

NORMAN MACLEOD FERRERS. 1829—1903.

The Rev. Norman Macleod Ferrers was born at Prinknash Park, Gloucestershire, on August 11, 1829; his father being Thomas Bromfield Ferrers. He was educated at Eton and entered Gonville and Caius College in 1847. He was Senior Wrangler in the Mathematical Tripos, 1851, and became first Smith's Prizeman immediately after. After a short period, during which he studied law, in London, and was called to the bar at Lincoln's Inn, he returned to Cambridge and took orders. He was ordained Deacon in 1859 and Priest in 1860, by Bishop Turton, of Ely. He then began to hold in succession many offices in College. He was Dean for five years and became a Senior Fellow in 1861. In 1865, the Rev. C. Clayton resigned the Tutorship of the College on being presented to a living by the Bishop of Ripon. The Master of Caius College then divided the office between Ferrers and the Rev. B. H. Drury.

When the British Association met in Cambridge, in 1862, Ferrers was one of the local Secretaries.

His chief recreations at this period were his walking trips in Switzerland and at home. The present writer has several times accompanied him on these tours. As was then the custom we walked over the hills with our knapsacks on our backs, indifferent to all conveyances and sometimes without having settled where we should stay for the night. That he thoroughly enjoyed them was evident, and no doubt the loss of his walking power later on must have been a great deprivation. He used often to count how many times he had ascended Helvellyn; more than twenty times, he told the writer, and on one occasion he did this twice on the same day. Though so fond of mountains he did not attempt any of the more dangerous ascents in Switzerland, but contented himself with such difficulties as were presented at that time by the Titlis. He also regarded a Christmas trip to Rome as one of the events of his life, a mine of pleasing recollections, as he called it. In returning he travelled *over* Mont Cenis; this was done on sledges on which the diligence was placed after being separated from its wheels.

On April 3, 1866, he married Miss Lamb, daughter of Dr. Lamb, Dean of Bristol and Master of Corpus Christi College, Cambridge. During the following years, and until his election to the Mastership of his College, he resided first in Hills Road, and then for twelve years in Brookside, where all his children were born. Here also he seems to

have given a few private pupils the advantage of residing in his house. In 1876, he was appointed a Governor of St. Paul's School, and in 1885, a Governor of Eton College. From 1855 to 1891 he was the acting editor of "The Quarterly Journal of Mathematics," assisted first by Sylvester, then by Cayley and other distinguished mathematicians. He was elected an F.R.S. in 1877, being admitted on the same evening as the late Emperor of Brazil.

On October 12, 1880, Dr. Guest resigned the Mastership of the College, dying about six weeks after, and Ferrers was elected to fill the vacancy on October 27. He was admitted to the degree of D.D., *jure dignitatis*, along with James Porter, the late Master of Peterhouse, on June 7, 1881. The honorary degree of LL.D. was conferred on him at the University of Glasgow, in 1883.

It was in the winter of 1879 that he felt the beginning of those rheumatic symptoms which afterwards made him a complete cripple. He thought nothing of them then, but no remedies could stop the steady progress of the disease. He died at the Master's Lodge, on January 31, 1903, at the age of 73. The burial service was read in the chapel, crowded to its utmost extent, and at its termination, in accordance with the old custom in many colleges, the dead Master was carried round the Court, preceded by the choristers and followed by the members of the College and other friends. At the Gate of Honour the *Nunc Dimittis* was sung and we bade farewell to the body. His remains were subsequently cremated, and, as we were informed, would finally rest in the chapel.

Ferrers played an important part in University politics, being for more than twenty years a member of the Council. This too was a time which included some momentous periods in the history of the University. He also held the high office of Vice-Chancellor during the years 1884, 1885. He first came on the Council at a chance vacancy in 1865, and had little doubt of being re-elected for a full term of four years at the general election in November, 1866. Here, however, he was doomed to disappointment for, the question of the admission of Non-conformists to Fellowships having in the meantime come to the front, his liberal ideas on that subject were not acceptable to the majority of the electoral roll. This question formed the subject of active discussion during the following years, but the controversy was finally closed by the passing of the Tests Act in 1871. He was again rejected at the election of 1868, but in 1872 the position had changed and he was elected for a full period. Finally, in 1878, he was placed at the head of the poll and retained his seat for sixteen years, when his increasing illness obliged him to decline re-election. The University Act was passed in 1877, and this again brought on a period of statute-making. The tenure of Prize Fellowships was shortened, as Ferrers

thought, unduly. The taxation of the Colleges had to be faced. Ferrers urged that this should be effected by a percentage on the divisible revenues of each College, but the Commissioners insisted on the principle of raising a fixed annual sum from the Colleges collectively. This sum began at £5,203 in 1883 and rose gradually to over £25,000 in 1902.

As a consequence of his position as Tutor and Lecturer, Ferrers was necessarily much employed in examinations. The standard of the papers set in Caius College, under his superintendence, was considered to be high, so that it was generally worth while for a student to consult them as a source of good questions from which something out of the common could be learnt. He was Moderator or Examiner eleven times, more times he believed than any one else recorded in University history.

His first book was called "Solutions of the Cambridge Senate House Problems for the Four Years, 1848—1851." In this he was assisted as joint author by J. S. Jackson, another Caius man and fifth wrangler in his own year.

Ferrers was also the author of a treatise on "Trilinear Co-ordinates," published in 1861. These co-ordinates seem first to have been brought into notice in the University by some chapters in "Salmon's Conics," but there was no regular treatise on the subject. Ferrers' book at once became one of the text-books much used for the Tripos examination. There was a second edition in 1866, and a third in 1876. The subject is, however, not now studied to the same extent.

At the request of the Master and Fellows of Caius College, Ferrers edited the "Mathematical Writings of George Green," a man of consummate genius who was fourth wrangler in 1837, and afterwards Fellow of his own College. This important work was published in 1871, and rendered generally accessible a series of memoirs which have remained of fundamental importance in both pure and applied mathematics. These writings have also a special interest as the work of an almost untaught mathematician; a glance at the contents of the volume shows how much of the after progress of discovery had been anticipated by him, or has its roots in his work.

His treatise on "Spherical Harmonics," published in 1877, presented many original features. The theory of ellipsoidal harmonics was first studied by Green and Lamé, who used different methods. In his last chapter Ferrers gives an account of these functions, using both methods and adding things of his own. He also illustrates their application by the problem of the attraction of a heterogeneous ellipsoid.

One of his early memoirs was on Sylvester's development of

Poinsot's representation of the motion of a rigid body about a fixed point by means of a *material ellipsoid* whose centre is fixed and which rolls on a rough plane. This paper was read to the Royal Society in 1869, and printed in the "Transactions." He investigates expressions for the pressure and friction, and arrives at a treatment of the problem different from that of Sylvester, in the course of which some other theorems presented themselves which were not without interest.

His contributions to the "Quarterly Journal" are too numerous to be discussed at any length. A complete list of his papers may be found in the Royal Society's "Catalogue of Scientific Papers." We may, however, mention the headings of a few, to show the varied nature of his writings. In 1861 and 1862, he has a series of notes on trilinear and quadriplanar co-ordinates, the latter being probably preparatory to a treatise on "Quadriplanar Co-ordinates," which he once informed the present writer he intended to publish. Then in 1867, he investigates the envelope of the Simson or pedal line of a triangle, and shows that it is a three-cusped hypocycloid. In 1873, he has an extension of Lagrange's equations. In 1875, he has two good papers on hydro-dynamics. In the first, he supposes that a cylindrical vessel is constrained to move in a given manner with fluid inside and outside. He compares the problem to find the motion of the fluid with that to determine the potential of an attracting film, and finally uses the known results of the second problem to solve the first. In the second paper, he solves the same problem when the cylinder is replaced by an ellipsoidal vessel. The manner in which he treats this problem is different from and simpler than that of his predecessors Green and Clebsch in the same work.

These hydro-dynamical researches were allied to the theory of attractions, and accordingly we find him writing on the latter subject in 1877. The components of the attraction of a solid ellipsoid, whose strata of equal density were similar to the boundary, had been investigated by Poisson. Ferrers gave a method of deducing from these the potential of a solid ellipsoid whose density varies as $x^f y^g z^h$, which is easily applied when the integers f, g, h , are not large. He also explains a new device by which the potential of an ellipsoidal shell may be deduced from that of the contained solid.

Lastly, in 1882, he applied himself to study Kelvin's investigation of the law of distribution of electricity in equilibrium on an uninfluenced spherical bowl. In this he made the important addition of finding the potential at any point of space in zonal harmonics.

The writer is indebted for several of the dates mentioned in the first part of this obituary notice to a brief fragment of an autobiography kindly lent to him by Mrs. Ferrers.

E. J. R.