it was which seems to have most impressed those who knew him personally." His personal character was one of singular beauty, its salient points being " simplicity and honesty. Absolutely and fearlessly honesty from cradle to grave." (MACMAHON). He had the friendship and esteem of many people, among whom only a few of the mathematicians may be mentioned, namely : BERTRAND, BORCHARDT, CAYLEY, CHASLES, DE MORGAN, DUHAMEL, HERMITE, OTTO HESSE, JOACHIMSTHAL, KELLAND, KUMMER, LEJEUNE-DIRICHLET, B. PEIRCE, PONCELET, SALMON, SERRET, and WILLIAM THOMSON, with many of whom his correspondence was frequent and voluminous. Comparatively few of his letters have been published. After finding that more than four score of them were available in America, I selected thirty, which seemed to be of particular interest from varying points of view. For permission to publish these letters I am greatly indebted to the courtesy of their owners, Mr. BENJAMIN P. ELLIS of Cambridge, Mass., Harvard University Library, Columbia University Library, and Library of Congress.

The main facts of the period of SYLVESTER's life from October 1841 to November 1844 have not previously been adequately treated, in SYLVESTER's biographies. Material from some of our new Letters, from the centennial history of the University of Virginia, and from some other sources, reduces this period of the unknown to July 1843-Nov. 1844. So many inaccuracies of statement in other periods were met with, it seemed well to put on record a chronological " Curriculum Vitae," containing much new information and making clear at just what periods in his career various national and international recognitions took place

A ready reference list of what has been written about SYLVESTER and his work, seemed to be a desideratum, and this has been supplied along with references to considerable new material. A recently discovered mathematical publication of SYLVESTER, earlier than anything formerly listed, is discussed in another Section. The account of "SYLVESTER'S Poetry" brings together an appreciable amount of information for the first time, and more than one of the items has not been referred to before in any sketch.

While most of this paper is occupied with Letters and commentary, there is, then, also much new material in other Sections.

II. — CURRICULUM VITAE

- 1814 (Sept. 3). Born in London, youngest (sixth) son of ABRAHAM JOSEPH. The eldest son SYLVESTER JOSEPH adopted the name SYLVESTER and his brothers did the same.
- 1829-30. Pupil at Royal Institution, Liverpool, where he won the first prize in the mathematical school. "While here, also, he was awarded a prize of 500 dollars for solving a question in arrangements, to the great satisfaction of the contractors of Lotteries in the United States, the question being referred to him by the intervention of his elder brother in New York." (BAKER). See Section VI of this paper.
- 1831 (July)-1833, 1836 (Jan.)-1837 (Jan.). At St. John's College, Cambridge. As a Jew he was not eligible for a Smith's Prize, a Fellowship, or a degree. By 1872 (see there) more enlightened times had arrived.
1837. Second wrangler; GEORGE GREEN (1793-1841) was fourth wrangler for this year. CLIFFORD, LORD KELVIN, J. J. MAXWELL, and J. J. THOMSON were later, also, *second* wranglers.
- 1838-41. Professor of Natural Philosophy, University College, London.
- 1839 (Apr.). Fellow, Royal Society of London.
1841. "After sitting for a portrait in oils by PATTEN of the Royal Scottish Academy, now in possession of the family, he embarked [Oct. 19, for Boston] in a Cunard sailing vessel. The portrait is evidently the work of a good painter, and is stated to be an excellent likeness. It represents a young man of six and twenty, in cap and gown, with dark, curly hair, and spectacles, seated, book in hand, at a table." (MACMAHON). I can not check that any artist of this name was an R. S. A. Of course it is barely possible that Sir NOEL PATON (1821-1901), an associate member R. S. A. in 1846 and an Academician in 1850, was meant. But perhaps more probably GEORGE PATTEN (1801-65) an English portrait and historical painter, but not an R. S. A. Where the painting now is, has not been determined.
1841. B.A. and M.A., University of Dublin.
- 1841 (Nov.)-1842 (24 Feb.). Professor of mathematics, University of Virginia.
- 1844 (9 Dec.). Actuary and Secretary, Equity and Law Life Assurance Co., but was relieved of his secretarial duties 1 Jan. 1848. He retained the office of Actuary until 12 May 1855. He was then appointed Consulting Actuary a position he resigned 5 Mar. 1856.

- 1850 (Nov.). Called to the Bar, but did not practice.
- 1853-55. Actuary of the Law Reversionary Interest So. Ltd., which he "founded" (BAKER).
1855. First appearance of *Quarterly Journal of Mathematics*, edited by SYLVESTER and N. FERRERS. SYLVESTER continued as an editor until Oct. 1878.
- 1855 (15 Sept.)-1870 (July). Professor of mathematics and Lecturer in natural philosophy, Royal Military Academy, Woolwich. The salary "was £550 per annum combined with a government residence, medical attendance and the right of pasturage on the common."
1856. Member, Athenaeum Club, London.
1860. Royal Medal, Royal Society of London.
- 1861 (Jan.). Hon. Member, Manchester Literary and Philosophical So.
- 1861-69. Examiner in Algebra, Royal Society of Arts, London.
- 1862-64, 1884-85. Member of Council, Royal Society of London.
- 1863 (Dec.). Correspondent, Academy of Sciences, Institut de France, Paris, in succession to STEINER.
1864. Foreign Corresponding Member, Society of Sciences, Göttingen.
- 1864 (May). Foreign Corresponding Member, Royal Academy of Physical and Mathematical Science, Naples.
1865. Vice-president, London Mathematical Society.
1865. LL.D., University of Dublin.
- 1866 (July). Corresponding Member, Prussian Academy of Sciences.
1866. President (second), London Mathematical So.; DE MORGAN was the first president.
1869. President of the Mathematics and Physics Section, British Association for the Advancement of Science.
1871. LL.D., Edinburgh Univ.
1872. B.A. (Feb.) and M.A. *honoris causa* (May), University of Cambridge. SYLVESTER remarked, "I am perhaps the only man in England who am a full (voting) Master of Arts for the three Universities of Dublin, Cambridge, and Oxford, having received that degree from these Universities in the order above given : from Dublin, by *ad eundem*; from Cambridge, *ob merita*; from Oxford, by decree."
- 1872 (Apr.). Examiner in Mathematics and Natural Philosophy, University of London.
- 1872 (Nov.). Foreign Corresponding Member, Academy of Sciences, St. Petersburg, Russia.
- 1873 (May). Foreign Fellow, American Academy of Arts and Sciences.
1874. Fellow, Royal Society of Edinburgh.
- 1876 (Feb. 19)-1883 (Dec.). Professor of Mathematics, The Johns Hopkins Univ.
- 1877 (July). Fellow, American Philosophical Society.
1878. First volume of *American Journal of Mathematics* published by The Johns Hopkins Univ., with SYLVESTER as Editor-in-Chief, until May 1884.
1879. Corresponding Member, Société Nationale des Sciences Naturelles et Mathématiques de Cherbourg.
1880. Copley Medal, Royal Society of London. The mathematicians who previously received this medal were : WARING (1784), IVORY (1814), GAUSS (1838), STURM (1841), CHASLES (1865), PLÜCKER (1866). This Medal, awarded annually, is the highest honor in the Royal Society's gift.
- 1880 (June). Hon. Fellow, St. John's College, Cambridge Univ.
1880. D.C.L., Oxford Univ.

1883. Foreign Associate, Academy of the Lincei, Rome.
1883. Foreign Member, Society of Sciences, Göttingen.
- 1883 (Apr.). Foreign Associate, National Academy of Sciences, Washington.
- 1883 (Dec.). Gold Medal, The Johns Hopkins Univ., when he retired from his professorship. The medal was struck at the United States Mint, Washington, bearing on the obverse his likeness—a bust—with the word “SYLVESTER,” and on the reverse a wreath of oak leaves and the following inscription : Per septem annos in Vniversitate ab Johns Hopkins Fundata Professor inde ab A.D. MDCCCLXXVI usque ad A.D. MDCCCLXXXIII. A copy of the medal, in silver, was presented to St. John’s College by The Johns Hopkins University in 1884, and is now in its Library (*The Eagle*, St. John’s College, v. 13, p. 226). A copy in bronze is in the Library of the Academy of Sciences of the Institut de France.
1883. Professor Emeritus, The Johns Hopkins Univ.
- 1883 (Dec.)-1897. Savilian Professor of Geometry, Univ. Oxford., following H. J. S. SMITH (d. 9 Feb. 1883).
1883. Fellow, New College, Oxford.
- 1884 (Feb.). M. A. Oxford Univ. “by decree of convocation”.
- 1885 (Mar.). Hon. Member, Royal Irish Academy.
1886. Hon. Member, Association for the Improvement of Geometrical Teaching (A. I. G. T.)
- 1887 (Nov.). De Morgan Gold Medal, London Mathematical Society (the second award; the first was made to CAYLEY in 1884).
1888. Founded the Oxford Mathematical Society, of which he was the first president.
1889. Portrait by A. E. EMSLIE painted at the request of friends at Cambridge and elsewhere; now hanging in the Hall of St. John’s College; was exhibited at the Royal Academy for this year; reproduced as frontispiece to SYLVESTER’S *Collected Mathematical Papers*, v. 4, 1912. A copy is also in the Hall of New College, Oxford. On 14 July 1889 SYLVESTER wrote from the Athenaeum Club as follows to the mathematician R. F. SCOTT (1849-1933), Master of St. John’s (*The Eagle*, v. 19, p.603-604) : “ I have just parted with ROBERT BROWNING on the steps of the Athenaeum. He stopped me to say that he had been looking at my portrait in the Academy, and thought it one of the best portraits he had ever seen, and congratulated the artist and myself on the success. Many other persons of note in the world and of my Oxford associates have expressed themselves in similar terms; and I think it right that you and my other too partial friends in Cambridge should be made acquainted with this opinion. Of course when I look at it (which is seldom) I think of photographs taken a quarter of a century ago and murmur to myself *Quantem mutatus ab illo*.
- “ It is fair also for me to state that members of my own family and intimate acquaintances say that whilst it is a good likeness and a good painting, they think EMSLIE ‘ has not taken me in my happiest mood,’ which is not wonderful, as I was in much trouble at the time I sat to him, and could scarcely keep awake on my chair from the effect of the light on my wearied eyes.” A list of the subscribers to the portrait is given in *The Eagle*, v. 15, p. 499.
1890. Hon. Sc. D., Univ. Cambridge.
1890. Officier de la Légion d’Honneur by the President of the French Republic, on the recommendation of the Academy of Sciences of the Institut. [CAYLEY received a similar award at the same time.]

1891. President, A. I. G. T.
- 1893 (30 May). Honorary member of the Imperial Univ. Kazan.
1894. A deputy, WILLIAM ESSON, F. R. S., appointed (at SYLVESTER's request) to carry on the duties of his chair at Oxford Univ.; for a reference to Esson see Letter XXX.
1895. Associate, Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique.
1896. Foreign Associate, Royal Academy of Science in Turin.
- 1897 (15 Mar.). Died. Buried in the Jewish cemetery at Dalston, near London.
1901. First award, to POINCARÉ, of the Sylvester Medal, Royal Society of London. This Medal "accompanied by a grant of the balance of the income of the Sylvester Medal Fund, is awarded triennially for the encouragement of pure Mathematical Research, irrespective of nationality." Later awards have been G. CANTOR (1904), W. WIRTINGER (1907), H. F. BAKER (1910) "on the ground of his researches in the Theory of Abelian Functions and for his edition of SYLVESTER's Collected Works," J. W. L. GLAISHER (1914), DARBOUX (1916), P. A. MACMAHON (1919), LEVI-CIVITA (1922), A. N. WHITEHEAD (1925), W. H. YOUNG (1928), E. T. WHITTAKER (1931), and Earl RUSSELL (1934). By all odds the finest reproduction, of both faces of this medal, which has been published, is on plate 10, opposite p. 130 of *The Record of the Royal Society of London*, second ed., London, 1901. Around the portrait bust on the obverse side is the inscription: "JACOBUS . JOSEPHUS. SYLVESTER.NAT.MDCCCXIV.OB.MDCCCXCVII." On the reverse between palm branches: "IN | DISCIPLINIS | MATHEMATICIS | OPTIME | MERITO | REG. SOC. LOND. | DECREVIT."
- 1901 (Feb.). First awards of the Sylvester Prize of The J. H. U. (a bronze medallion of Sylvester, framed in Oak), to Lord Kelvin and Simon Newcomb. No awards have been made since.
- 1904-12. *The Collected Mathematical Papers of James Joseph Sylvester* published by the Cambridge University Press. The Delegates of the Press informed SYLVESTER in 1891 that they were prepared to bear the expense of publishing in quarto a complete edition of his mathematical works.

In a number of notices of SYLVESTER's life (e.g. *The Eagle*, 1897, and *Acta Mathematica 1882-1912. Table Générale*) it is stated that SYLVESTER was a foreign corresponding member of the Vienna Academy of Sciences. On referring to *Almanach der kaiserlichen Akademie der Wissenschaften*, Vienna, for the years 1896-98, it may be verified that the statement is incorrect. Similarly for R. Istituto Lombardo di Scienze e Lettere, Milan, on referring to the lists of its members in its *Rendiconti*. And this, in spite of "Milan" on the title-page of SYLVESTER's *Laws of Verse* (1870).

III. — PUBLICATIONS DEALING WITH SYLVESTER'S LIFE AND WORK

This list of such publications is intended to serve as a comprehensive guide for the inquirer, and as one to which frequent reference shall be made in this paper. Since every item listed,

except *Baltimore American*, 1897 (*e*), has been personally inspected it is hoped that the information given may be exact. The meaning of most abbreviations employed will be obvious. It may be noted, however, that *A. J. M.* = *American Journal of Mathematics*. *J. H. U.* = The Johns Hopkins University; *J. H. U. C.* = *Johns Hopkins University Circulars*. *The Eagle* = *The Eagle. A Magazine supported by Member of St. John's College, Cambridge*. Three quotations illustrating SYLVESTER's personal qualities have been introduced into the list, in connection with the corresponding items.

1842. *Testimonials of J. J. Sylvester, Esq., A.M., F. R. S., &c.* (13.5 × 21.5 cm.).

This is the cover title of a pamphlet of 48 pages published by SYLVESTER. Copies may be seen in the Boston Public Library (without the cover), Columbia Univ. Library, Library of Congress and the New York Public Library. The first title page is "Testimonials obtained by Professor SYLVESTER, on occasion of becoming a candidate for the chair of natural philosophy, in University College London, (commonly called the University of London,) in the year 1837." On p. 3-20 are testimonials of J. W. HEAVISIDE, E. STEVENSON, S. EARNSHAW, G. PEACOCK, W. H. MILLER, H. PHILPOTT, J. HYMERS, W. HOPKINS, J. W. COLENZO, P. KELLAND, J. BOWSTEAD, JOSHUA KING, J. CUMMING, F. THACKERAY, J. HILDYARD, J. HYMERS and C. YATE (jointly), E. BUSBY, R. WILSON, J. CHALLIS, O. GREGORY, J. W. LUBBOCK.

On page 21 is the title: "Testimonials obtained by Professor SYLVESTER on occasion of offering himself as a candidate for the professorship of mathematics in the University of Virginia, in the year 1841 [changed by pen from 1837]"; p. 22 is blank. Then follow testimonials of A. DE MORGAN, J. IVORY, Sir JOHN LUBBOCK, R. J. LATHAM, C. GRAVES, J. MACCULLAGH, J. T. GRAVES, Sir JOHN HERSCHEL, CHARLES BABBAGE, J. A. COOMBE, R. CULLEN, and J. ROBSON. At the bottom of p. 35, in italics, is the following: "Mr. SYLVESTER succeeded in obtaining this appointment, the annual emoluments of which appeared, from the Proctor's Books to have averaged, for the past four years, \$3,900 per annum, exclusive of house or land; but, in consequence of differing in opinion with a majority of his colleagues in respect to certain acts of insubordination on the part of two students, he sent in an unconditional resignation a few months after accepting office." P. 36, blank. P. 37 third title page, "Incidental Testimonials," and p. 38 blank. "Testimonials" p. 39-48. On p. 42-43 is a note dated 21 July 1842 from CHAS BAGOT, Gov. General of Canada, stating that it was not in his power to "promote his [SYLVESTER's] interests in Canada." On p. 43-44 is a reference to RICHELOT's article "Nota ad theoriam eliminationis pertinens," in CRELLE's *Journal* (v. 21, 1840, p. 226-234) where an exposition is given (p. 226) of the rule for dialytic elimination announced earlier by SYLVESTER. P. 45-48 are taken up with extracts from *Reports* made in 1840 to the meeting of the British A. Adv. Sci., "On the relation of STURM's auxiliary functions to the roots of an algebraic equation." SYLVESTER concludes the pamphlet by remarking "Mr. SYLVESTER, by the aid of his New Theory of Elimination, succeeded in the memoir alluded to in this report,

- in giving an *entirely new* character and meaning to the discovery which procured for Mr. STURM the honour of a place in the Institute of France.”
1871. “The Government and Professor SYLVESTER,” *Nature*, v. 4, 24 Aug., p. 326; reprinted from *The Times* London. With regard to SYLVESTER’S dismissal from Woolwich, and his pension.
1881. *New York Tribune*, 5 Apr., p. 4, col. 6. Anecdotes taken from the *Boston Courier*.
1884. “Departure of Professor SYLVESTER,” *J.H.U.C.*, v. 3, Jan. 1884, p. 31. Report of meetings on 20 December 1883. MATTHEW ARNOLD (to whom SYLVESTER had dedicated his *Laws of Verse*, 1870), NEWCOMB, and ASAPH HALL, among other colleagues, were present. Professor W. E. STORY gave a brief review of mathematical lectures 1876-83, and Dr. CRAIG of contributions published in the *A.J.M.* for the same period. The last paragraph of a paper read by Professor GILDERSLEEVE, and adopted by the meeting “as an expression of their respect and good will,” was as follows: “To the work of his own department, he brought an energy and a devotion that have quickened and informed mathematical study not only in America, but all over the world; to the workers of the University, whether within his own field or without, the example of reverent love of truth and of knowledge for its own sake, the example of a life consecrated to the highest intellectual aims. To our presence, the work, the example of such a master as Professor SYLVESTER the teachers of Johns Hopkins University all owe, each in his own measure, guidance, help, inspiration, and in grateful recognition of all that he has done for them and through them for the University, they wish for him a long and happy continuance of his work in his native land; for themselves the power of transmitting to others that reverence for the ideal which he has done so much to make the dominant characteristic of this University.”
- 1885, 1889. R. P. GRAVES, *Life of Sir William Rowan Hamilton*, Dublin, v. 2, 3. Letter dated London, 20 Sept. 1841 from SYLVESTER to HAMILTON, v. 2, p. 348-349.
1887. *Men of the Time*, 12th ed., London 1887.
1888. *A.J.M.*, v. 10, frontispiece portrait.
- 1889.—A. CAYLEY, “Scientific Worthies xxv. James Joseph Sylvester,” *Nature*, v. 39, 3 Jan. p. 217-219; frontispiece of SYLVESTER engraved by G. J. STODART from a photograph by Messrs. J. STILLIARD and Co., Oxford. The article is also in *The Collected Mathematical Papers of Arthur Cayley*, v. 13, 1897, p. 43-48. Also reprinted in *J.H.U.C.*, v. 8, Feb. 1889, p. 23-24.
1890. F. CAJORI, *The Teaching and History of Mathematics in the United States*, Washington, p. 261-271, 285. The information here given includes reminiscences of SYLVESTER’S pupils, G. B. HALSTED, E. W. DAVIS, A. S. HATHAWAY, W. P. DURFEE.
1890. J. E. SANDYS, *Jewish Chronicle*, 6 June 1890, p. 9 from “advanced proof” of a sketch by the “public orator” sent to the *Cambridge Review*, but not there published.
1895. G. B. HALSTED, 1. “Original research and creative authorship the essence of university teaching,” inaugural address by the president of the Texas Academy of Science, 12 Oct. 1894, *Science*, n.s., v. 1, 22 Feb.; SYLVESTER, p. 205-206.
1895. G. B. HALSTED, 2. *Amer. Math. Mo.*, v. 1, Sept., p. 295-298; portrait frontispiece of SYLVESTER.

1896. W. B. ROGERS, *Life and Letters of William Barton Rogers*, edited by his wife [EMMA SAVAGE R.], Boston, v. 1. Professor ROGERS had been filling the chair of mathematics at the Univ. of Virginia after the death in 1840 of its regular incumbent. In a letter of 17 Nov. 1841 he wrote from the University as follows (p. 200) : "For several days we have been anxiously looking for the arrival of Professor SYLVESTER. We learn he lost all his baggage in Boston; this may have detained him." In a later letter, 6 Dec. 1841 (p. 201) : "the faculty, students and others attached to the University are all greatly pleased with Mr. SYLVESTER. He was terribly embarrassed at his first lecture, indeed quite overwhelmed, but has been doing better since. He has a good deal of hesitation, is not fluent, but is very enthusiastic and commands the attention and interest of his class."
1897. A. CAPELLI, *Accademia delle Scienze Fisiche e Matematiche*, Naples, *Rendiconto*, s. 3, v. 3, July, p. 165-168.
1897. S. DICKSTEIN, *Wiadomości Matem.*, v. 1, p. 175-177 (in Polish); portrait, p. 175.
1897. F. FRANKLIN, Amer. Math. So., *Bull.*, v. 3, June, p. 299-309; an address delivered at a memorial meeting at J. H. U. 2 May 1897. Also in *J.H.U.C.*, v. 16, June, p. 53-56. Also in F. FRANKLIN, *People and Problems; a Collection of Addresses and Editorials*, New York, 1908, p. 11-27.
1897. A. GEIKIE, [Reminisces], *New York Tribune*, 4 May, p. 6, col. 4.
1897. D. C. GILMAN, 1. Minute of a memorial meeting, Baltimore, 2 May 1897, Introductory Remarks, *J.H.U.C.*, v. 16, June, p. 56. Dr. FRANKLIN (see above), Sir ARCHIBALD GEIKIE, and Professors NEWCOMB and REMSEN also contributed to the program.
1897. G. B. HALSTED, 3. *Science*, n. s., v. 5, 16 Apr., p. 597-604.
1897. G. B. HALSTED, 4. *Amer. Math. Mo.*, v. 4, June-July, p. 159-168; portrait frontispiece.
1897. H. LAMB, Manchester Lit. and Phil. So., *Proc.*, v. 41, p. liii-lv.
1897. E. LAMPE, "Arthur Cayley† und James Joseph Sylvester†. Nachruf," *Naturwissenschaftliche Rundschau*, v. 12, 10 July, p. 359-363.
1897. A. LEVINE, Institute of Actuaries, *Journal*, v. 33, July, p. 345-349.
1897. P. A. MACMAHON, 1. *Nature*, v. 55, 25 Mar., p. 492-494; reprinted in *J.H.U.C.*, v. 16, Apr., p. 25-27.
1897. P. MANSION, 1. *Mathesis*, v. 17, Nov., p. 245-246, based on the sketches of HALSTED 3, LAMPE, and PICARD. Reprinted in P. MANSION, *Mélanges Mathématiques (1883-1898)*, Paris, 1898, p. 39-41. See also under 1913.
1897. É. PICARD, *Revue Générale des Sciences*, v. 8, 15 Sept., p. 689-690. Quotation : "L'illustre mathématicien était peu au courant des travaux modernes sur l'Analyse et la Théorie des fonctions, et il n'eut jamais de goût pour l'érudition. Son imagination, extraordinairement puissante, était toujours en travail, et il lui était bien difficile de lire un ouvrage de mathématique dans le seul but de savoir ce qu'il contenait. La bonne volonté ne lui manquait pas, cependant; je me rappelle que dans un de ses voyages à Paris, il y a environ dix ans, il vient me demander si, en six semaines il pourrait apprendre la Théorie des fonctions elliptiques. Sur ma réponse affirmative, il me pria de lui désigner un jeune géomètre qui voulût bien, plusieurs fois par semaine lui donner des leçons. Celles-ci commencèrent, mais, dès la seconde, les reciproquants et les matrices vinrent faire concurrence aux fonctions elliptiques; quelques leçons continuèrent, où le jeune professeur fut initié aux dernières recherches de SYLVESTER, et on en resta là."

1897. L. A. TOLLEMACHE, "Professor Sylvester and Mrs. Gamp," *Spectator*, London, v. 78, 12 June, p. 835; see also "Dickens's names" by J. M. LUDLOW, 19 June, p. 869; also *New York Tribune*, 4 July, Suppl., p. 13, col. 4.
1897. A. VASILIEV, Société Physico-Mathém. de Kasan, *Bulletin*, s. 2, v. 7, *Protokoli*, p. 89-91 (in Russian).
1897. J. W(ATSON), *The Eagle*, v. 19, June, p. 596-605; in v. 29, 1908, p. 380-381, there is a letter (dated 1 May 1861) from G. SALMON to SYLVESTER, a humorous and apt criticism of SYLVESTER's treatment of his own discoveries. It is reprinted, in part, by BAKER (1912).
1897. J. J. WALKER, London, Math. So., *Proc.*, v. 28, p. 581-586.
1897. Anonymous: (a) "Sylvester's 'Spring début,'" *Academy*, v. 51, 27 Mar., p. 358; (b) *Athenaeum*, London, 20 Mar., p. 382-383; (c) *Allgemeine Zeitung des Judentums*, v. 61, 26 Mar. "Der gemeindebote Beilage," p. 4; (d) *A. J. M.* v. 19, Apr., suppl. 1 p.; (e) *Baltimore American*, 16 Mar. p. 1 and 17 Mar. p. 11; (f) *Bolletino di Storia e Bibliografia Matematica (Suppl. Giornale di Matematiche)*, p. 16; (g) *Illustr. London News*, v. 110, 27 Mar. (reproduction of an interesting photograph by GRILLET, Naples); (h) *Jewish Chronicle*, 19 Mar. p. 12, main article by "O. J. S." and next are unsigned (this is one of the few places where his father's name is given correctly as "ABRAHAM JOSEPH"); (i) *Leopoldina*, v. 33, June, p. 90-91; (j) "Professor SYLVESTER at Oxford," *Oxford Mag.*, v. 15, 5 May, p. 293-294 (reprinted in *J.H.U.C.*, v. 16, June, p. 56); (k) *Post Mag. and Insurance Monitor*, p. 225; (l) Royal So. of Arts, *Journ.*, v. 45, 19 Mar., p. 387; (m) *The Times*, London, 16 Mar., p. 9, col. 6; (n) *Zeitsch. f. mathem. u. naturwissen. Unterricht*, v. 28, p. 309 (reprinted from *National-Zeitung*, Beiblatt, 24 Mar.).
1898. MATHILDA B. BETHAN-EDWARDS, *Reminiscences*, London, 1898, p. 124; reprinted in *Math. Gazette*, v. 12, July 1924, p. 168-169.
1898. P. A. MACMAHON, 2. Royal So. London, *Proc.*, v. 63, p. ix-xxv.
1898. P. E. MATHESON and E. B. ELIOT, *Dict. National Biography*, v. 55, p. 258-260; reprinted in *J.H.U.C.*, v. 18, p. 29.
1898. M. NOETHER, *Mathem. Annalen*, v. 50, p. 133-156.
1898. W. THOMSON (Lord KELVIN), Royal So. Edinburgh, *Proc.*, v. 22, p. 9-10.
1900. G. B. HALSTED, 5. "De Morgan to Sylvester," *Monist*, Chicago, v. 10, p. 188-197; four letters of DE MORGAN, 1856-65, addressed to SYLVESTER at Woolwich. Both sides of the Sylvester Medal of the Royal Society are reproduced on p. 189.
1905. A. R. WALLACE, *My Life. A Record of Events and Opinions*, New York, v. 2, p. 114-115; anecdotes of SYLVESTER heard when WALLACE was lecturing in Baltimore, Dec. 1886.
1905. G. LIPKIND, *Jewish Encyclopedia*, New York, v. 11, p. 614-615; there is an illustration reproducing both sides of the Sylvester Medal of the Royal Society awarded triennially.
1906. D. C. GILMAN, 2. *The Launching of a University and other Papers. A Sheaf of Remembrances*, New York, p. 65-70.
1911. *International Insurance Encyclopedia*, New York and London, v. 1, p. 639.
1912. H. F. BAKER, *The Collected Mathematical Papers of James Joseph Sylvester*, v. 4, p. xv-xxxvii; on p. xv reproduction of the portrait side of the Sylvester Medal of the Royal Society.
1913. [E. HEPPNER], *Juden als Erfinder und Entdecker*, Berlin, p. 120; only four lines.

1913. P. MANSION, 2. *Revue des Questions Scientifiques*, s. 3, v. 23, p. 568-579.
1913. M. RIESZ, *Acta Mathematica, Table Générale*, 1882-1912, p. 115-116. 174 (portrait).
1916. G. B. HALSTED, 6. "Sylvester at Hopkins", *J. H. Alumni Mag.*, v. 4 Mar. 1916, p. 178-188 + portrait plate.
1916. A. MACFARLANE, *Ten British Mathematicians*, (Mathematical Monographs, no. 17), New York, p. 107-121.
1919. C. L. BARNES, "James Joseph Sylvester," *Papers of the Manchester Literary Club, Manchester Quarterly*, v. 45, Jan., p. 37-48; on p. 47 quotes a SYLVESTER sonnet discussed in no. 11 of Section VII of this paper.
1921. D. S. BLONDHEIM, "A brilliant and eccentric mathematician," *J. H. Alumni Mag.*, v. 9, Jan., p. 119-140 + portrait plate.
1921. P. A. BRUCE, *History of the University of Virginia 1819-1919*, New York, v. 3, p. 73-77.
1922. D. E. SMITH, "Among my autographs. 18 SYLVESTER as a poet," *Amer. Math. Mo.*, v. 29, Jan., p. 14-15; poem "Retrospect" printed, with a letter dated 9th Nov. 1884.
1925. R. H. MURRAY, *Science and Scientists in the Nineteenth Century*, London, p. 340, 401-402.
- 1926-27. F. KLEIN, *Vorlesungen über die Entwicklung der Mathematik im 19. Jahrhundert*, 2 v.
1927. *Grosse Jüdische National-Biographie*, v. 6, p. 72.
1934. D. E. SMITH and J. GINSBURG, *A History of Mathematics in America before 1900* (Carus Mathematical Monographs no. 5), Oberlin, O., numerous references in index, and portrait. See *Amer. Math. So., Bulletin* (v. 41, 1935, p. 603-606) for a review of the work.
1935. R. C. ARCHIBALD, "J. J. Sylvester, mathematician: family and Patten portrait" [query], *Notes and Queries*, v. 168, 20 Apr., p. 279.
1936. D. E. SMITH, *Dictionary of American Biography*, New York, v. 19.
- See also POGGENDORFF, *Biograph.-Literar. Hand. Wörterbuch d. exacten Wissen*. In the *Royal Society Catalogue of Scientific Papers* 321 of SYLVESTER's papers are listed and in his *Collected Mathematical Papers* (v. 4, 1904-12) 342 are printed. The index to CAYLEY's *Collected Mathematical Papers* leads to invaluable commentary. FRANZ MEYER's "Bericht über den gegenwärtigen Stand der Invariantentheorie," *Deutsche Mathem.-Ver., Jahresbericht*, v. 1, 1892, should also be consulted for its many references to SYLVESTER's work in appropriate setting. See also E. NETTO, *Vorlesungen über Algebra*, 2 v., 1896, 1900, E. NETTO, *Lehrbuch der Combinatorik*, 1901, G. SALMON, *Lessons Introductory to the Modern Higher Algebra*, fourth ed., 1885, *Encykl. d. Mathem. Wissen.* and the French edition and *Collected Papers of Charles Sanders Peirce*, Cambridge, Mass., v. 1, 3-5, 1931-34.

* * *

If apart from the first item in the above list, one were asked to state what six sketches were the most important, one would undoubtedly say those by BAKER, CAYLEY, FRANKLIN, MACMAHON, NOETHER, and WATSON.

IV. — SYLVESTER'S FIRST MATHEMATICAL PUBLICATION

CAYLEY states, "The writings of SYLVESTER date from the

year 1837," referring to his paper "Analytical development of FRESNEL's optical theory of Crystals," *Phil. Mag.*, v. 11, 1837. MACMAHON 2. refers to this as his "first paper," but states that on the occasion of laying the foundation stone of the Mechanics Institution, Mount Street, Liverpool, SYLVESTER "presented Lord BROUGHAM with his pamphlet criticising EUCLID's definition of a straight line as length without breadth." Since the cornerstone in question was laid in July 1835 (*The Picturesque Hand-Book to Liverpool...*, Liverpool, 1842, p. 91) this statement implies that SYLVESTER had published this pamphlet, at the age of 21, at least a year and a half before he had completed the work leading to a degree at St. John's. The vagueness of MACMAHON's statement, and the improbability that SYLVESTER would publish a pamphlet devoted to the discussion of any such topic, led me to reject this as SYLVESTER's first mathematical publication.

But there was a publication of 1836 to which I have found no reference in print, not even in the *English Catalogue*, in any mathematical bibliography, or in any of the printed catalogues of British libraries. The title of the pamphlet in question is as follows :

A Supplement to Newton's First Section containing a Rigid Demonstration of the Fifth Lemma and the general Theory of the Equality and Proportion of linear Magnitudes by J. I. Sylvester, St. John's College, Cambridge. Cambridge, Printed by J. HALL, opposite the Pitt Press. 1836. ix + 16 p. + 1 folding plate of figures. 8vo. The only copy I have ever found is in the Boston Public Library to which it was presented in 1858 along with the Bowditch Library. This copy was a gift by SYLVESTER to his eldest brother, a broker in New York at the time of its publication. On the fly-leaf is the following inscription in SYLVESTER's hand writing : "S. I. SYLVESTER Esqre | from his grateful and attached Brother | the Author." Contents : "Preface" (p. iii-iv); "Introduction" (p. v-ix); "Supplement to Newton" (p. 1-16).

The first four of the five paragraphs of the preface are as follows :

"The annexed essay is one of a series, which the author had intended to publish upon the 'Nature, meaning and force of Geometrical Language.'

"What is here given completes all that is requisite for the comparison of Line., but was intended to constitute only the *first* chapter, (as it is marked at the heading),

in the main design. The publication of the rest is postponed until an opinion, favorable or condemnatory, may be inferred from the encouragement or neglect which this portion of the work is destined to meet with.

“A kind reception will warm into life some speculations, which the author believes are new and important, upon the origin of Geometrical terms and the ‘conceptions embodied in them’: subjects intimately connected with our notions of Matter and Space, as well as practically useful in the curtailment of some proofs, and the exposure of many fallacies admitted in most Geometrical treatises.

“The embarrassment and inconsistencies to be found in the pretended demonstrations and explanations, given by *received* authors, of the Fifth Lemma, (the most important in the whole Section, of which it forms the very keystone) will amply justify the *intention* of this little work. If there be any who censure as trifling the manner of its *execution*, or sneer at the precision of its details, from such the author makes his appeal to the lovers of sound Logic, and to all who are *capable* of appreciating the *spirit* in which NEWTON composed his First Section, or EUCLID his Fifth Book.”

The “Lemma V” in question, is (in the MOTTE-CAJORI translation) as follows: “All homologous sides of similar figures, whether curvilinear or rectilinear, are proportional; and the areas the squares of the homologous sides.”

V. — SYLVESTER AND THE UNIVERSITY OF VIRGINIA

The University of Virginia was founded by THOMAS JEFFERSON and received its charter in 1819. It was opened to students in 1825 and the first professor of mathematics was THOMAS H. KEY (1825-27). He was succeeded by CHARLES BONNYCASTLE (1827-40) as “professor of natural philosophy and mathematics.” Until SYLVESTER’s appointment W. B. ROGERS was interim professor (see under 1896 of Bibl.). SYLVESTER had been professor of natural philosophy at University College, London since 1838, with A. DE MORGAN, and the above-mentioned T. H. KEY, as colleagues. He resigned this position and sailed for the United States in October 1841.

The amount of misinformation which has been disseminated concerning this visit to the United States and SYLVESTER’s connection with the University, even in sources which might be thought of as reliable, is extraordinary, and in *no* biographical sketch up to the present, has the reason for SYLVESTER leaving the University of Virginia been correctly stated. Some examples may be cited: (a) In the memorial page, *A. J. M.*, 1897, it

is stated that he was at the University of Virginia "from 1840 to 1841"; (b) MACMAHON 2, states that "the cause of his exit from the country after six months arose from an unfortunate incident with two students in his own class," and it is clear that the incident referred to is the lurid one retailed in HALSTED, 2, and often repeated. There is no basis in fact for these statements. Rev. Dr. DABNEY of Virginia is quoted by HALSTED as his authority, who "has seriously assured me that SYLVESTER was actually deficient in intellect, a sort of semi-idiotic calculating boy." A fine authority! (c) BAKER makes grossly wrong suggestions in writing "... the question of slavery was a subject of bitter contention, and SYLVESTER had a horror of Slavery. The outcome was his almost immediate return; apparently he had intervened vigorously in a quarrel between two of his students." (Again HALSTED 2.) (d) In conferring the honorary degree Sc. D. at Cambridge in 1890 Dr. SANDYS, the public orator, referred to the period "1841-45" at the University of Virginia.

Now the true facts can be stated very briefly. *Sylvester arrived at the University of Virginia in November 1841 and resigned after about three months, on 24 Feb. 1842, "in consequence," as Sylvester himself states in his Testimonials of 1842, quoted above, "of differing in opinion with a majority of his colleagues in respect to certain acts of insubordination on the part of two students." After his resignation Sylvester remained in America at least one year and four months.*

Some facts are admirably set forth in BRUCE's *History of the University of Virginia*. In response to my inquiries in 1924 Professor BRUCE expressed the opinion that the Halsted-Dabny story was "the purest rubbish," while, on the other hand, his own account was based on parts of the minutes of the Chairman of the University, "drafted within a few hours after the examination of the circumstances of the case." In order that the true story may finally be rendered more generally accessible, the following rather extended quotation is made :

In 1841, J. J. SYLVESTER was called to the chair of mathematics made vacant by the death of BONNYCASTLE. KEY had warmly recommended his appointment. He was a graduate of St. John's College, Cambridge, and at the time of his election, professor of natural philosophy and astronomy in the University of London. Young as he was, he had already won a great reputation by his extraordinary

achievements in mathematical science. "He is regarded here," STEVENSON, the American Minister to the Court of St. James, wrote to CABELL in October, 1841, "as one of the first mathematicians of the age, and you may rely on it, if he has a fair chance, he will distinguish himself and do good service to our old State". Unhappily, SYLVESTER, who was a Jew by birth and in faith, was poorly versed in the usages of society. Although morbidly sensitive, he was inclined to nurse his self-esteem to the point of thinking himself infallible; and when aroused to anger, his sense of discretion always failed to put any restraint whatever upon its outburst.

In spite of his acknowledged eminence, he was chosen by the Board for one year only; and this, quite naturally, was a cause of mortification to him. "I would have not accepted a place nearer home on such terms," he told STEVENSON; and this statement was repeated by him in a letter to CHAPMAN JOHNSON. "I should certainly never have consented," he said, "to receive an appointment similarly limited in any institution nearer home, where there existed more sure means of becoming acquainted with my personal reputation and general character, and weighing the full value of the testimonials and other documents which I have been able to procure in support of my claims." JOHNSON replied in a spirit of independence. STEVENSON, it seems, had assured SYLVESTER that the probational tenure was customary, and without personal significance; but JOHNSON was not so considerate. "The professor elected for one year," he wrote, "was not always appointed permanently even when he had given satisfaction. So far from feeling themselves committed to a permanent appointment, the Visitors adopt the manner of a temporary one as a prudent precaution to enable them to judge upon better information how far the interests of the institution will be promoted by making the appointment permanent."

SYLVESTER was so much discouraged by the tone of this letter that he was only prevented from recalling his acceptance by the receipt of kindly messages from GEORGE TUCKER and JOSEPH C. CABELL. His extreme sensitiveness very often took the form of race consciousness, and he was probably first influenced in his determination to resign his excellent post in the University of London by the expectation that the social position of a learned Jew would be better in the United States than it was in England. But before leaving the English shores, he heard, with painful concern, that his appointment had been censured in the Richmond journals because of his Hebrew origin. It is plain that he set out for his destination with a feeling of justifiable soreness, caused partly by his temporary nomination, and partly by this bigoted reflection on himself in the Virginian newspapers. He reached the University in November, 1841, and his arrival, having been preceded by many rumors and conjectures, created a sensation; but he had no reason to complain of any lack of cordiality. "The students," we are told by JOHN C. RUTHERFOORD, who was present, "brilliantly illuminated the arcades in his honor, and made it the occasion of universal rejoicing."

The first impression of SYLVESTER was a pleasing one. "At his inaugural address," says Professor ROGERS, "he was terribly embarrassed; indeed, quite overwhelmed. He has a good deal of hesitation, is not fluent, but is very enthusiastic, and commands the attention and interest of his class." He had been filling his chair barely three months when he fell into a wrangle with one of his students, whom he had seen reading a newspaper while his lecture was underway. So soon as the class was dismissed, he had called up the delinquent, BALLARD by name, and sharply rebuked him. BALLARD was so disrespectful as to order

the professor peremptorily "to stop his jaw." SYLVESTER, in a high state of excitement, was walking up and down the platform while these remarks were banded (*sic*) between the two; and finally, in a rage, he commanded the young man to leave the room, which he refused to do, on the ground that, as the lecture was finished, SYLVESTER had no right to assert any further control over his actions: The Faculty, on receiving the Professor's indignant demand for BALLARD's expulsion,—which should have been complied with,—took the same view as the refractory student, but concluded to refer the dispute to the Board for decision.

While it would seem that SYLVESTER had been unable to prolong the pleasant impression which he had created at first, yet, at the same time, there was probably grave exaggeration in BALLARD's statement "that he had not conducted himself like a gentleman since his connection with the University began." It was indisputable that there was a provincial prejudice against him as a Jew and a foreigner. KRAITSIR complained,—with much less reason, undoubtedly,—that he too was the target of the same illiberal hostility because he was a Hungarian, and perhaps, also because he was a Catholic. KEY and LONG had been conscious of the same inimical attitude, though it was not so pronounced in their instance as in the cases of SYLVESTER, KRAITSIR, and BLAETTERMANN,—all three of whom were open to just criticisms for radical personal defects, which could not be brought against the two well-bred and socially accomplished Englishmen. Apparently, none of this feeling was aroused by BONNYCASTLE and DUNGLISON. On February 24, 1842, SYLVESTER resigned because he was very properly dissatisfied with the Faculty's failure to sustain him in the exercise of his rightful authority over an insulting student of his class. But the Board seems to have approved the Faculty's action, although they vaguely disclaimed "any intention to impute to the professor any blame in that matter."

In 1843, SYLVESTER was a candidate for the professorship of mathematics in Columbia College, and he wrote to his old associates at the University of Virginia for an expression that would remove the cloud that rested over his chances of success, in consequence of the report of his quarrel with BALLARD. "We desire, in justice to him," was the reply, "to correct any misconception on this subject which may now be operating to his disadvantage. We, therefore, beg leave to state that his separation from the University was entirely his own voluntary act, occasioned, as they conceive, by dissatisfaction at the course his colleagues thought it proper to adopt towards a student whom he had reprimanded for inattention in a lecture-room, and whom, in their view of the circumstances, they were unwilling to punish to the extent he required." Such were the incidents that accompanied the avoidable loss to the University of Virginia of one of the most extraordinary mathematicians of modern times (1).

VI. — SYLVESTER 1842-1855

We have seen that SYLVESTER resigned from the University of Virginia in February 1842 after he had been there scarcely

(1) In March, 1888, Dr. ARCHER ATKINSON, of Baltimore, presented the University of Virginia with a photograph of Professor SYLVESTER, which was received by the Faculty with an expression of high appreciation. This portrait as well as several of SYLVESTER's publications were destroyed in 1895 during the burning of the "Rotunda" of the University.

three months. That he probably remained in America continuously until June 1843, at least, is suggested by the very human Letters I-V, in the last section of this paper. It is also clear that he spent most of this time in New York where his eldest brother, SYLVESTER JOSEPH SYLVESTER had been living since 1827 at least. New York directories tell us that the firm N. & S. SYLVESTER had a "lottery and exchange office" at 130 Broadway, 1827-30, (see "Curriculum Vitae," 1829-30); they also tell us that SYLVESTER J. SYLVESTER was a "broker" at 130 Broadway and 22 Wall Street, and at other addresses, 1831-54. Since in directories for 1838-43, a FREDERICK J. SYLVESTER is listed as at 130 Broadway, this suggests that he may have been another brother. For the period 5 Sept. 1842-11 June 1843 the Letters reveal SYLVESTER's intimacy with BENJAMIN PEIRCE (1809-80) of Harvard University, his contacts with many interesting people, his strivings to obtain a new position at Washington, at the University of South Carolina, at Columbia College, at Harvard, in an insurance office. It has been already remarked that SYLVESTER appealed to former colleagues at the University of Virginia for recommendations at Columbia. We learn also of an *affaire du cœur*, which might blossom if only he could secure "a local habitation and a name; a fair plea for breaking my expressed intention of departing the country."

As to where SYLVESTER was during July 1843-November 1844 I have been unable to determine. But on 9 Dec. 1844 he was appointed actuary and secretary of the Equity and Law Life Assurance Society, London; he was relieved of his secretarial duties 1 Jan. 1848. He retained the office of actuary until 12 May 1855. He was then appointed consulting actuary, a position he resigned on 5 Mar. 1856. In a *Prospectus and Table of Rates, 1923* of this Society we find a "Table of whole life assurances. With profits. Annual premium for an assurance of £ 100". SYLVESTER computed this table which is still in use for age 25 upwards. The present rates for lives younger than age 25 at the entry, are slightly higher than those fixed by him. SYLVESTER was also the first actuary appointed by the Law Reversionary Interest Society, Ltd., on its foundation (by SYLVESTER, says BAKER) in 1853. He resigned at the end of 1855. On 15 Sept. 1855 SYLVESTER commenced his duties as professor of mathematics

and lecturer in natural philosophy at the Royal Military Academy, Woolwich, and one of the richest research periods of his life commenced. The scientific activity of the period being discussed is adequately treated elsewhere. Other facts may be noted, however. He entered at the Inner Temple 29 July 1846 and was called to the Bar 22 Nov. 1850. He seems to have given some private instruction in mathematics, and counted among his pupils, Miss FLORENCE NIGHTINGALE, whose name was afterwards famous. In a country where an annual with mathematical problems like those in the *Lady's Diary*, and *Lady's and Gentleman's Diary*, flourished for 167 years, 1704-1871, such study on the part of a lady was not necessarily unusual, even 85 years ago.

VII. — SYLVESTER'S POETRY

It seems to be largely a matter of chance that SYLVESTER ever became interested in poetry, and this chance dates back to the years 1842-43 when he was living in New York, possibly at "Mrs. Cadell's Broadway" (Letters III-IV, below), and had as a friend a young Moravian clergyman "who tenanted a contiguous attic to my own." This friend was on the staff of the *New York World* and, in making poetical translations, from time to time appealed to SYLVESTER for a word or a rhyme. These appeals finally resulted in him taking the pen out of his friend's hand and dashing off, in hot haste, a translation of BLUMAUER'S "To the Danube." And thus, he writes, "I was made conscious for the first time of the possession of a traductory power of the existence of which within me I was until then entirely unconscious."

Since SYLVESTER was very thorough in all that he undertook, he made an intensive study of verse forms, while he continued his translations. This study resulted in the publication in 1870 of his volume, *The Laws of Verse*, which received praise from SIDNEY LANIER, and was thought very highly of, in various aspects, by the reviewer in the *Gentleman's Magazine*. The work includes twelve of his translations from Latin and German, poems by BLUMAUER, GOETHE, HORACE, RÜCKERT, SCHILLER, UHLAND, and twelve poems of unknown authorship, selected "for the sake of exemplifying syzygetic principles." The translations include

“To the Danube” referred to above. SYLVESTER had undoubted literary power and feeling and was possessed of a wide range of knowledge of languages. He wrote French with ease and conversed fluently in French, German, and Italian. His knowledge of Latin and Greek was also extensive. It was a matter of pride to him that during the periods of his editorship of the *Quarterly Journ. Math.* and of *A. J. M.*, each bore on its title page a Greek motto chosen by himself. The one on the latter is still retained there.

Another German translation, which must date back close to American days, is the “Ballad of Sir John de Courcy” which was published anonymously in the *Gentleman’s Magazine* and recited at the Working Men’s Institute of Baltimore in 1880. His extraordinarily fine translation of HORACE’S Ode to MAECENAS was recited at a Penny Reading in Dec. 1869. But apart from such translations, we have from the years 1876-80 two “studies in monochrome,” so called because they rang the changes upon a single rhyme through a long series of verses, giving an effect like that of “the regularly recurring dash and plash of the waves on the seashore.” Two such productions were “Spring’s Début,” and “Rosalind,” the public reading of the latter of which, with its entertaining foot notes has been amusingly described by FRANKLIN. Other original poems were “Retrospect,” “The Lily fair of Jasmin Dean,” eight sonnets, and Latin epigrams. SYLVESTER put enormous labor into the composition of his poems and translations. His friends also were constantly called into service. To obtain a tolerable translation of a few hundred lines of HORACE he thought that the only way “would be to parcel the work out among the members of a society who should each devote the labour of a year to effect the adequate rendering,... the results to be submitted to the criticism and correction of the joint body to be periodically convened for the purpose.”

The translation of HORACE’S MAECENAS ode seems to have been his finest poetical effort but “The Ideals” of SCHILLER and the second sonnet of no. 11, below are also good. Of the rest, so far as it has been discovered, perhaps “The Lily fair of Jasmin Dean” is the best. An attempt has been made below to give full information concerning SYLVESTER’S published verse, scraps of information brought together from very diverse sources. It is realized that many things may have been missed. There

are scattered bits of verse in his memoirs, for example (a) five verses introducing his long paper on "syzygetic relations," and (b) various lines in his "Constructive theory of partitions." See also his Letters XXI-XXIV below, for other references to his poetry.

1. *The Laws of Verse or Principles of Versification exemplified in Metrical Translations: together with an annotated reprint of The Inaugural Presidential Address to the Mathematical and Physical Section of the British Association at Exeter...* London, LONGMANS, GREEN, and Co., 1870, 152 p. "The Laws of Verse" occupy p. 1-98. On p. 5 is the dedication, "To MATTHEW ARNOLD, Esq., D. C. L. sometime Professor of Poetry at the university of oxford, a consummate master of the art, in grateful recognition of much valuable criticism and generous encouragement received at his hands, I dedicate this attempt to display and exemplify the Laws of Verse."

The work begins with a translation (the original Latin is also given) and discussion (p. 24-44) of HORACE's famous ode to MAECENAS, iii, 29, "originally printed for Recital and Distribution at a Penny Reading held in the National School Rooms, Eltham, December 22, 1869." Concerning SYLVESTER's composition of this ode see M. BETHAM EDWARDS's *Reminiscences* (listed in Bibliography); his own ideas as to the great labor which should be devoted to such translation are set forth on p. 43 of the work under consideration. This translation is followed by 12 others: 2. SCHILLER's "Ideals"; 3. UHLAND's "The Goldsmith's daughter"; 4. SCHILLER's "Cassandra"; 5. GOETHE's "Comfort in tears"; 6. Another translation of no. 1; 7. SCHILLER's "To spring"; 8. BLUMAUER's "To the Danube"; 9. UHLAND's "The hostess' daughter"; 10. RÜCKERT's "The death-lock"; 11. UHLAND's "The castle by the shore"; in a footnote SYLVESTER writes "Mr. LONGFELLOW, I am informed, has translated this poem, but to the best of my recollection I have not seen his translation." Now follow 11 poems of unknown authorship, and two translations; 12. "The evening star"; 13. "Acrostic"; 14. "Winter"; 15. "To an ink-spot upon a lady's cheek"; 16. "Melancholy"; 17. "April 30"; 18. "Indifference"; 19. "Remonstrance"; 20. "Faith"; 21. "KEPLER's apostrophe"; 22. "From the Italian," four verses and a translation; 23. "What's in a name?" And then 24. "The story of Europa," translation (with the original Latin) of HORACE's ode, iii, 27 (p. 93-98).

For a review of this work of SYLVESTER see *Gentleman's Mag.*, Dec. 1870, p. 38-48. The review ends with a quotation of the poem no. 19 above, mistakenly imagined to be SYLVESTER's. Of the MAECENAS ode the reviewer writes: "The translation... is in our opinion, both for spirit and closeness to its original, the happiest reproduction in English of an ode of HORACE to be met with since the time of MILTON. This is high, but we believe well-merited praise. Our author has achieved what would seem to be the well nigh impossible task of converting sixteen alcaic stanzas, pregnant with fire and freedom, into sixteen verses of alternately rhyming octosyllabics, in which not only the nervous grace, but even

the happy word-painting and musical cadence of the master are faithfully reflected." The review points out also that the truth of what SYLVESTER wrote about anastomosis was strongly confirmed by two extremely able and suggestive papers by Dr. T. G. HAKEL (*The Athenaeum*, 10 and 17 Sept. 1870).

In *The Cambridge History of English Literature* (v. 13, 1916, p. 248) G. SAINTSBURY refers to SYLVESTER's work as "a book somewhat abstruse in appearance but very lively and suggestive in fact." But in his *A History of English Prosody*, (v. 3, second ed., 1923, p. 444-445), SAINTSBURY writes more at length, as follows: "The short title of Professor J. J. SYLVESTER's tract on the *Laws of Verse...*, and its author's deserved reputation as a mathematical philosopher of the first order, have attracted to it, not more attention than it deserves, but a kind of attention likely to result in disappointment. The most interesting thing about it is the author's agreement, from almost the most opposite preparation and point of view conceivable, with POE—an agreement which extends to the doctrine that accent *creates* quantity. The tractate, with its terminological exactitude of anastomosis, syzygy, symptosis, and the like, may alarm some readers; but it is most amusingly written and illustrated with many experiments of the author's own in translation. The main purpose is to recommend syzygy, not in its classical sense, but in that of 'apt juncture of syllables'."

In more than one place SIDNEY LANIER (in his *The Science of English Verse*. New York, 1880, p. vi, xiv-xv, 306-08) refers in a complimentary way to SYLVESTER's work, and especially to the part dealing with "phonetic syzygy," a term "so happy as to be a genuine contribution to the nomenclature of the science of English verse." H. E. SHEPHERD tells (*Confederate Veteran*, Nashville, Tenn., v. 27, Dec. 1919, p. 450) of hearing in Feb. 1879 a discourse of LANIER upon the relation of music to poetry; "the subject possessed a peculiar fascination for Professor SYLVESTER, one of the sovereign lights of the mathematical world, then associated with J. H. U. It was on this occasion that SYLVESTER bestowed upon LANIER his notable tribute, 'this great poet,' no mere conventional adulation, but a genuine utterance in which enthusiasm blended with the rarest discernment and subtlety of judgement."

See also G. D. BIRKHOFF, *Aesthetic Measure* (Cambridge, Mass., 1933), p. 173-174, 176-177, 203-204. BIRKHOFF writes, "There is no doubt that SYLVESTER's concept of verse was much influenced by that of POE. However, SYLVESTER went further than POE in approaching the point of view demanded by our mathematical theory." SYLVESTER's reference to POE's *Rationale of Verse* is on p. 64. The review in *The Athenaeum*, 27 Aug. 1870, p. 265, was far from favorable. SYLVESTER's reply in a letter dated "Athenaeum Club, August 31, 1870" is in the issue 10 Sept. 1870, p. 341.

SYLVESTER must have prided himself a good deal on this volume, since one of his last letters to *Nature* (v. 36) is signed, J. J. SYLVESTER Savilian Professor of Geometry in the University of Oxford and Author of "The Laws of Verse."

2. "The ballad of Sir John de Courcy" translated from the German by "Syzygeticus," *Gentleman's Mag.*, Feb. 1871, p. 313-316.

There are 26 stanzas and SYLVESTER states that the translation was made "upwards of 20 years ago" i.e. before 1851. He also adds: "The name of the author has escaped my recollection, but I should not be surprised if my original turned out to be itself a translation from some English ballad, probably

familiar." MACMAHON remarks that SYLVESTER recited this ballad at the New Quebec Club and Institute at a reading on 11 Apr. 1879. See further under no. 5 below.

3. *Rosalind* a "mock-sentimental" poem of four hundred lines all ending in *ind* or *ind* was "printed, not published" in *Fliegende Blätter*, a pamphlet dedicated to "FREDERICK LOCKER Esq., Laureate of the Lighter Muse," and intended "For the Exclusive Use of the Donee."

This information is given by BLONDHEIM (see section III) who states also that SYLVESTER read it at the Peabody Institute 18 Feb. 1879. FRANKLIN (see Bibl.) gives an amusing account of this reading. In GILMAN 2 we find the following: This extraordinary composition, a veritable *tour de force*, reached four or five hundred verses, each closing with the three monotonous letters or their vocal equivalents. I do not know whether he ever gave away printed copies of this extraordinary production of his fertile brain, but he read his verses to many unwilling hearers, and I know that he kept the type standing for months at the printer's for additions and emendations. An early manuscript copy is in the archives of the University, and I will give a few lines from it—I am afraid to give more:

TO ROSALIND

(Key to the sentence of some hundreds of lines, all rhyming with *ind*)

In Cecilia's name I find—
 (Deem not thou the guess unkind)—
 Celia, with a sigh combined, (1)
 Whose five letters, loose aligned,
 Magic, set and recombined,
 Fairest O! of lily kind,
 Shall disclose to every mind,
 From Far West to Orient Ind
 With each mortal thing unkind
 Thy sweet name, dear Rosalind!

President GILMAN states that "the manuscript copy is in the archives of the University," but the present librarian of J.H.U. writes that no such manuscript or other copy of *Rosalind* is to be found. Furthermore, he believes that what was originally there was a printed proof, such as President GILMAN refers to, with manuscript changes. I have not been able to find any copy of this printer's proof; other verses are contained in the following quotation from BLONDHEIM: The poem ends with an explanation of the meaning of the name "Rosa-lind":

"Rose smells sweet, and soft spells *lind*,
 Soft, smooth, sweet, spell Rosalind".

In a note he quotes TAUCHNITZ' German Dictionary as defining "*lind* = soft, mild." One can appreciate the feelings of the clever correspondent who wrote to the author of the poem: "So powerful a will must in time disintegrate the

(1) Celia + ci = Cecilia.

dictionary like water on a lump of sugar, and make every final syllable flow into the channel of Ind; in fact,

„Language is all Sylvest'lined
In the light of Rosalind ”

In the library of St. John's College, Cambridge, there is a copy of SYLVESTER'S *Fliegende Blätter. Dedicated to Fredrick Locker Esq. Printed not published. Private.* London, 1876, and in this is the poem Rosalind of 227 lines. The Baltimore edition was evidently considerably extended.

4. “ Spring's Début. | *A Town Idyll* | *in two centuries of Continuous Rhyme*, | by | J. J. SYLVESTER, F. R. S., | *Author of the Laws of Verse.* | «decoration» | *Opera ac Verba.* | Printed for Private Circulation only.” 32 p. (15 × 22 cm.) The title page is undated but at the foot of p. 28 is the date “ January 1880.” “ Printed by JOHN MURPHY Co., Baltimore ” is at the bottom of p. 32. Copies of this pamphlet are to be found in many libraries.

The poem is in praise of Miss MARY WINN of Baltimore, and as finally printed consists of 213 seven-syllabled lines, all ending in rhymes or assonances to this lady's name. This explains the “ key of in ” reference in Letter XXI below (23 Mar. 1879) to SIMON NEWCOMB. At this date SYLVESTER refers to having “ just completed ” the poem, extending “ to over 150 lines ”; but with SYLVESTER nothing was ever completed and it is not surprising to find that nine months later more than fifty lines had been added. Other facts of the Letter include the statements that he did not know Miss WINN, that the poem was “ a pure play of fancy.” Lines 23-40 may be quoted as a sample :

“ Fine as point-lace or Mechlin.
Circe—but more feminine,
Pamela, artless genuine,
Like loved child of Cymbelin'—
Sainted, sweet-souled Imogen,
Not more lively, dear Nell Gwynne,
Dreamier, nocturne of Chopin
Swan-song of weird [*sic*] Lohengrin,
Calmer, aureoled Capuchin
Niched beneath stone baldaquin,
Loved of the Dryads Evelyn,
Daintier, touch of Maturin,
Purer, Rill of tears, Undine,
Shedde to undoe eache staine of Sinne,
Prouder self-ruled, Catherine
Ere rose might of Mazarin
Or who broke to rein Berlin
High Autocrator Tzarin,
Pious as Evangeline : ”

The explanatory notes throughout the poem are entertaining. There is an extended review in *The Academy* 27 May 1897, reprinted in *J.H.U.C.*, v. 16, p. 56-57.

5. To this item, I believe that no previous reference has been made in print, and the only copy that I know of is in the Treasure Room of the Harvard Univ. Library. It was formerly the property of CHARLES ELIOT NORTON and on it SYLVESTER wrote : " For Professor NORTON with the writer's best regards." The title page of the " printed manuscript " is as follows : *Sir John de Courcy | and | Schiller's Ideale. | As recited in English Verse at the Working Men's | Institute of Baltimore, November 18, 1880. | With other Poems. | By J. J. Sylvester, F. R. S., Hon D. C. L. Oxon. | Author of the Laws of Verse. | Printed Manuscript.*

The pamphlet contains 48 leaves paged and printed on one side only. " The ballad of Sir John de Courcy " occupies p. 2-8 and there are a number of revisions of the 1871 form (no. 2 above); for example, the first two lines—

" He grasped his fallen blade,
High o'er his head then hurled;"

were later changed to

" He flashed his lightning blade,
The scabbard from him hurled;"

Then follow in succession, SCHILLER's " Ideals," TASSO's " Soliloquy," " The Story of Europa " (with the Latin), GOETHE's " Comfort in Tears," UHLAND's " The goldsmith's daughter," SCHILLER's " Cassandra," HORACE's ode III, 29 (with the Latin), and finally (p. 48) " Sonnet after the Italian." All of these except the last are new editions of items in his *Laws of Verse*. Indeed after the pamphlet was sent to Professor NORTON, newly printed pages (20 and 22) of " The story of Europa," and 40 and 46 of the Maecenas ode, were sent to him for substitution in the pamphlet. These may also be seen at Harvard. This was doubtless another item, referred to by President GILMAN (see no. 3 above), where " he kept the type standing for months." See Letter XXIV below, from which it appears that SYLVESTER contemplated adding more poems and issuing a volume of 125 to 150 pages.

A translation of SCHILLER's " Ideale," made by Sir WILLIAM ROWAN HAMILTON in 1838, is given in his *Life* by R.P. GRAVES, v. 2 (1885), p. 252-253. But HAMILTON does not, as SYLVESTER does, adhere to SCHILLER's meter; nor is he, in places, so accurate.

6. " Retrospect," *Academy*, v. 26, 8 Nov. 1884, p. 305. A poem of five four-line stanzas, dated " New College, Oxford : Nov. 1, 1884 " and signed " J. J. S." In the *Academy* for the following week (15 Nov., p. 323) there is a five-stanza " Answer to ' Retrospect ' " by H. RIX, and dated " London : Nov. 10, 1884." On 9 Nov. 1884 SYLVESTER sent a revised copy of " Retrospect " to W. J. C. MILLER (see Section VIII) with the following note : " These are the verses referred to in my previous

note in their more perfect form. The *third* stanza is new, the 18th and 19th lines altered, and the 22nd retouched." This has reference to the *Academy* version. This ms. and letter are in the David Eugene Smith Library, Columbia University. They were published by Professor SMITH in *Amer. Math. Mo.*, v. 29, 1922, p. 15. According to SYLVESTER's note of 1887 (see no. 10, below), there must be, somewhere, another printed version of "Retrospect" since the "3rd stanza" there quoted bears no resemblance to any of those referred to above.

7. "To a missing member of a family group of terms in an algebraical formula," a sonnet in the midst of an inaugural lecture at Oxford, 12 Dec. 1885, "On the method of reciprocants as containing an exhaustive theory of the singularities of curves," *Nature*, v. 33, 7 Jan. 1886, p. 228; also in *The Eagle*, v. 14, Dec. 1886, p. 251-252; also in W. AHREN's *Scherz und Ernst in der Mathematik*, Leipzig, 1904, p. 232; also in SYLVESTER, *Coll. Math. Papers*, v. 4, p. 293.

After delivering this sonnet, which he called a "jeu de sottise," the lecturer continued, "Having now refreshed ourselves and bathed the tips of our fingers in the Pierian Spring, let us turn back for a few brief moments to a light banquet of the reason, and entertain ourselves as a sort of after-course with some general reflections arising naturally out of the previous matter of my discourse."

8. "Sonnet to the Savilian professor of astronomy in the University of Oxford, author of a memoir on the proper motion of forty stars in the Pleiades, on receiving the gold medal of the Royal Astronomical Society for his investigation of the relative brightness of fixed stars," *Nature*, v. 33, 1 Apr. 1886, p. 516; corrections to the version are given 15 Apr., p. 558.

The astronomer in question was CHARLES PRITCHARD (1808-1893), a fellow Johnian with SYLVESTER, and an intimate friend after he went to Oxford. The sonnet is also quoted in *The Eagle*, v. 14, Mar. 1886, p. 120, and in revised form, Dec. 1886, p. 251. The first form is dated New College, 13 Feb. 1886. By request this sonnet was recited on the evening of the public presentation of the medal, at the dinner of the Fellows of the Royal Astr. Society.

9. "Sonnet... On being aroused out of an algebraical reverie by a lady," *The Eagle*, v. 14, Dec. 1886, p. 242.

10. "Music and Mathematics," *Nature*, v. 35, 9 Dec. 1886, p. 132. This is a letter dated Nov. 15, followed by "Sonnet, To a young lady about to sing at a Sunday evening concert in

Bailliol College." Both the letter and sonnet are changed and a seven-line note is added in a reprint in *J. H. U. C.*, v. 6, Apr. 1887, p. 86.

The verse

"To her whose star shines bright o'er Maelor lake,"

refers to SOPHIE KOWALEWSKI then lecturing on mathematics at Stockholm. The added "note" is as follows: "A companion picture to the skyscape in the 1st stanza of the sonnet below will be found in the 3rd stanza of my *Retrospect*—

'Eve's fiery armament, frowning the crimson sky,
Like glow by passion lent, like passion's dream to die,'

the first line of which may recall to some of my readers, JUVENAL'S

'*Quicquid habent telorum armamentaria coeli.*' *Sat.*, xiii, 83."

11. (a) "Sonnet to a high soprano, accompanying herself on the piano" (dated New College, Oxford, July 20); (b) "Sonnet to a young lady with a contralto voice, on her singing, on a warm summer's afternoon, without accompaniment, save the music of the birds heard through the open window of the author's rooms overlooking the beautiful garden of New College, Oxford, the old English ditty 'Deck not with gems that lovely form for me,' in which occurs the line, 'I must have loved thee hadst thou not been fair'" (dated Athenaeum Club July 25); (c) "Sonnet commemorative of an incident which occurred in St. Margaret's church, Westminster, on August 9, 1888" (dated New College, Oxford August 26), *Nature*, 9, 16, 30 Aug. (a) p. 347; (b) p. 371; (c) p. 421.

In connection with (b) there is a very entertaining footnote filling two-thirds of a column in fine print; it is here stated that (b) was the original form of (a). This form was reprinted in *Manchester Quarterly*, v. 45, 1919, p. 47, in the article of BARNES discussing SYLVESTER as a poet. To (c) there is also the following footnote: "This sonnet would furnish an unrivalled new situation and a noble subject for a young painter with lofty aims (if such there be among us) to depict. In the church invited to participate in the sacred rite were Star-gazers, Wonder-workers, and Magi (the DARWINS, the THOMSONS, and the CAYLEYS), who may be supposed in the person of their representative to be doing homage to the Spirit of Womanhood incarnated in the infant held in the arms of her proud and comely nurse, from whom I learned that the child's name was Imogene."

12. "Sonnet to Gladstone revisiting Oxford. *Scene*—The Union. 'I love Oxford from the bottom of my heart'", *Oxford Magazine*, v. 8, 19 Feb., 1890, p. 213. "Reprinted with important alterations" in *The Eagle*, v. 16, June 1890, p. 279. Also in

A Pair of Sonnets. By J. J. S. New College, Oxford May 5, 1890, revised version printed in an edition of 25 copies.

According to the librarian of St. John's College there is a copy in the college library which contains not only the Gladstone sonnet but also one "To W. L. COURTNEY leaving Oxford."

13. "The Lily fair of Jasmin Dean," *The Eagle*, v. 15, Dec. 1888, p. 251-253. This poem consists of 65 lines, divided into four stanzas of unequal length as follows: 14 lines in the first, 12 lines in the second, 26 lines in the third, and 13 lines in the fourth. On 29 May 1890 an edition (25 copies) of a "revised first edition... in its complete form" was printed with the following title: *The Lily Fair of Jasmin Dean. A Reminiscence recast from a poem printed in The Eagle... of Dec. 1888.* A copy of this may be seen in the library of St. Johns' College, Cambridge.

14. Mar. 13, 1896 For private circulation only. Presented by the Author J. J. SYLVESTER, Athenaeum Club, Pall Mall, London. | NULLUS HONOR SINE CRUCE. | COMMENTARII ITINERIS NUPER IN SCOTIA FACTI. | A PROFESORE SAVILIANO GEOMETRIAE, | ET EODEM COLLEGII NOVI SOCIO APUD OXONIENSES. || 4' unnumbered p. (19.3 × 25 cm.).

There is a copy of this in the London Library, and a mutilated copy in the Library of Harvard Univ. On page 1 are VIII Latin poems of two to four lines and extensive footnotes. On p. 2 (headed with the word "Lectio," are Latin poems IX-XIV and footnotes. A place and date is given for each of these poems. No. XIII is as follows:

"Urbi et orbi

Lond: 1865.

Quum theorema Newtoni de radicibus imaginariis equationum per longos annos non demonstratum, demonstrassem.

Ortae ex Cartesio, quam Newtons insuper auxit,
Doctrinae en! demum fons et origo patent."

Page 3 is headed with the word "INTERPRETATIO" and contains a translation, and notes, of each of the poems on p. 2. The equivalent of no. XIII is given as follows (the different years are correct):

"To Oxford and the World

Turnbridge Wells, October 13th, 1895.

When I had demonstrated the theorem of Newton concerning the imaginary roots of equations which had remained undemonstrated for a long course of years.

Sprung from Descartes, which Newton to a higher level bore,
See now the fount and source lie open of that lore.

From the word "lore" is a reference to the following footnote :

Descartes' and Newton's law lay hid in night :
Heaven touched my heart with fire, and all was light."

This form of couplet was doubtless suggested by the lines in Pope's epitaph on Newton (1730) :

"Nature and Nature's Laws lay hid in night :
God said, *Let Newton be!* and all was light."

This discovery was also referred to by an American poet, SIDNEY LANIER (1842-1922) in an "Ode to The Johns Hopkins University," read 22 Feb. 1880 (*J.H.U.C.*, v. 1, Apr. 1880, p. 38; also in *Poems of Sidney Lanier*, ed. by his Wife, new ed., New York, 1922, p. 108). Lines 10-14 are as follows :

"From far the sages saw, from far they came
And ministered to her,
Led by the soring-genius'd Sylvester
That, earlier, loosed the knot great Newton tied,
And flung the door of Fame's locked temple wide."

On page 4 of no. 14 the text and notes are mostly in Latin, with miscellaneous comments on the preceding poems.

In the library of St. John's college there appear to be three earlier editions of this publication, namely : (1) *Corolla Versuum...* 15 Oct. 1895, 4 p., 22.5 × 15 cm.; (2) *Idem*, 9 Dec. 1895, "Revised edition for private circulation only, 4p., 25 × 19 cm.; (3) *Idem*, enlarged and with title *Nullus honor sine cruce*, "For private circulation," 26 Feb. 1896, 4 p., 25 × 19 cm.

VIII. — LETTERS OF SYLVESTER

From 87 letters of SYLVESTER found in the United States, 30, which have never before appeared in print, have been edited and are herewith offered to the public. They are scattered over a period of nearly fifty years, 5 Sept. 1842-29 Sept. 1891. A complete calendar of the 87 letters is given below. The mere transcription of the selection from the mss. was a problem of not a little difficulty, as the facsimiles of two pages of Letter I may suggest. Where I have felt that there was any doubt in the transcription of a word, a question mark has been put after it in square brackets [?]. There are only two places where I felt that my guess was to be regarded as excessively in doubt, namely in Letters II and XXIX. Except in the case of XIII and XXIII the Letters have been published in their entirety, with punctuation (or lack of it), spelling, and capitalization exactly as in the originals. Explanatory notes following the letters clear up most of the allusions; space considerations curbed further comment I should otherwise have made.

Six of the Letters are addressed to BENJAMIN PEIRCE (1809-1880) and his wife. Very full information concerning PEIRCE's life and work is given in *Amer. Math. Mo.*, v. 32, 1925, and reprinted with additional information and portraits by the Math. Assoc. of America; see also *Dict. Amer. Biography*. Eleven Letters are addressed to SIMON NEWCOMB (1836-1909) the astronomer and mathematician, who attained to more general international recognition than any other American scientist. Full information regarding his career is to be found in *Memours of the Nat. Acad. Sci.*, v. 17, 1924.

SYLVESTER was exceedingly interested in the problem department of the *Educational Times (E. T.)*, London. Consecutively numbered mathematical questions seem to have begun with the issue for August 1849, although questions solutions and mathematical papers appeared occasionally before this. SYLVESTER's first proposed problem was no. 1421 (1863) and the last, no. 13660 (*E. T.*, Nov. 1897). A number of his final problems were proposed within three months of his death on 15 Mar. 1897; one is dated 22 February. Of many of SYLVESTER's problems no solutions were ever published. Hence most of these can only be found by consulting a file of *E. T.* Those problems with solutions, and a few repropoed without solutions, were reprinted in semi-annual volumes, *E. T. R.* All of these have been listed in SYLVESTER, *Coll. Math. Papers*, v. 4, p. 743-747. During the whole 35 years that SYLVESTER made almost monthly contributions to *E. T.* the mathematical department was edited by WILLIAM JOHN CLARKE MILLER (1832-1903). Nine of the Letters are addressed to him and one to the publisher of *E. T.* A biographical sketch of MILLER, and a portrait, appeared in *Amer. Math. Mo.*, v. 3, 1896; see also *Math. Gazette*, v. 14, 1929, p. 396-398 and *E. T.*, v. 56, 1903, p. 138.

Apart from comment already made in Sections VI and VII of this paper, and at the conclusions of the Letters, I may only call attention to their general excellency of phrasing, to their display of very human qualities, to passages not without pathos, to SYLVESTER's frankness, kindness, and thoughtfulness of others, to his little vanities, and to his enthusiasms. To the list of SYLVESTER expressions in praise of CAYLEY (BAKER, p. xxii-xxiii) we have a new one (Letter XV) "CAYLEY who is my oracle always."

Now follows the calendar :

A. David Eugene Smith Library, Columbia University, New York City (C. U.). Unless otherwise stated the letters are addressed to W. J. C. MILLER.

C. U. 1. 7 Oct. 1856; 2. 1 June [?] 1862; 3. 21 Oct. 1862; 4. 9 Sept. 1863; 5. 12 Sept. 1863; 6. 12 Sept. 1863; 7. 13 Sept. 1863; 8. 28 Oct. 1863; 9. 4 Nov. 1863; 10. 18 Nov. 1863; 11. 21 Nov. 1863; 12. 4 Dec. 1863; 13. 9 Mar. 1864; 14. 13 Mar. 1864; 15. 22 Mar. 1864; 16. 3 Apr. 1864; 17. 15 Apr. 1864; 18. 12 May 1864, Letter VI; 19. 5 Oct. 1864; 20. 11 Oct. 1864; 21. n.d. 1864 [?]; 22. 9 May 1865; 23. 16 July 1865, [to C. F. HODGSON & Son], Letter VII; 24. 6 Sept. 1865; 25. 21 Sept. 1865, Letter VIII; 26. 3 Oct. 1865; 27. 5 Oct. 1865; 28. 5 Oct. 1865; 29. 11 Oct. 1865; 30. 13 Oct. 1865; 31. 16 Oct. 1865, Letter IX; 32. 23 Oct. 1865; 33. 24 Oct. 1865; 34. 3 Nov. 1865, Letter X; 35. 14 Nov. 1865; 36. 1 Dec. 1865, Letter XI; 37. n.d. 1865 [?]; 38. 26 Mar. 1866; 39. 19 July 1866; 40. 8 [?] 1866; 41. 10 Sept. 1866 (?), Letter XII; 42. 30 Sept. 1866, Letter XIII; 43. Sept. 1866; 44. undated 1866 [?]; 45. undated 1866; 46. 24 Mar. 1867; 47. 13 June 1867; 48. 24 June 1867; 49. 20 Sept. 1867 [?]; 50. 25 Nov. 1867; 51. undated 1867 [?]; 52. undated 1867 [?] 53. 15 Feb. 1873, Letter XIV; 54. 12 Aug. 1876; 55. 11 Jan. 1879, to A. CAYLEY, Letter XX; 56. 9 Nov. 1884; 57. 22 July 1887; 58. 8 May 1889, Letter XXVI; 59. 29 Sept. 1891, to E. M. LANGLEY, Letter XXX; 60. 23 Sept. 1893, to D. E. SMITH.

B. Letters in the possession of Mr. B. P. ELLIS, (Cambridge, Mass.), a grandson of BENJAMIN PEIRCE.

B.P.E. 1. 5 Sept. 1842, to BENJ. PEIRCE, Letter I; 2. 28 Feb. 1843, to BENJ. PEIRCE, Letter II; 3. 19 May 1843, to B. PEIRCE, Letter III; 4. 22 May 1843, to B. PEIRCE, Letter IV; 5. 11 June 1843, to B. PEIRCE, Letter V; 6. 17 Mar. 1878 to B. PEIRCE, Letter XVIII; 7. 25 Mar. 1880, to Mrs. BENJ. PEIRCE, Letter XXII; 8. 3 June 1883, to J. M. PEIRCE.

C. Letter in Harvard University Library, Treasure Room.

H.U. 1. 20 Feb. 1881, to CHARLES E. NORTON, Letter XXIV.

D. Letters in the Library of Congress, addressed to SIMON NEWCOMB.

L.C. 1. 21 Jan. 1877; 2. 1 Mar. 1877; 3. 25 May 1877; 4. 26 Oct. 1877; 5. 31 Oct. 1877, Letter XV; 6. 14 Jan. 1878, Letter XVI; 7. 30 Jan. 1878, Letter XVII; 8. 12 Mar. 1878; 9. 18 Apr. 1878, Letter XIX; 10. 23 Mar. 1879, Letter XXI; 11. 18 Jan. 1881, Letter XXIII; 12. 7 May, 1881; 13. 30 May 1881; 14. 20 Oct. 1881, Letter XXV; 15. 16 Nov. 1881; 16. 18 Jan. 1882, Letter XXVII; 17. 26 July 1883, Letter XXVIII; 18. 8 Jan. 1891, Letter XXIX.

With respect to the Purpose of Water which
 we have discussed just before left A C.

A B C, & C B D be being separated



we infer the purpose of A B = $\frac{1}{2}$ weight of ~~substances~~

in A B C: as required Caloric response that
 may result (for the whole system cases if undisturbed)
 by making C B D become liquid again & taking the

moments about B: This latter is the simplest
 method, but the same result might be obtained
 by counting upon A B
 taking away the moment



of any optical system; and making that become
 fluid, its weight combined with the purpose must
 be equivalent to a force passing through O the axis
 of the opened cylinder. N.B. for ~~the~~

Answers we may form from the connection of these
 kinds & double the theory of Equilibrium
 maybe made as prolific as that of the
 C. G. in the Generation of Geometrical
 Systems Are you aware of my author.
 has distinctly stated ~~the~~ in Analytical language
 the test which must be applied ~~to~~
 when fluid is a web, or even above those actually
~~and~~ ~~the~~ ~~calculus~~ in the ordering
 & results. Undoubtedly ~~the~~ does not
 then are not sufficient: we must have an
 inequality ~~in~~; ~~the~~ ~~enough~~ ~~with~~

I. — (B.P.E.-1) *To Benj. Peirce*

New York,
Sept. 5, 1842.

My dear Sir,

I never remember more happy days than those I passed lately, under your roof, in the enjoyment of the pure pleasures which spring from the feeling of mutual good will and mental adaptation. It was the fault of your own hospitality and kind bearing, and of the good nature and charitable indulgence of others of your household, if I appeared to feel too much at my ease with you, for so short an acquaintance and appropriated myself more than my fair share of your company and conversation.

I will not therefore solicit pardon for these transgressions,—but content myself with begging you and Mrs. Peirce to accept my sincere acknowledgements of indebtedness for the many pleasing impressions which will always be associated in my mind, with my recollections of my visit to Harvard University. Your last friendly act in furnishing me with a valuable letter to Mr. Cogswell deserves my special thanks. He is living out at Yorkville with Mr. Astor, and I intend going out to call upon him at the first opportunity. I have not yet seen *him*. Mr. Gill I shall probably visit at Flushing this very day.

With respect to the Pressure of Water question which we were discussing just before I left ABC, and CBD becoming *separately* solid we infer the pressure upon AB = $1/2$ weight of liquid in ABDC : as regards *Center* of pressure that may be got (for the last supposition leaves it *undetermined*) by making CBD become liquid again and then taking the moments about B : This latter is the simplest method; but the same result might be obtained otherwise by erecting upon AB *any* cylindrical segment; and making *that* become solid; its weight combined with the pressure must be equivalent to a force passing through O the axis of the assumed cylinder.

N.B. for theoretical purposes we may form the conception of *Plane* liquids and doubtless the theory of equilibrium may be made as prolific as that of the C. G. [?] in the generation of geometrical systems. Are you aware if any author has distinctly

stated in *Analytical* language the test which must be satisfied when a fluid is at rest, over and above those contained in the ordinary equations. Undoubtedly it seems to me these are not *sufficient*: we must have an *inequation* [?] *as well* analogous to that which determines the *continuance* of the motion of a body on a curve; the failure of which is not indicated by the appearance of an impossible quantity in the treatment of the equations of motion, and of course ought not to be so indicated, since in obtaining them, the pressure is supposed free to assume any degree of *negative* as well as positive magnitude.

I think we could together make out a beautiful system of Mechanics much more satisfactory and more agreeable to common sense than any yet attempted at least so far as regards the deduction of laws from *first principles*.

I would make almost any sacrifice consistent with independence to have the advantage of a long course of study with you.

Without envy or jealousy by joining our forces in a constant and faithful cooperation in reading and reflection we might achieve wonders: Could any situation be made for me at your University? My expectations as to pay would be very limited as I know that your University cannot not [*sic*] afford large salaries. My first wish and desire is intellectual progress and if my services would be worth obtaining I should not set an exorbitant price upon them.

I shall be still for some time in this city, where I am at present staying at my brother's who is in business at 130 Broadway to whose care you can address any letter which you may feel disposed to favor me with.

Please to present my very kind regards to Mrs. Pierce and Mrs. Mills and my compliments to Mr. Otis, Mr. Hilliard, Professors Lovering and Felton and any others of your many agreeable friends who may chance to ask after me and believe me to be My dear Sir

Very faithfully and truly yours,
Jas. J. Sylvester.

JOSEPH GREEN COGSWELL (1786-1871), bibliographer, was a friend and companion of JOHN JACOB ASTOR (1763-1848), wealthy man of business, and philanthropist. There is another reference to COGSWELL in Letter V.—“Mr. GILL” is certainly CHARLES GILL (1805-1844) an Englishman who arrived at New York in 1831 and settled at Flushing. He was the first actuary in America

and showed mathematical ability in editing *Mathematical Miscellany* (1836-39). See *Scripta Mathematica*, v. 2, 1934, p. 139-142.—PEIRCE's notable work, *A System of Analytic Mechanics* was published in 1855 and in his conversation with SYLVESTER he may have dealt with ideas later developed in this work.—The brother referred to was his eldest brother SYLVESTER JOSEPH SYLVESTER, who was a "broker" with offices at both 130 Broadway and 22 Wall Street.—The Mrs. MILLS referred to was doubtless Mrs. PEIRCE's mother.—JOSEPH LOVERING was Hollis professor of Mathematics and Natural Philosophy at Harvard, 1838-88. CORNELIUS C. FELTON was Eliot professor of Greek Literature at Harvard 1834-60.—Pages 2 and 4 of this letter are reproduced in facsimile. SYLVESTER spells PEIRCE's name incorrectly here, and in later letters.

II. — (B.P.E.-2) *To Benj. Peirce*

Washington,
February 28th/43.

My dear Sir,

Your most acceptable letter came to me at a period which made it doubly welcome, preventing a medium [?] course, at a time when only one of two distressful alternatives seemed open to my choice. The effect was electric; and redeemed me instantaneously from a state of utter prostration and despondency to a new birth of hopes and reweakened vigour of purpose. I am here inquiring into the National University (on Smithson's foundation) *that is to be*; but when Heaven only knows. I have seen your friend Davis and like him very much. Tomorrow we are to see Adurnis [?]. On our return North after spending two or three weeks in New York I shall accept your call to Cambridge. The pleasure I have in your social and scientific sympathy will reconcile me to a *temporary* deadening of other feelings; and the life of literary adventure, you picture has great charms for my imagination. It is just possible an appointment may be made vacant for me in New York; a few weeks ago I had a right to calculate upon that arrangement as a moral certainty, but one blow after another has fallen recently upon my prospects there without however absolutely killing them or me.

I feel grateful to your friends for their kind remembrance of me and beg you to reciprocate in my name. Sturm and Cauchy's notices are very consolatory. I see plenty of Samuel Ward in New York; he knows all my affairs and is very friendly disposed.

my letter which you may feel is
 to inform me with
 Please to present
~~my regards to~~
 Mrs Pierce & family and Mr. Chapman
 to Mrs Pies Mrs Bellard, Professors Luning
 and Tilton and our others of your many
 friends who may change ~~with~~ after
 decide me to be ~~my dear~~ ~~with~~ ~~truly~~ ~~truly~~
 Dec. 8. 1862

Professor Pierce
 etc etc etc
 Cambridge Mass
 Massachusetts

I shall be still for some time in this city
 where I am at present staying at my
 brother's who is in business at 130 Broadway
~~with~~ to which care you can address

It would be heaven on earth to have two or three years hard reading with you, were my mind at rest in other respects.

Please to name me in the kindest manner to Mrs. Pierce and Mrs. Mills and believe me now and ever very faithfully and truly
 your friend,
 J. J. Sylvester.

The Smithsonian Institution was established in Washington in 1846 "for the increase and diffusion of knowledge among men." This resulted from the receipt in 1838 by the United States Government of \$515,169 from the Court of Chancery of Great Britain. "Friend DAVIS" is probably PEIRCE's brother-in-law CHARLES HENRY DAVIS (1807-75), a naval officer. For a time he was superintendent of the Naval Observatory, Washington, and published the English translation of GAUSS's *Theoria Motus*...—The notices of STURM and CAUCHY possibly refer to : (a) J. C. F. STURM's paper "Démonstration d'un théorème d'algèbre de M. SYLVESTER," *Journ. de Mathém. Pures et Appliquées*, v. 7, 1842, p. 356-368; (b) A. CAUCHY, "Mémoire sur l'élimination d'une variable entre deux équations algébriques," where there are a number of references to SYLVESTER. This mémoire appeared in *Exercices d'Analyse et de Physique Mathématique*, v. 1, Paris, 1840; also in *Œuvres Complètes*, s. 2, v. 11, p. 466. SAMUEL WARD (1814-1884), author, banker, miner, diplomat, was married first to a daughter of W. B. ASTOR, son of J. J. ASTOR. The famous JULIA WARD HOWE was his sister. He was depicted by his nephew MARION CRAWFORD as "Mr. Bellingham" in *Dr. Claudius* (1883).

III. — (B.P.E.-3) To Benj. Peirce

Mrs. Cadell's 691 Broadway
 New York,
 Friday, May 19.

Dear Pierce,

I was on my way down to the agents of the packet company to take my berth by the *Gladiator* which sails tomorrow; but the representations of a friend; whom I encountered on the way, have induced me to stay over till the next packet of the 30th instant, as an *unannounced* departure might bear the misconstruction of a *flight* when taken in conjunction with the unpleasant affair to which I alluded in our midnight stroll.

My mind was so unsettled between going and staying and the arguments so equally balanced on either side, that I was obliged to make the result of seven throws with a quarter of a dollar piece give the final impulse to my determination.

Now that ten new days intervene I am afraid of myself in

the interim. Write me if you have been able to find out anything that would do. A moderate nay [?] a *very inconsiderable* opening if it were a certainty and compatible with living out at Board in Cambridge to join studies with you, would yet turn the scale.

Kindest regards to all the members of your family and please to believe me

Your much attached and faithful friend
J. J. Sylvester.

I have as yet caught no glimpse of *the* one. Missed spending some hours last night where we should have met by a narrow chance. I am in an ill run of luck. *Before*, we were constantly chancing to meet. *Now*, as constantly missing.

Believe in runs, i.e. that there is a providence and destiny directing hazard; believe I mean that there is a law of good and ill fortune and one chafes less at, and becomes much more reconciled to, a *series* of disappointments. They are then felt not as an aggregate of misfortunes but as an aggregate result of a single ill turn, parallel with some acquiesced in mental or bodily infirmity. This is not *theory* but a philosophy of consolation which flashed upon me as a reality only yesternight [?], and already in my own case reduced to practice.

Convey my compliments to the President, Mrs. Otis, the sisters Blake and all other Boston friends, not omitting Mr. Bowditch.

Address me care Mrs. Cadell, 691 Broadway, New York.

The President of Harvard in 1843 was JOSIAH QUINCY.—“MR. BOWDITCH” is doubtless one of the sons of NATHANIEL BOWDITCH (1773-1838) translator into English of LAPLACE’s *Mécanique Céleste*, and author of *The New American Practical Navigator*. The son HENRY I. was one of PEIRCE’s early school friends.

IV. — (B.P.E.-4) To Benj. Peirce

Mrs. Cadell’s Broadway
Monday Morning

My dear Pierce,

I thought your presentiment about Saturday would come to nothing; for, after writing to you on Friday, I came to the decision to give the affair up and arose the next day, as imagined cool and indifferent, like one awakened from a fever or fit of delirium.

But fate had decreed otherwise; we met and the first glance like a lightning stroke of inspiration dispelled all doubts all ungenerous feeling and brought her back to my mind pure and noble as in the springtime of our acquaintance, my imagination delighted to paint her :. we met again and yesterday I joined her alone in a short walk and something like an explanation took place. For the first time she evinced warmth of feeling and of this I am fully satisfied that she never designedly fostered expectations which she knew were not to be fulfilled. I can scarcely help flattering myself that I have inspired her with some regard; her friends are dead set against me and it is to their opposition I must attribute all that has appeared cold and ambiguous in her deportment. How far her regard extends I am still in doubt or whether it has ever transcended the bounds of friendly esteem; or how far her apparent acceptance of my intentions may not have proceeded from a good natured endurance or unconsciousness of the extent of their significance, or of the deductions which self-love might build upon such acceptance.

She has heard of my determination about leaving for England and were I now without good or tenable reasons to draw back, that announcement would appear to her in the light of a *base* to elicit from her some manifestation of feeling that would otherwise have been withheld; on the other hand if I leave she is lost to me forever.

Now therefore in the name of love and friendship do if it be possible in the nature of things find me something with a *home*, (no matter *how trifling*, how unworthy as you might consider the remuneration) to keep me in the country and with you.

Think upon this; get your friends to canvass for me; I care not what the employment may be if it only afford a fair pretext for delaying my return. Could I effect this delay, new elements will arise in the expected presence of friends from England, which may be turned to good account. I now much regret my precipitation. Our yesterday's interview, might have been effected a fortnight previously in precisely the same way and I cannot help thinking now (as I did then suspect) that *she* desired it. We could then have met after an explanation with a secret good understanding and my position would have been better than ever it was before. June the first, the vessel sails; I have

written to South Carolina to learn about the condition of the Professor of Mathematics there and may get an answer before the first, but build little upon this. Please to answer this, if you are able, by return mail; say whether there are any hopes that anything can be done for me. Is there *no opening* in the Insurance offices? I know your friendship and your character too well to apologize for putting this trouble upon you. The happiness of my life may depend upon the issue of the next few days.

I repeat [the] extent of remuneration is of no consequence : I want only position, a local habitation and a name; a fair plea for breaking my expressed intention of departing the country. With kindest regards to all your family believe me my dear Pierce, your true friend

J. J. Sylvester.

This letter, marked "private," was written on "Monday Morning" May 22 1843, and "Friday" would be May 19, the date of Letter III.—The professor of mathematics in South Carolina was THOMAS S. TWISS who did not resign until 1846.—In his paper on NEWTON's rule for the discovery of imaginary roots (1864) SYLVESTER quotes from the fifth act of SHAKESPEARE's "Midsummer Night's Dream"

"Turns them to shapes and gives to airy nothing
A local habitation and a name."

V. — (B.P.E.-5) *To Benj. Peirce*

June 11th/43
New York.

My dear Pierce,

I was told yesterday to my great surprize that you are a candidate or propose becoming so for the chair in Columbia College. This was not communicated to me as a matter of certainty but as a rumor.

If so, I beg you will excuse my having written to you on the subject in perfect ignorance of your intentions and request you will not allow anything in the way of false delicacy to prevent you from making the application. Your chances of success are much greater than my own and if it would better your condition to make the exchange, or in any manner conduce to increase the happiness of yourself and family, I assure you your success in obtaining it, will give me as much or more pleasure than if

I succeeded myself. You are in every way better entitled to it than I am, and of a character and habits far more likely than mine to conduce to the advantage of this or any similar institution with which you may become connected.

Please let me know your intentions. These sentiments I immediately avowed to Mr. Anthon, who was my informant, and should be proud to do so to all who have any influence in the election. If however it is not your design to seek this change, I know I may reckon securely on your support. *Private letters* to your individual trustees from yourself or others would be much more valuable even, than a general testimonial or letters of recommendation. I am told Cogswell, is in Boston; if so, supposing again that you are not in the field yourself, you would perhaps do me the favor of speaking to him in my favor.

I am told he can influence several of the trustees.

With every feeling of sincere friendship and esteem, I am now and ever

Yours truly,
J. J. Sylvester.

The one actually appointed professor of mathematics and astronomy in Columbia University in 1843 was CHARLES W. HACKLEY.—“Mr. Anthon,” is probably CHARLES ANTHON (1797-1867) teacher of Greek at Columbia College for over forty years.

VI. — (C.U.-18) *To W. J. C. Miller*

12 May 1864.

For the *Educational Times*

By Profr Sylvester

Show that the discriminant of the form

$$ax^5 + b\lambda x^4y + c\lambda^2 x^3y^2 + c\mu^2 x^2y^3 + b\mu xy^4 + ay^5$$

will be a rational integral function of the quantities $a, b, c, \lambda\mu, \lambda^5 + \mu^5$ and of the second degree only in respect to the last of them and establish an analogous proposition for a form of any degree.

The theorem given overleaf is of great importance in the proof of Newton's theorem of imaginary roots carried to the 5th degree which I have succeeded in effecting by aid of it—but after long and laborious efforts.

J. J. S.

This was published in *E.T.* as problem 1667, except that the last eleven words are omitted. CAYLEY's solution was published; see *E.T.R.*, v. 3, 1865, p. 78-79.

VII. — (C.U.-23) *To C. E. Hodgson & Son*

Aber. North Wales

16th July 1865

Sir,

Be so good as to cancel my name from the list of subscribers to the *Educational Times*. That you should not only avail yourself of Mr Miller's invaluable services without giving him any compensation but that you should also presume to express dissatisfaction with him for sending copies of the work he edits to his gratuitous contributors and endeavour to put pressure upon him to recruit for subscribers among the same appears to me so preposterous a proceeding that I must henceforth decline to be concerned in any shape or form with your journal.

Your obt servt
J. J. Sylvester.

Although there is no name of an addressee on the letter, this explosion was evidently intended for the publishers of the *E.T.*, and forwarded by them to MILLER, who soon had SYLVESTER constantly contributing as formerly.

VIII. — (C.U.-25) *To Miller*

For Educational Times

Supposing P, Q, R to be any 3 points in a right line let $[PQR]$ signify $+1$ when Q is intermediate between P, R and -1 in the contrary case. Required to prove that if A, B, C, D are four points in the same right line then the equation $[ACD] \cdot [CAB] \cdot AC^2 + [ADC] \cdot [DAB] \cdot AD^2 + [BCD] \cdot [CBA] \cdot BC^2 + [BDC] \cdot [DBA] \cdot BD^2 = 2AB \cdot CD$ arithmetically constructed remains true whatever may be the order of succession of the 4 letters A, B, C, D .

N.B. The above theorem arises *naturally* out of certain properties of form-probability recently investigated by the proposer.

Dear Mr Miller,

The above slight corollary to a certain general theorem of form-probability strikes me as containing a somewhat novel kind of property and *notation* in segmental geometry and if you approve of it I shall be glad to see it inserted in the Ed. Times. Would you like the theorem itself out of which this springs?

Yours truly

J. J. S.

21st Sept. 1865

This was published in *E.T.* as question 1840 in the following form : If, when L, M, N are three collinear points, $[LMN]$ denote $+1$ or -1 as M is within or external to the segment LN ; prove the following theorems of four collinear points A, B, C, D anyhow situated relatively to one another : (1) $[ACD][CAB] = [BDC][DBA] = -[ADC][DAB] = -[BCD][CBA]$; (2) $AC^2 + BD^2 - AD^2 - BC^2 = 2[ACD][CAB]AB.CD$; (3) $[ACD][CAB]AB.CD + [ADB][DAC]AC.DB + [ABC][BAD]AD.BC = 0$. See *E.T.R.*, v. 5, 1866, p. 21-22.

IX. — (C.U.-31) To Miller

For *Educational Times*

(1) Four points are taken at random upon a finite straight line; find the probability that it may be possible to form with the three segments between them an acute angled triangle

(2) Two points are taken at random upon a straight line AB and two others upon BC lying in AB produced, find the probability that it may be possible to form with the three segments included between these four points an acute angled triangle.

16 Oct. 1865

Dear Mr Miller,

Would you oblige me by allowing some scribe to write out *at my expense* a copy of all my probability *questions* sent to you within the last few weeks. I imagine they must mount up to a dozen or more and I have failed to keep copies.

There is another point on which I should like to make a suggestion viz whether in the future reprints you might not make a selection of the more valuable questions which have

remained *unanswered* and assign them a separate place in the *index*. I confess it would be a great satisfaction to me to see some of my own which really contain the germs of theories thus preserved for future reference and placed on record. The additional expense of printing would I think be very trifling.

Again might it not be useful to give the names of the proposers against each question in the index?

Yours very truly

J. J. Sylvester.

This problem was 2317 in *E.T.*, v. 19, Jan. 1867, p. 232; reposed in *E.T.R.*, v. 7, 1867, p. xv. No solution appears to have been published. The suggestions of the letter were all carried out.

X. — (C.U.-34) *To Miller*

For Educational Times

If the distance between two positions of a planet whose periodic time is given is c , the time between them w , and the sum of the distances from the attracting focus s , and if e, u, u' be the eccentricity and the two eccentric anomalies,

1°. Prove that \mathcal{J} the Jacobian of c, w, s , in respect to e, u, u' takes the form

$$Ae + Be^2 + Ce^3$$

2°. Show that $\mathcal{J} = 0$

3°. Infer hence EULER's (commonly called Lambert's theorem) for the time in terms of c and s .

3d Nov. 1865

Dear Mr Miller,

The investigation above indicated is *very simple* and elegant and as it proves a most important theorem in Astronomy, I imagine you may like to have it by way of variety for yr. journal which is sometimes accused of being too exclusively geometrical.

Yours truly,

J. J. S.

The Jacobian being zero proves that dc, dw, ds are in syzygy so that the time is independent of e when c, s are given and the

periodic time a constant which is what Euler's (erroneously called Lambert's theorem) amounts to.

\int is very easily shown to be zero by making e necessarily ∞ , 1,—1.

The 3 determinants obtained by these specializations are seen immediately to be all equal (!) and the first is very easily calculated and shown almost in a single stroke to be zero.

Compare SYLVESTER, "On LAMBERT's theorem for elliptic motion," *Mo. Notices R. Astr. So.*, v. 26, 1865, p. 27-29; or *Collected Mathem. Papers*, v. 2, p. 496-497. EULER first proved the theorem for a parabola (*Misc. Berol.*, v. 7, 1743, p. 1); LAMBERT extended it to any conic in his *Insigniores Orbitae comitarum proprietates*, Augsburg, 1761, prob. 41. See *Encykl. d. mathem. Wissen.*, v. 6 (2), p. 367-389.

XI. — (C.U.-36) To Miller

Woolwich Comm.

1st Dec 1865

Dear Mr Miller,

I have received yr last number of the Educational Times and ought not to conceal how much satisfaction and encouragement I have derived from the handsome notice evidently from yr pen of my Newtonian researches. Pray accept my best thanks for your generous sympathy—What has become of my solution of N^oImporte's question?

I am anxious to know in case you have worked it out whether our solutions agree—and when mine is likely to appear?

Yours very truly

J. J Sylvester

The "notice" referred to (*E.T.*, v. 18, Dec. 1865, p. 207-08) quotes from an article of H. J. PURKISS on "PROFESSOR SYLVESTER's proof of NEWTON's theorem" in *Oxford Camb. and Dublin Messenger Math.*, (v. 3, Oct. 1865, p. 129-142). This article discusses SYLVESTER's proof and generalization (in 1864-5) of NEWTON's rule (*Arithmetica Universalis*) for the discovery of imaginary roots in algebraic equations, and for assigning an inferior limit to their number. I. TODHUNTER in his *Elem. Treatise on the Theory of Equations* (fourth ed., London, 1880), concludes a chapter on the subject as follows: "If we consider the intrinsic beauty of the theorem which has now been expounded, the interest which belongs to the rule associated with the great name of NEWTON, and the long lapse of years during which the reason and extent of that rule remained undiscovered by mathematicians, among whom MACLAURIN, WARING, and EULER are explicitly included, we must regard Professor SYLVESTER's investigation as among the most important made to the the Theory of Equations in modern times, justly to be ranked with those of FOURIER, STURM, and CAUCHY."

For other interesting notes in this connection see no. 14 in "SYLVESTER'S Poetry," above.

XII. — (C.U.-41) *To Miller*

Woolwich Com
10th Sept. 1866

Dear Mr Miller,

In a *novel!* recently published by a Mr Mortimer Collins. occurs a question which I think would do very well for the Ed Times.

"Construct an equilateral triangle whose angles lie respectively on the circumferences of three given concentric circles." You might write under the question [from the novel "Whos the heir"].

Is this a known question?

It is a very pretty one

Is Mr Collins a worker in the Ed. Times. He talks somewhere of one of his characters amusing "himself as a mild recreation with forming the Hessian of the Hessian of a Quartic"!

And again of "his being occupied with writing notes on Sylvesters proof of Newton's process, etc.—The beautiful child of Newtons youth" words which I remember but had forgotten having used in my lecture at Kings College.

Salmon's new edition of the Lessons on Algebra will soon appear. I have seen some of the proof sheets—and I am persuaded the magic beauty and power of the new doctrine will gain more and more upon the poetic English mind.

Could you get Hodgson to send over a set of *all* the reprints to "M. Chasles" "Membre de l'Institut", Passage St. Marie, Paris, Rue du Bac, through some bookseller with whom Chasles can settle the payment. It is an old promise of mine to Chasles to attend to this and I regret it has escaped my memory until now.

You would like to see Chasles' name (I think) among the regular subscribers and he wishes to subscribe regularly.

In the latest number of the Neapolitan Journal I see there is again a solution of a Question by Griffiths out of the Ed. Times.

Why not add a notice at the foot of the mathematics that "Papers and Journals for the Editor of the Times may be addressed to etc."

The editors of the Neapolitan Journal would I am sure be glad

to spare you a copy of each number as it appears and probably others also if they knew how to reach you.

Your's very truly
J. J. S.

MORTIMER COLLINS (1827-1876), an English novelist and writer of lyrics contributed a number of problems and solutions to *E.T.* and was mathematical master of Queen Elizabeth's College, Guernsey 1850 (?)–56; but after 1862 was occupied with literary work. *Who is the Heir* was his first novel and it appeared serially in *Dublin Univ. Mag.* (v. 64-66, Dec. 1864–Oct. 1865), and then in 3 vols. (London, 1865). The passages to which SYLVESTER refers occur v. 66, p. 165, 388, 175. The problem is an old one; for example, G. LAMÉ, *Examen des différentes Méthodes employées pour résoudre les Problèmes de Géométrie*, Paris, 1818, p. 81 (compare this with *E.T.R.*, v. 26, p. 24); and RITT, *Problèmes de Géométrie*, 2d ed. 1842, p. 73.—SYLVESTER's King's College lectures were delivered in 1859.—The first edition of SALMON's *Lessons Introductory to the Modern Higher Algebra* was in 1859; the 2d in 1866, the 3d in 1876, and the 4th in 1885.—HODGSON, the publisher of *E.T.*—The "Neapolitan Journal" is *Giornale di Matematiche* and the solution of a problem of GRIFFITH from *E.T.* is to be found v. 4, 1866, p. 241-242; an earlier solution was given p. 168-169. Problems of SYLVESTER and CAYLEY were also published in *Giornale*.

XIII. — (C.U.-42) To Miller

[First paragraph of this letter, dated 30 Sept. 1866, has been omitted; it continues below]

Hermite particularly wishes you to insert in the next number the following generalization of a part of his previous question.

By M. Hermite

"L'équation $1 + ax + bx^2 + \text{etc} = 0$ ayant toutes ses racines réelles, si l'on pose $\frac{1}{1 + ax + bx^2 + \dots} = 1 + Ax + Bx^2 + \text{etc.}$,

et qu'on opère avec la série ainsi obtenue sur une équation quelconque $F(x) = 0$, la nouvelle équation savoir

$$F(x) + AF'(x) + BF''(x) + \text{etc.} = 0,$$

aura au moins autant de racines imaginaires que la première."

Perhaps also you would like to subjoin the annexed which although simple enough, has been got out hand over hand by successive steps of generalization in the course of a rapid correspondence between Hermite and myself à propos of another part of the same question as that referred to over leaf.

By MM. Hermite and Sylvester,

(a) Prove that the Jacobian of two Binary Quantics cannot have a less number of real linear factors than the difference between the number of such in the two Quantics themselves separately taken.

(b) Prove that if F , ϕ , Ψ are three binary quantics the number of real linear factors in F cannot exceed the number of such in $(\phi \cdot x + \psi \cdot y) \left(\phi \cdot \frac{d}{dy} - \psi \cdot \frac{d}{dx} \right) F$

(c) From (b) deduce (a) and obtain Rolle's theorem as a particular case of the latter.

HERMITE's question is no. 2273 in *E.T.*, v. 19, Nov. 1866, p. 186; a solution is given in *E.T.R.*, v. 7, 1867, p. 53-54. The "previous question" is doubtless no. 2230 in *E.T.*, v. 19, Sept. 1866, p. 134 and Dec. 1866, p. 207; also *E.T.R.*—The second question is no. 2285 in *E.T.*, v. 19, Nov. 1866, p. 186. This was reproduced in *E.T.R.*, v. 8, p. xii, but no solution seems ever to have been published.

XIV. — (C.U.-53) To Miller

Athanaeum Club
Pall Mall
15th Febr 1873

My dear Mr Miller,

I only wrote about you the impressions I honestly entertained : on receipt of your last I addressed a reminder to Clifford of what he had said about the E. T. in my hearing and asked him to support you. If he has not done so *tout pis* for him—it will not much effect (or indeed at all in my opinion) yr chances of success. Hirst's excuse is like the man—thoroughly *insincere* : he has nothing to fear from the Senate whose service he is quitting and could have worked for you had he been so inclined—but he is probably bound by some engagement to a cabal with whom he is mixed up being an inveterate plotter—if it turns out differently I shall be glad to retract my opinion. If he can gain any point by pleasing Le Neve Foster or any one else he will do so remorselessly. Crofton is very anxious that you should succeed. You have heavy odds to contend against. If by any chance the Senate should make a previous selection and summon the selected candidates to a personal interview, I would avoid appearing before them with a white beard which if I am not

mistaken you wore when last in town, as that adds quite unnecessarily to yr appearance of age—which would I fear tell very much against you. I may be mistaken in the fact and hope you will excuse my drawing yr attention to so personal a matter as I look upon it as a matter of real importance to your chance of success. Let me know if I can be of use to you in any way in the contest as I should be glad to do anything to aid yr cause. I return the questions.

Yours very truly
J. J. S.

MILLER was for many years vice-principal and professor of mathematics at Huddersfield College, Yorkshire, indeed until, apparently, he became (1876) secretary and registrar of the General Medical Council, London. This letter suggests that three years earlier SYLVESTER had interested himself in helping him to a better position. At the time W. K. CLIFFORD was professor of applied mathematics in University College, London; Dr. T. A. HIRST was director of studies in the Royal Naval College, Greenwich (see Letter XXX); M. W. CROFTON was professor of mathematics and mechanics in the Royal Military Academy, Woolwich; PETER LE NEVE FOSTER (1809-79), Secretary of the Society of Arts is, presumably, the one here in question, though it may have been his son Sir CLEMENT LE NEVE FOSTER (1841-1904) who was made H. M. Inspector of Mines in 1873. Facts at my disposal do not make clear what the position in question was. MILLER's picture in *Amer. Math. Mo.*, v. 3, June-July 1896, frontispiece, shows a fringe of beard around the whole of his face. He was only 41 years old at this time.

XV. — (L.C.-5) *To Newcomb*

31st October 1877.

My dear Sir—

Many thanks for your *most welcome* packages. Believe me I most thoroughly reciprocate to you and your family the kind feeling which you express and which I deeply appreciate. I beg to congratulate you on what I presume to be an improvement in your official position in being entrusted with the superintendence of the Nautical Almanac and wish you health and long life to enjoy this and all the other honors and distinctions which you have so fairly won. Cayley who is my oracle always speaks of you in the highest terms. Our numbers at the J. H. U. do *not* increase as fast as might be desired but our authorities appear content with the progress we are making. But will not the outside public sooner or later make a grievance of our limited

numbers! I fear that day will come when that would be the case. The falling off of our income from the diminished dividend on the Baltimore and Ohio stock is also a hindrance to our more immediate development. Of course you will please to accept these remarks as confidential I enclose a \$5 bill to cover the expense of the last three packages and the preceding amount. Any balance can be taken on to count when I receive my next portion which I shall be glad to do Many thanks for your most kind offer of a desk in your office I shall hope ere long to run over to Washington for a few days to have the pleasure of seeing you and the Henrys to whom please give my kind regards The new theory gives me constant occupation and takes almost exclusive occupation of my thoughts—there is so much to be done on it both in the way of extension and of filling up.

Ever yours truly
J. J. Sylvester

Profr Newcomb.

In Sept. 1877 NEWCOMB was appointed senior professor of mathematics in the U. S. Navy with the relative rank of Captain, and also superintendent of the American Ephemeris and Nautical Almanac Office. — In the course of a commemoration day address at J. H. in 1877 (printed in full in *Coll. Math. Papers*, v. 3, p. 72-87; *E.T.*, v. 30, Sept. 1877) SYLVESTER made the following remarks: "One of our great English judges observed on some occasion, when he was outvoted by his bretheren on the bench (or, perchance, it may have been the twelfth outstanding jurymen, who protested that never before in his life had he been shut up with eleven other such obstinate men), that 'opinions ought to count by weight rather than by number,' and so I would say that the good done by a university is to be estimated not so much by the mere number of its members, as by the spirit which actuates, and the work that is done by them." And on through a long paragraph the quality of students at J. H. U. is lauded.—The "new theory" was in connection with the "New Algebra" which GEORGE BRUCE HALSTED insisted on learning. As a consequence (see above address p. 76) "My brain took fire, I plunged with requickened zeal into a subject which I had for years abandoned, and found food for thoughts which have engaged my attention for a considerable time past, and will probably occupy all my powers of contemplation advantageously for several months to come."

XVI. — (L.C.-6) *To Newcomb*

Baltimore, Monday 14th Jan. 1878.

My dear Profr. Newcomb—I fear you must judge very ill of me for not at once writing to acknowledge your most kind

letter and enclosure for our Journal. But for the last few days I have been out of myself from toothache and neuralgia. The offending tooth has been today removed; the neuralgic pains still continue but will I suppose disappear in the course of time with the exciting cause. I will begin with your number "2." The first number of the Journal is now going through the press but I fear will not be out before the end of this month at earliest. Your paper worthily occupies the place of honor as our first article. Mr. Hill's paper is ready to be printed off—it appears to me to be a most valuable one—and we are most obliged to you for giving it us. It is rather a curious coincidence that he divides space into two parts by a surface got by making a square equal to zero—precisely as I do in the third part of my Trilogy in the Phil. Trans. for a very different purpose of course. If I remember right Mr. Hill's surface is of the 8th degree. Mine is of the 9th (the "amphigenous" surface) and a model of this has been constructed in plaster at the expense of the Royal Society.

(1) I have been occupied for the last week or two in completing my paper for the Journal and this has driven all other matters for the time out of my head—and I shall now have to be busy for some time to come in preparing my lectures for the university class which I resume in a day or two; so that I cannot at present fix a time for availing myself of your most kind and friendly offer for which I feel deeply grateful. Nothing would give me so much pleasure as to pay a visit to Washington when I can do so with a clear conscience and renew my acquaintance with Mrs. Newcomb and your dear little girl. My paper is on an application of the graphic method of Atomicity (Kekulé's) to the theory of Invariants. I feel anxious as to how it will be received as it will be thought by many strained and over-fanciful. It is more a "reverie" than a regular mathematical paper. I have however added some supplementary mathematical matter which will I hope serve to rescue the chemical portion from absolute contempt. It may at the worst serve to suggest to chemists and Algebraists that they may have something to learn from each other. I draw a parallel between *chemical atoms* and "quantics" between the "bonds" of the "atoms" and the factors of a quantic between "compound radicals" and "covariants" between "chemical substances" and "invariants" and

find that "free valence" corresponds to "degree" and "the number of bonds" to "Algebraic weight." This must appear to you very much of the nature of moonshine—but by aid of these analogies I can give an unmathematical audience some notion of the objectives and methods of the invariantive calculus. I have also ventured upon some purely chemical suggestions which seem to me to make the "Bond" or "Valence" theory more consistent with itself—without affecting in any way the existing chemical constructions. I wonder what the chemists will think of my "cheek." What a wonderful piece of news this liquifaction of oxygen!

Now to the most important part of your letter the paper "on the Eulerian functions."

These happen to be old acquaintances of mine I have called them Cumulants. I have not read Euler's paper anent them but I shall do so if possible. In my memoir "On Syzygetic relations" in the *Phil. Trans.* you will find them spoken of. It happens also (but I had forgotten it) that I have written about them in the *Phil. Mag.* A certain Mr. Mure has also written one or two papers about them in the *Phil. Mag.* and being at first unaware of my papers relating to them called them "Continuants" and has had the bad taste to "continue" doing so. I am not quite sure whether his last paper on the subject is in the *Phil. Mag.* or in the *Proceedings of the Mathematical Society* or some other of our English Mathematical journals. After this you will not be surprised by my saying that the theorems and properties that you have rediscovered are most of them familiar to me. Story and I both think that whether new or old the theory as you have put it together will supply a want to the American public and will be a useful article for our *Journal*. But if you have not read the papers to which I have alluded you would probably like to do so before publishing your paper—and to refer to the original sources where you may have happened to have been anticipated. I hope you will not mind reverting to one of the two names previously applied to your Eulerian functions. Of the two mine still seems to me the most appropriate and suggestive—as applying the process of formation by the continual accretion of new elements. If you have not kept a copy of your paper and would like to have it for the purpose of

adding new notes or observations I can return it to you for that purpose on being made acquainted with your wishes on the subject.

Wishing you all many happy returns of the new year and with my Kind regards to Mrs. Newcomb and Anita, believe me,

Yours most truly

J. J. Sylvester

The first number of *A. J. M.*, v. 1, did not appear until after 17 March 1878 (see Letter XVIII). The first article was NEWCOMB's "Note on a class of transformations which surfaces may undergo in space of more than three dimensions." G. W. HILL's notable paper, "Researches in the lunar theory," was continued in two later numbers of the volume (compare Letter XXIX). On p. 18 HILL sets the "square of the velocity" equal to zero and thus gets the equation of a surface of the sixteenth degree (not "eighth") "which separates those portions of space, in which the velocity is real, from those in which it is imaginary." SYLVESTER's "Trilogy in the *Phil. Trans.*" is his great memoir on NEWTON's rule in v. 154, 1864 (*Coll. Math. Papers*, v. 2, p. 376-479). The "amphigenous surface" is defined on p. 436. SYLVESTER's paper referred to is the one in the first number entitled "On an application of the new atomic theory to the graphical representation of the invariants and covariants of binary quantics,—with three appendices." With regard to the matter in this paper, SYLVESTER wrote on Jan. 1, 1878 to *Nature* a letter on "Chemistry and algebra," v. 17, 7 Feb. 1878, p. 284. The last paragraph of this letter is as follows: "I have thus been led to see more clearly than ever I did before the existence of a common ground to the new mechanism, the new chemistry, and the new algebra. Underlying all these is the theory of pure colligation, which applies indistinguishably to the three great theories, all initiated within the last third of a century or thereabouts by EISENSTEIN, KEKULÉ, and PEAUCELLIER." In the same volume of *Nature*, (p. 309) it is pointed out that the conception of valence or atomicity attributed to KEKULÉ by SYLVESTER was certainly evolved by others at an earlier time. For SYLVESTER's reply see *A. J. M.*, v. 1, p. 89. See further comment on this paper in Letter XVIII.—NEWCOMB's paper "On the Eulerian functions" is considered more at length in Letter XVII; as a result it would seem as if NEWCOMB never offered the paper for publication. SYLVESTER's memoir, "On the theory of syzygetic relations of two rational integral functions..." appeared in v. 143, 1853, of the *Phil. Trans.* (see *Coll. Math. Papers*, v. 1, p. 429-586). Mr. "MURE" is the one who later became Sir THOMAS MUIR, and whose papers on continuants, referred to as in *Phil. Mag.*, are in s. 5, v. 3, 1877; for a full account of the subject, see T. MUIR, *The Theory of Determinants*, v. 3. As a result of MUIR's note on the word "continuant" in *A. J. M.*, v. 1, p. 344, SYLVESTER acknowledged that there was "sufficient justification" for its use.—ANITA was NEWCOMB's eldest daughter (see other references to her in Letters XXIII, XXIX).—Liquification of oxygen seems to have been first effected in 1877 by CAILLETET and VIETET.

XVII. (L.C.-7) To Newcomb

Private

30th Jany 1878.

My dear sir—I am very sorry that my young colleague wrote

you the letter that you returned to me to see. It would certainly not have gone had I seen it previously. He is inexperienced has seen little of the world has not a facile pen and had been suffering a great deal from illness and over work when he wrote. He mentioned to me that your proof had come back a good deal altered and *I am guilty* so far as I said to him—"you had better allude to it in a delicate way when you write to Profr. Newcomb." I don't think you would have minded this any more than I do similar *anticipatory* observations by Borchardt who has once and again besought me to make no more than absolutely unavoidable corrections of the press in the proof sheets he is sending over to me from Germany.—I am quite sure that poor Story meant no harm—although I also must allow that you had just cause to feel offended—so I must ask your free and generous forgiveness for him and for myself so far as I was accessory before the fact. (However what I wanted him to express had reference to the *future* and not to the *past*).

To begin with your postscript—(but first let me ask you to excuse the delay in my reply as I have still been in continually renewed suffering from neuralgia—and I have hardly been in condition to deal with the matter involving some little difficulty of explanation). I should say that the possibility of effecting what Tait in a recent number of the Educational Times calls a *Perversion* of a solid figure in 4-dimensional space ought to be susceptible of proof. I remember hearing 20 years ago that Sir W then plain William Thomson gave as his reason for believing in such space that he felt the necessity of being able to rotate a left-handed screw with a right-handed one.

In conformity with your desire I return with this your Mss. and subjoin the remarks you invite referring to the letters which I have marked in pencil in the Mss.

- A. is the same as my solution for Cumulants;
- B. is of course familiar—and I must frequently have used it;
- C. will not be necessary if you revert to the term Cumulant.
- D. The Determinant form of a Cumulant is given by me and subsequently by MURE.

Mure by the bye wrote to me that he is drawing up a history of continued fractions—if you could communicate with him it might be well to do so—but I have lost his address.

E. Is certainly a part of the Common stock of ideas in this subject. I remember Cayley telling me about 20 years ago — but cannot say where it is to be found.

F. This enumeration of the terms of the different quarters I do not remember seeing anywhere.

G. Is quite familiar to me and must I think be generally known—because one has to make use of it as a principle in getting rid of any fractional partial quotient in a continued fraction.

You have done so much in which no one has anticipated you that you can well afford to say in a matter of minor moment “*Pereant qui ante nos nostra dixerunt.*” Any man must be very lucky indeed to whom it has never befallen to have to emit a like malediction

Believe me My dear Sir,

Yours most truly
J. J. Sylvester

Profr. Simon Newcomb

The “young colleague,” Associate Professor W. E. STORY, was “associate editor in charge” of the *A. J. M.*—C. W. BORCHARDT was long the editor of *Journal für die reine und angewandte Mathematik*, founded by A. L. CRELLE.—I can find no place in *E. T.*, even for six years previous to this letter, where TAIT, discusses any question like that suggested. True one does find in *E. T.*, v. 29, 1876, p. 206 a review of TAIT’s *Lectures on some Recent Advances in Physical Sciences* and a quotation is made from p. 5-6 of “Introductory”; the last sentence of this is as follows: “So it is possible that in the rapid march of the solar system through space, we may be gradually passing to regions in which space has not precisely the same properties as we find here—where it may have something in three dimensions analogous to curvature in two dimensions—something, in fact, which will necessarily imply a fourth-dimensions change of form in positions of matter in order that they may adapt themselves to their new locality.”—The next paragraph refers to NEWCOMB’s paper, and MUIR’s results, already discussed in Letter XVI.—The Latin quotation in the last paragraph, attributed to ÆLIUS DONATUS (c. 360 A.D.), may be translated, “Perish those who said our good things before us!”

XVIII. — (B.P.E.-6) *To Benj. Peirce*

4 Cathedral St. Baltimore
17th March 1878.

My dear Peirce,

Mr Gilman tells me that he has asked you to name some day when you can if convenient combine a visit to Washington with

one to us at the University to dine with us and some of the supporters of the *Mathematical Journal* to celebrate its birth which is now daily expected and which you have done much to promote.

I do hope that you may be able to accept the invitation and that I may have the great pleasure of seeing you here. The publication has been delayed owing to the default of the printers but the last sheet is now about to be printed off and by the beginning of next week the *Journal* will I think be fairly launched.

I hope it may not disappoint the expectations of its promoters.

We have over a hundred annual subscriptions actually paid up so that I think it will not perish for want of external support. Story is a most careful managing editor and a most valuable man to the University in all respects and an honor to the University and its teachers from whom he received his initiation. We have some very promising mathematicians in our small troupe and two or three of them will, I believe, make their mark in the world of science and do something to be remembered by. I hope it will not be long before you fulfill your promise of sending us a contribution to the *Journal*—it will be very welcome. We have some good articles in hand for the second number. My life here is not very brilliant, and I have few resources out of my own rooms and quiet pursuits as I have not cultivated, perhaps, as much as I ought, social relations with the people of the place and they do not go out of their way to draw me among them. I cannot say that I have had much experience of the unbounded hospitality to which Baltimoreans lay claim. In June I hope to revisit Europe to pass my vacation there. I was pleased to see your son Charles on his way through Baltimore. You may have seen in our circular that I have a paper coming out in the *Journal* on an application of the Atomicity method of chemistry to Invariants. It is a mixture of guess work and reasoning and I am anxious but not at all sanguine as to the opinion that may be formed of it—but of the reality of the ideal connexion between the two theories I think there can be no question and that chemists and algebraists may gain ideas and suggestions in one science from the results obtained or sought for in the other—so that if as is possible some of the conclusions are faulty, the paper may still I hope be useful in its indirect quickening effect. Please

to present my kindest regards to the Ladies of your family and to Profr James and believe my my dear Peirce,

Your sincerely attached friend

J J Sylvester

“Mr. GILMAN” was the president of J. H. U.—The list of the first hundred subscribers was published in the first number of the *A. J. M.* (p. v-vii).—The “small group” at J. H. U. included THOMAS CRAIG, F. FRANKLIN, J. W. GORE, D. W. HERING, O. H. MITCHELL, S. NEWCOMB, C. S. PEIRCE, W. E. STORY, W. I. STRINGHAM, and SYLVESTER.—PEIRCE made no personal contribution to *A. J. M.*, he died 6 Oct. 1880 and at his funeral SYLVESTER and NEWCOMB were two of the ten pall-bearers. It is true that in *A. J. M.*, v. 4, two of PEIRCE’s papers were reprinted.—For a note on CHARLES see Letter XXII.—For a note on SYLVESTER’s paper in *A. J. M.*, no. 1, see Letter XVI.—WILLIAM JAMES, later to become the great psychologist, was at this time “assistant professor of physiology” at Harvard.

XIX. — (L.C.-9) *To Newcomb*

Baltimore

18th April 1878.

My dear Sir—We have not yet received your promised paper (from the third party) on an Astronomical subject for the Journal; our next number is more than filled up but it will be very acceptable for a later one. I have seen a letter from Klein of Munich in which he expresses great interest in your work in 4-dimensional space and asks for your address in order that he may write to you. As he cannot have seen your last paper on the subject in our Journal he must refer to your previous one in Borchardt.

I want to read a little more of Tait on Knots before sending it on to you—as I begin to take some little interest in the subject. I am hard at work correcting the proofs for the continuation of my paper for the next number (Story being absent) and in making additions to it as I want to have done with it for good and all, and to go on to something fresh. I hope you are getting ready another paper on the matter you mentioned to me and if you think Tait would be useful for that purpose (but I doubt it much for the subject seems to me not so much belonging to geometry as to an abstract theory of arrangements) I will send it on to you at once and you can return it when done with. I only returned here last Monday and have been kept too busy with Journal

matters to have been able to join the Scientific Association at Washington. Please give my kindest remembrances to Profr. Henry when you see him—(How is he?) and with kind regards to Mrs. Newcomb and the young ones of your family believe me

Yours Very truly

J. J. Sylvester

Profr. Newcomb.

FELIX KLEIN (1849-1925) one of Germany's prominent mathematicians of the nineteenth century, was professor of mathematics at the Technische Hochschule, Munich, 1875-80. The paper of NEWCOMB which attracted KLEIN's attention was "Elementary theorems relating to the geometry of a space of three dimensions and of uniform positive curvature in the fourth dimension," BORCHARDT's *Journal*, v. 83, 1877, p. 293-299.—JOSEPH HENRY (1797-1878), first secretary, and director, of the Smithsonian Institution, professor emeritus, College of New Jersey (1848-78). See also Letters XXI and XXII.—P. G. TAIT's 3 papers "On knots" were published in Royal So. Edinb., *Trans.*, v. 28 and 32, 1877, 1884, 1886 and in TAIT, *Scientific Papers*, v. I, 1898, p. 273-347, but it is naturally only the first of these (p. 273-317) to which SYLVESTER had reference.

XX. — (C.U.-55) To A. Cayley

Baltimore Jan 11 1879

Dear Cayley. You will have seen in the *Comptes Rendus* I had already made the correction necessary for the N. G. F. of the 7^e. Your paper will appear in our next number—it was too late for the one just out. It is a most valuable and beautiful idea. I had *recalculated* it *de novo* using Euler's theorem for Ruled Partitions—and keeping to the known units as you do—and thought very probably this was the "methode [*sic*] propre à vous" but I see [I] was mistaken. Our work by my new method is probably about 75 pct. less than by the old, say reduced to 1/4th of what it was—and Franklin and I estimate that the work by your method is about 2/3d of that by the new one. I shall probably use your method for the 9^e and 10^e. What do you think of the fact brought to light in the 7^c that there is *no finite canonical form* for this case : see *Comptes Rendus*. If my Postulate is true, there is no Irreducible Invariant of the degree 20 or any other multiple of 10. This discovery it was which led me to scrutinize your table thinking that possibly this result was due to an error therein : and an error as you know we found but one which has no influence on this result.

Do you think that the £80 can be better applied than in going on with the calculation of the N. G. F. immediately of the 9^e —10^e the (2.5)^e and other systems? I think not as the example of the 7^e shows that there [are] new phenomena to be brought to light. Have I a right to charge the recalculation of the N. G. F. to the fund or not? Franklin is such a Calculator as probably has no superior (indeed I am sure he has none) in the whole world (for I have had experience of calculators before) and it seems a pity not to utilize such a force when it is at hand. But please write me yr views and wishes on the subject. — I am very glad Mrs Ferrers is quite recovered and trust that they will have long years of uninterrupted wedded happiness to come. Congratulate him from me on this (if allowable) and certainly on Gilbert's achievements and high promise.

Let us have another letter from you as soon as possible—why shd we not unite the Quarterly and the American! have you ever thought of this—? With kindest regards to your wife children and sisters and best wishes for many happy returns of the New Year believe me your's most truly

J J Sylvester.

Next number will contain a bibliography of the Pascal Hexagram question in which yr name often occurs as well as Kirkman's Cremona's and a certain *Veronese* the last writer on the subject with some additions by the Author Miss Ladd herself who is staying this year in Baltimore and attends my lectures. She is going to try and will no doubt obtain a Doctor's degree.

CAYLEY's paper, "Calculation of the minimum N. G. F. [numerical generating function] of the binary seventhic," appeared in *A. J. M.*, v. 2, 1879, p. 71-84. SYLVESTER's correction and note was in *Comptes Rendus*, Paris, v. 87, 9 Dec. 1878, p. 899-903. "EULER's theorem" of partitions is doubtless the one which states

$$(1 - x)(1 - x^2)(1 - x^3)\dots = \sum_{j=-\infty}^{j=+\infty} (-1)^j x^{\frac{3j^2+j}{2}}, \quad \text{EULER, "De$$

partitione numerorum," *Nov. Comm. Acad. Imp. Petrop.* v. 3, 1753, p. 125.—The incomparable "calculator" was FABIAN FRANKLIN (1853-), associate professor of mathematics J. H. U. (1879-95), who married (1882) the Miss CHRISTINE LADD (1847-1930) referred to. Her paper on "The Pascal hexagram" occupied p. 1-12 of v. 2 of the *Journal*. Though women were not admitted to Johns Hopkins SYLVESTER persuaded the Univ. to admit her on a special status, and even to grant her a fellowship which she had for three years, or till 1882. By that time she had qualified for the degree of Ph. D., but the Univ. did not grant

her the degree until 1926. (See *Dict. Amer. Biog.*, v. 10, 1933).—The grant for the computation was made by the committee of the Br. A. A. S. of which CAYLEY was chairman. Mrs. FERRERS was the wife of NORMAN MACLEOD FERRERS (1829-1903) the mathematician and F. R. S., and master of Gonville and Caius College (1880-1903).—That the question of uniting the *Quarterly Journ. Math.* and *Amer. Journ. Math.* was ever raised, is of interest.

XXI. — (L.C.-10) *To Newcomb*

28 Cathedral Street
23rd Mch 1879.

My dear Profr. Newcomb,

I am afraid that you may have thought me ungrateful in not having written to say I was prevented from paying you my promised visit about 3 weeks ago Please be assured that there is no one whose society is more pleasant and agreeable to me than that of your amiable family and that of your own. It is an act of self-denial that I practice when I defer my visits to you at the last moment something always springs up that requires to be attended to and defeats my intention of making a holiday. I have not stirred from this place except on the melancholy occasion of Profr. Henry's death for the last twelvemonth or nearly so. I see that Todd has got married. Please present him my kind regards and congratulations to the happy pair with thanks for his courtesy in sending me cards.

Begging to be kindly remembered to Mrs. Newcomb and the children believe me

Yours very truly
J. J. Sylvester.

I have just completed a new poem on a local subject and an actual street occurrence which I will have the pleasure of sending you a copy of in a day or two. It is all about a lady in this city whom I don't know and who is the same to me as any other of her charming sex neither more nor less—a pure play of *fancy*—but I am told by some who know her that the *character* is very well hit off. It extends over 150 lines mostly in the “*Key of in.*” I defy you to guess what that means.

For a note on Professor HENRY see Letter XIX. DAVID TODD, the astronomer, was married 5 Mar. 1879. He was chief assistant on the Nautical Almanac

(1878-81), and professor of astronomy and navigation, and director of the Observatory, Amherst College (1881-1920).—The poem referred to in the post-script is "Spirits Début," a description of which is given above in the Section on "SYLVESTER'S Poetry."

XXII. — (B.P.E.-7) *To Mrs. Benj. Peirce*

25th March 1880

My dear Mrs. Peirce—It gave me very great pleasure to see you again and no less to hear from you and receive a letter written in so kind a strain. It is gratifying to me to receive the intimation of your approval of my rhymes—if there should be any person to whom you think the possession of a copy of them would be agreeable, I should be delighted to forward to you as many copies as you might desire.

I only wish to distribute copies to parties who would desire to have them and give very few away in Baltimore.

It is possible that I may be Charles' companion on board the *Amérique* next month as our Governors have in the kindest manner acceded to my request to be allowed to leave for Europe this year a month earlier than usual to enable me to attend the meetings of learned societies and meet the Savants before they are on the wing for their summer vacation.

I am glad your son likes his work and seems to be well satisfied with his location here. I feel that my connexion with Johns Hopkins has given me a new lease of mathematical life and activity and it is to your husband in connexion with the late Prof. Henry of honored memory to whom I am almost exclusively indebted for bringing the connexion about—

I have everything (except *one*) that I could reasonably desire and am exempt from all but trivial annoyances so that I have every reason in the world to think well of America and Americans.

Our December number of the *Journal* still tarries in coming out, but in a few days I believe will be ready to be issued—It will be a glorious number and two contributions from Charles (to be followed by another of very great interest and importance in the number after this) will form not the least interesting part of its contents. It opens with Tables of Invariants and

concludes with two dissertations on the 15 puzzle. So you see we take a wide range. But I tell Dr. Story that the 15 puzzle will be the gem of the number and help to make the other matter go down.

With my kindest regards to the Professor and all the members of your family believe me my dear Madam—

Yours most truly
J. J. Sylvester.

The "rhymes" to which reference is made are doubtless those in "Springs Début" issued in printed form in the previous January, and referred to in Letter XXI as completed in 1879.—Mrs. PEIRCE's distinguished son CHARLES S. (1839-1914) was a lecturer at J. H. U. (1880-82). His two articles in *A. J. M.*, v. 2, Dec. 1879, are "On the ghosts in RUTHERFORD's diffraction spectra," and "A quincuncial projection of a sphere." See Letter XVIII.—W. W. JOHNSON and W. E. STORY contributed the notes on KIRKMAN's "15" puzzle.—The "Professor" would be Mrs. PEIRCE's son, J. M. PEIRCE, in the mathematics department at Harvard.—On 25 Aug. 1875 HENRY wrote SYLVESTER a letter regarding the future university at Baltimore; this letter is printed in *Science*, n. s., v. 5, 16 Apr. 1897, p. 602. Part of the letter reads as follows: "I have mentioned your name prominently as one of the very first mathematicians of the day; what the result will be, however, I can not say... It would give me great pleasure to have you again, as my guest, and I will do what I can to secure your election." Presumably SYLVESTER was HENRY's guest before in 1843; HENRY was the first secretary of the Smithsonian (see Letters II and XIX).

XXIII. — (L.C.-11) *To Newcomb*

[The first two paragraphs of this letter written from Baltimore and dated 18 Jan. 1881, are omitted; the conclusion is published below].

I gave a lecture the other day at the scene of your former display the Hopkins Hall here, as I had been asked to contribute to the scientific lectures for the public to be given by our "scientific professors" So I chose "the Laws of Verse" as my subject as I happened at the time to be engaged in polishing up some old sets of verses. It went off very satisfactorily. I think I shall be able to give 5 poetical translations from Latin and German to the world superior to anything of the kind that has ever appeared in the English language—bold as this assertion may appear, as much superior as the New Algebra and the New Geometry to the Old. You seem to have sent us a splendid contribution for which I very much thank you and believe it will add to your

laurels and our own reputation. With my kind regards to Mrs. Newcomb, Anita and the rest of yr family believe me

Yours Very Truly

J. J. Sylvester.

SYLVESTER's lecture on January 7 was the first of 17 lectures (the last on Feb. 4) by "the Scientific Professors, at the special request of the Trustees." The other four professors, who each gave four lectures on his specialty, included REMSEN, on topics in chemistry, and ROWLAND, on the conservation of energy.

XXIV. — (H.U.-1) *To C. E. Norton*

Baltimore

20th Febr 1881

My dear Prof. Norton,

Very many thanks for your pleasant and suggestive letter and for the information therein conveyed. If ever you write to Stringham I shd. feel much obliged if you would tell him with my kind regards that I received his letter with great pleasure when I was on the continent of Europe and intended answering it but unfortunately the letter got mislaid and I have not even yet succeeded in recovering it. If he will write me again he may rely upon an immediate reply.

Enclosed are some printed pages of the Europa and the other later ode which I should feel much obliged by your taking the trouble to substitute for the corresponding ones in the proof previously sent. Most of the present corrections are in fact restorations of earlier and better readings. I have about a score more of small pieces enough with those in yr possession to make about a hundred or more *small* printed pages. With notes and an introduction the matter might be made to extend even for 125 to 150 pages possibly. What could I do to get rid of this perilous [?] stuff which weighs upon the brain, so as to have done with them for good and all? I should like to publish a new edition of my laws of Verse which would take all this in. Would it be possible (do you think?) without taking too much trouble to find an American publisher?

Yours Very truly,

J. J. Sylvester.

The Stringham here referred to is doubtless SYLVESTER's former student W. I. STRINGHAM (1849-1909) who took his Doctor's degree at J. H. U. in 1880 and was studying under KLEIN in Leipzig at the time this letter was written. He was professor of mathematics at the University of California 1882-1909.—The meaning of the second paragraph of this letter is clear after perusal of the commentary concerning the fifth item in the section on "SYLVESTER's Poetry" discussed above.

XXV. — (L.C.-14) *To Newcomb*

Johns Hopkins University

20th October 1881.

My dear Sir,—

I used the last of the paper which I owed the possession of to yr kindness when I was in England. If it would be in yr power to procure me a quantity more, without putting yourself to inconvenience, I should feel truly obliged by your doing so. All the matter for Vol. IV, No. 1 of the Journal is in the press and I hope will be published early next month. Have you anything fresh on hand that would be valuable for the Journal? Any article from you will always be most welcome. Could not you induce Mr. Hill to resume his highly valuable contributions to the same? Who is to be the new superintendent of the Coast Survey? Why should you not allow it to be known that you would accept the appointment supposing you would be willing to do so! Profr. & Mrs. Cayley are expected here about Jany 3. His course of lectures in the university is to be "Analytical Geometry and the Abelian and Zeta functions." He will have a class of 10 or 12 from our students and teachers.

Kind regards to Mrs. Newcomb and the children from

Yours ever truly
J. J. Sylvester.

Profr. Newcomb.

In several letters SYLVESTER appeals to NEWCOMB for letter paper, apparently, such as is here referred to.—The request for a contribution from HILL seems to have met with success since he contributed to v. 4, "Note on HANSEN's general formulae for perturbations."—ARTHUR CAYLEY, (1821-95) was a senior wrangler in 1842 and was a lecturer at J. H. U. Jan.-June 1882.

XXVI. — (C.U.-58) *To Miller*

New Coll
8th May 1889.

Dear Mr Miller,

I am glad you like my questions. The one on Electoral voting is all right and I return it to you accordingly. Very likely the formulæ are given in some books on logic or on life insurance for they belong to either subject—but I am inclined to think that formula 2—has never been set out so completely and explicitly before. The non-appearance of n in the formula $P_i (1 + P_1)^{-i-1}$ is I think a very interesting feature.

The two questions asked back were the one you have returned about a necklace of beads and another one bearing on the same question in an imperfect form sent before it on the same day (Sunday). I hope you are well and remain

Yours very truly
J. J. S.

The letter is written from New College, Oxford. The first problem referred to in this letter was no. 10140 in *E.T.*, v. 42, June 1889, p. 261; no solution seems to have been published. The problem is as follows: “(1) If the probability of i or more out of a constituency of n persons (all equally likely to vote) going to the poll at a certain election, is p_i show that the probability of exactly i electors doing so may be symbolically represented by

$$\frac{\pi(n)}{\pi(i)\pi(n-i)} p_i (1-p)^{n-i}$$

with the convention that the laws of interpretation are to be the same for subscript as for superscript indices. Thus *ex. gr.*, $p_3 (1-p)_5$ is to be interpreted to mean $p_3 - 5p_4 + 10p_5 - 10p_6 + 5p_7 - p_8$.

As a particular case the probability of no persons voting will be $(1-p)n$.

“(2) If P_i represent the sum of the probabilities of every combination of i electors voting with or without the others any others, show that the sum of the probabilities of every combination of i (and no more) voting may be expressed under the same convention as before by $P_i (1 + p_i)^{-i-1}$.”

“* * * P_∞ will be liable to become infinite, or the series to diverge and the formulæ become futile, if the constituency is infinitely great; but, in the practical application of the theorem the number of voters is necessarily limited, and then P_j becomes zero whenever j is greater than the limiting number. As an example, let the limit be 5, and let Q_i represent the sum of the probabilities of all the combinations of i electors voting without any others; then we shall have

$$\begin{aligned} Q_5 &= P_5, Q_4 = P_4 - 5P_5, Q_3 = P_3 - 4P_4 + 10P_5, \\ Q_2 &= P_2 - 3P_3 + 6P_4 - 10P_5, Q_1 = P_1 - 2P_2 + 3P_3 - 4P_4 + 5P_5, \\ \text{and } Q_0 & \text{ (the probability of no elector voting)} = 1 - P_1 + P_2 - P_3 + P_4 - P_5. \end{aligned}$$

It must be understood that the above formulae have a purely logical basis and that the probability of A and B both voting is not to be assumed as known when the probabilities A and B separately voting are given; *i.e.* A's voting and B's voting are not to be treated as independent events. Essentially the theorem is one of things and not of quantities."

The second problem, no. 10180, in *E.T.*, v. 42, July 1889, p. 293, is as follows: " n round beads of equal size are arranged in a circular necklace each in contact with its neighbor on either side. i of the beads it is required shall admit of being cut by the same right line. Find the least value of n that will serve to fulfill this condition." A solution was published in *E.T.*, v. 42, Oct. 1889, p. 436; and in *E.T.R.*, v. 52, 1890, p. 76. *Note in the page proof*: Until too late it was not noticed that this Letter should come after XXVIII.

XXVII. — (L.C.-16) *To Newcomb*

Baltimore.

18th Jan'y 1882.

My dear Profr. Newcomb,—

Hermite writes to me from Paris as follows " M. Newcomb votre illustre concitoyen (*sic?*) Américain fait aussi partie du petit nombre des savants de l'étranger qui reçoivent le même ouvrage, et si vous le trouvez convenable je vous serai reconnaissant de l'en informer de ma part.

Dans quelques semaines vous receviez tous deux le premier volume aussi que la notification officielle qui vous sera adressée au nom de l'Académie par le secrétaire perpétuel M. Bertrand."

The work referred to is a complete edition of Cauchy's works in 25 Vols.

It is a magnificent gift.

Yours Very truly

J. J. Sylvester.

As suggested, the first volume of *Œuvres Complètes d'Augustin Cauchy* was published in 1882, but even at the time of SYLVESTER's death in 1897 only 14 v. had been published; and when NEWCOMB died in 1909, but 20 v. were out. The twenty fourth appeared in 1932 and the twenty fifth (s. 2, v. 2) has not yet been published.

XXVIII. — (L.C.-17) *To Newcomb*

Athenaeum Club

Pall Mall

26th July 1883.

Dear Profr. Newcomb—This is written from Cambridge where

I am trying to settle down to write mathematics—so far a vain attempt. I handed over your esteemed letter to Gilman whose name occurs in it and forgot to get it back from him. He is now on the continent—when I last heard from him at Antwerp. I could not write to you before with the certainty that my letter would reach you as you did not give any address except Neuchatel (pur et simple). Mrs. Cayley has supplied me with the more specific one. She and the Todhunters speak of the favorable impression Anita produced during her stay here. My kind regards to her and her mother and the rest of the young ones. I had hoped to be appointed Profr. at Oxford to succeed the late Henry Smith : the sad death of Spottiswoode I *believe* has frustrated at all events for the present and possibly for good and all that expectation. The election that was announced for the 7th Inst. is postponed until in December next. Possibly I may withdraw my candidature to make room for younger men—and to avoid the mortification of a refusal. I expect however to remain in England on extended leave asked for but not yet obtained until the end of this year. The trustees of Johns Hopkins will have a perfect right to put before me the alternative of returning to Baltimore *animo morandi* or to resign. In the unfortunate absence of your letter I must ask your forgiveness if I leave any topics referred to in it unanswered I am altogether uncertain as to my future movements and ill at ease in mind—but in good (so-called) bodily health—if it is being well to be fit for nothing. With my best wishes and thanks for yr recollection of me and hoping soon to hear from you again believe me Yours with sincere regards
J. J. Sylvester.

ISAAC TODHUNTER (1820-84), author of many popular mathematical works, spent most of his life in Cambridge.—As to “Anita,” see Letter XVI.—WILLIAM SPOTTISWOODE (1825-1883), mathematician and physicist, president London Math. So. (1870), president B. A. A. S. (1878), president Royal Society of London (1878), was buried in Westminster Abbey.—*Animo morandi* is doubtless to be interpreted, “with the intention of staying.” SYLVESTER returned to J. H. U. and did not leave there until Dec. 1883. The first paragraph of his inaugural address at Oxford 12 Dec. 1885 (*Nature*, v. 33, Dec. 1886, p. 222, *Collected Mathematical Papers*, v. 4, p. 278) is as follows : “It is now two years and seven days since a message by the Atlantic cable containing the single word “Elected” reached me in Baltimore informing me that I had been appointed Savilian Professor of Geometry in Oxford, so that for three weeks I was in the unique position of filling the post and drawing the pay of Professor of Mathematics in each of two

Universities : one, the oldest and most renowned, the other—an infant Hercules—the most active and prolific in the world, and which realises what only existed as a dream in the mind of Bacon—the House of Solomon in the New Atlantis.”

XXIX. — (L.C.-18) *To Newcomb*

Hôtel Wagan
208 Rue de Rivoli 208
Paris

8th Jany 1891.

My dear Profr. Newcomb—

How ill mannered and ungrateful you must think me for leaving your letter of Nov. 24 now lying before me and which since its receipt has been Continually in my thought, so long unanswered. But I ought not even to have waited for this to write to you to express to you as I do now my most hearty and joyful congratulations on the distinction conferred on you or rather upon the recognition of your just deserts by the award of the Copley Medal the second which has followed to the Profr. of Mathematics at the Johns Hopkins University. I have been here since early in December and stay on for the benefit of a malady in my eyes for which I am being daily treated by an eminent oculist here Dr. Galizowski. The affection for which I am being treated is that of the Lacrymyl [*sic*] Ducts—and I think the treatment which is of a surgical character is doing me great good. But besides that I have lost the use of one eye by Cataract and the other is affected with an incipient form of the same affection—for which there is no help but the extraction of the lens when the proper time arrives What you say about the premature intellectual extinction of the J. H. geniuses always struck me very forcibly. Is there no help for it? Can nothing be done to keep the men together after they have taken their degrees?—I hope you will be able to take your projected tour with your affected limb restored to its normal condition this summer and that we may meet in Oxford or in London. I have just received a lithograph paper from Stone our Radcliffe Observer “on the use of Newcomb’s Correction to Hansen’s Lunar tables etc.” They speak great things here of Poincaré’s prize memoir in the Acta—and he

seems to have taken some of his most fruitful ideas from Hill of whom he speaks most highly both (as I noticed [?] in the memoir) and also in conversation as has been the case in talking with me. All the French Mathematicians young and old bow their heads before Poincaré whom they regard as the greatest Mathematician in Europe and who is as simple and modest as he is eminent. Please give President Gilman and Mrs. and Miss Gilmans my Kindest regards. I hope all is well with your family and beg to be Kindly remembered to such of them as may remember me. Your clever daughter is I think married. What is the case with the rest? Truly thanking you for your letter and with the sincerest good wishes believe me ever your attached friend

J. J. Sylvester.

The Copley Medal (accompanied by a check for £50) was awarded to NEWCOMB in Nov. 1890; SYLVESTER received the Medal ten years earlier.—In 1879 NEWCOMB published a "Note on the correction of the mean longitude of HANSEN's lunar tables," and in 1884 a "Note on Mr. [E. J.] STONE's explanation of the error of HANSEN's lunar tables."—It is curious that SYLVESTER spells incorrectly the name of the great POINCARÉ whose 270-page memoir crowned by the King of Sweden in Jan. 1889 is in *Acta Mathematica*, v. 13. It is entitled "Sur le problème des trois corps et les équations de la dynamique." HILL's results, praised by POINCARÉ, were in his remarkable memoir discussed in notes to Letter XVIII—The "clever daughter" is undoubtedly ANITA who was married in Feb. 1888 to W. J. MCGEE; her sister EMILY K., was married in Apr. 1890, but her youngest sister ANNA JOSEPHA did not marry until 1896.—I am by no means sure that my interpretation of SYLVESTER's writing ("as I noticed,") is correct.

XXX. — (C.U.-59) *To E. M. Langley*

New College
29th Sept 1891

Private

Dear Mr Langley,

With reference to my note of yesterday's date, I should be sorry if you were to infer from it that I did not consider the representation proposed to be made to the Board of Faculty as reasonable *in itself*. But as a member of that Board, I should be placing myself in an anomalous position in signing the Memorial. It will not as I have written and still think produce any immediate

effect if presented but I am not prepared to say that it may not be useful as a protest against the present unreasonable course pursued in the Geometry pass examinations and if it came before the Board and I were referred to on the subject, I should of course express the opinion I entertain of the desirability of what your address recommends being adopted — but there are I am aware good grounds for believing that no measure would have a chance of being adopted which might appear to increase the difficulty of the existing pass examinations.

May I inquire whether there was any meeting of the Council at which it was agreed to present such an address? I do not remember the subject being mentioned at the only general meeting at which I was present : If I am not mistaken in this point and there was a meeting where I was not present but the principle of presenting such [an] address was agreed to, might it not be possible for you to get the document signed by the Hon. Secs and the Chairman of that meeting on behalf of the Council?

Please feel assured that I have the best feelings towards the Association but at the same time feel that I am quite unable to perform the duties which ought to attach to the office of its president. Have you thought of Dr Hirst or Henrici or Esson? Any one of these would (if willing to act) make in my opinion a satisfactory and useful President : far better than

Yours sincerely
J. J. Sylvester.

At this time SYLVESTER was president of the Association for the Improvement of Geometrical Teaching (A. I. G. T.) and E. M. LANGLEY (Portrait and biographical sketch in *Math. Gazette*, v. 7, 1913) was one of the honorary secretaries. In *Report* 19 of the A. I. G. T., 1893 (p. 5-7) it is noted that early in 1892 the Council presented a memorial to the Board of the Faculty of Natural Science at Oxford drawing attention to a serious defect in the pass examinations in geometry. The reply of the chairman of the Board is published.—SYLVESTER's failing health (he was then 77) compelled him to resign the presidency after one year in office. He was followed by CHARLES TAYLOR. Dr. T. A. HIRST was the first president of the A. I. G. T. As to ESSON, see Section II, under 1894.

Postscripts

Since Sections I and IV of this paper were written I have discovered that a copy of SYLVESTER's first mathematical publication of 1836 is listed in the *Catalogue of the Books and Tracts on Pure*

Mathematics (1901) in the Newcastle-upon-Tyne Public Library.

In Section V I neglected to give the explanation of SYLVESTER's reference to "acts of insubordination on the part of two students" while Professor BRUCE's account refers to only one student, BALLARD, that is, Wm. H. BALLARD of New Orleans. The incident happened on 21 Feb. 1842. At the faculty meeting on 23 Feb. SYLVESTER gave an account of it, and later during that meeting BALLARD and other students were summoned to give testimony. In addition to BALLARD, W. F. WEEKS gave a vivid account of the affair, after SYLVESTER had left the room. At a faculty meeting held on 24 Feb. SYLVESTER, who meantime had opportunity to read the record of WEEKS's testimony, denied the accuracy of much of it, and spoke derogatively of WEEKS as a student. It seems possible, therefore, that in referring later to insubordination he was linking WEEKS with BALLARD.

Brown University

RAYMOND CLARE ARCHIBALD

31 July 1935.