Engineers in 1881. He invented a gas exhauster and also a patent syphon, which have since been extensively used.

In 1854 he married Louisa, daughter of Reuben Young, of Nottingham.

For many years he was an active member of the magisterial Bench for Middlesex, and in 1887 was one of the 60 chosen to carry on the work during the time that the Cities of London and Westminster were being amalgamated under the title of County of London. He was a member of the first London County Council, and was for 18 years Chairman of the East Islington Conservative Association.

Mr. Horsley was elected a Fellow of the Society on the 9th of April 1884. He died on the 4th of January 1905.

By the death of Mr. FRANK MCCLEAN, LL.D., F.R.S., English astronomy loses not only an assiduous worker whose artistic sympathies ensured for all his work a high standard of elegance and finish, not only one whose enterprise carried his survey of the sky over both hemispheres, and whose insight detected for the first time direct evidence of the presence of oxygen outside our planet, but also one of those whose lavish generosity aided and inspired the work of many others. It would be difficult, perhaps impossible, to find his equal in the triple capacity of worker, discoverer, and benefactor.

The main facts of his life may be briefly told. He was born in 1837, the only son of the late distinguished engineer Mr. J. R. McClean, F.R.S., who was also a Fellow of our Society, and of whom the following words, of some significance in connexion with what we know of the son, are recorded in our annals: "His numerous acts of unostentatious kindness and generosity will make his loss deeply regretted by those—and they are many—who have been aided and befriended by him in their struggles and difficulties" (*Monthly Notices*, vol. xxxiv. p. 149). The son was educated at Westminster, at The College, Glasgow, and at Trinity College, Cambridge, of which he was a Scholar. He graduated as equal 27th Wrangler in 1859.* In the same year he took up his father's profession, and was apprenticed to Sir John Hawkshaw, and three years later he was taken into partnership in the firm of McClean & Stileman. In 1870, however, he retired from this work and devoted himself for the remainder of his life to scientific and artistic interests. He had married in 1865, and settled in 1871 at Tunbridge Wells (first at Ferncliffe and in 1884 at Rusthall House); and though latterly he also occupied a house in London (first at 21 Onslow

* The list is of some interest to astronomers. It contains among others the names of the Rev. J. M. Wilson, Senior Wrangler, now Archdeacon of Manchester (joint author with Mr. Gledhill of the book on double stars); the late E. J. Stone (4th Wrangler); Professor W. G. Adams (12th); Professor Alex. Herschel (20th).

Square and then at 1 Onslow Gardens), the greater part of his scientific work was done at Tunbridge Wells.

His first interests (in 1872) were not astronomical, being centred in electrical work on coils; but in 1875 an observatory was completed at Ferncliffe, and he began an examination of stellar spectra, devising a spectroscopic eyepiece for the purpose which was introduced to general notice by the late Mr. John Browning at one of the Royal Society's *soirées*, and has since become a well-established instrument. But his first published paper is dated some twelve years later than this, and shows that his thoughts had taken a new direction.

In 1889 he presented to the Royal Astronomical Society his "Photographs of the Red End of the Solar Spectrum," comprising just half the visible spectrum from λ 5800 to λ 7700, whereas Dr. Rowland's published photographs extended from λ 3900 to λ 5800. Alongside the photographs of the red end subsidiary photographs of the green to violet spectrum were given, so that there were exceptional facilities for determining the scale value. This thoroughness was characteristic of the work of Mr. McClean. Within a year he presented to the same Society parallel photographs of the spectra of the Sun, of iron, and of iridium; and within a few years other series of comparative pictures of high and low Sun spectra, and solar and metallic spectra. All these photographs were on a large scale, and afforded valuable information to those working at such spectra. The instrument employed at this time was a telescope stopped down to four inches aperture, of 98 inches focal length, fixed parallel to the polar axis, the sunlight being reflected into it by means of a heliostat mounted on the roof of Mr. McClean's house at Tunbridge Wells. From 1879 to 1890 a large Rutherford grating was used; in 1890 a Rowland plane grating was obtained and substituted. In taking the photographs of high and low Sun spectra particular attention was paid to two points: first, a method of screening different parts of the spectrum by means of glass cells an inch thick filled with coloured solutions; secondly, the special preparation of the photographic plates. All such work as this Mr. McClean undertook with his own hands. Some of the metallic spectra are those of rare metals not easily obtainable.

In 1895 Mr. McClean ordered from Sir H. Grubb a telescope of the pattern adopted for the Astrographic Chart, but with the addition of an objective prism with an angle of 20°; and he commenced a systematic survey of the spectra of the stars brighter than $3\frac{1}{2}$ magnitude in the northern heavens. This work was completed in 1896; and in 1897 Mr. McClean carried the prism with him to the Cape of Good Hope and mounted it on the telescope at the Royal Observatory of the same pattern as his own. He thus extended his survey to the whole sky—a notable achievement for a man working single-handed. For this work he received the Gold Medal of the Royal Astronomical Society in 1899. From the survey he deduced important con-

clusions respecting the distribution of stars of different spectral types; and he discovered the presence of oxygen in the star *β Crucis* and other helium stars.

The main part of the northern survey is published in the Royal Society's *Philosophical Transactions*, vol. cxci.; but the southern survey was published separately in a quarto volume of 16 pages and 30 plates, under the title *Spectra of Southern Stars*.

When Nova *Persei* appeared Mr. McClean, though a man of many interests and engagements, put all aside to devote himself to the spectrum of the new star, and obtained a valuable series of photographs, enlargements of which he presented to the Society. No reproductions of these were, however, published in our *Monthly Notices* along with the brief descriptions (see vol. lxi. pp. 334, 386), as is the case also with his earlier photographs of metallic spectra, &c. Perhaps the time has come when the rectification of this omission may be considered.

Quite independently of this work of a purely scientific kind, Mr. McClean has claims on the gratitude of astronomers for his munificent gifts and bequests to their science. In 1890 he founded at the University of Cambridge three Isaac Newton studentships for the encouragement of study and research in astronomy (especially gravitational astronomy) and physical optics at a cost of £12,500. To the Cape of Good Hope Observatory he presented the Victoria photographic telescope of 24 inches aperture and 22½ feet focal length, with an 18-inch visual telescope associated, and fully equipped with both object-prism and slit-spectroscope.

These gifts have been supplemented by bequests at his death to the Universities of Cambridge and Birmingham, to the Royal Society, the Royal Astronomical Society, and the Royal Institution.

Some characteristics of the work of Mr. McClean, which have been already mentioned, may be emphasised. In the first place he always worked alone, never employing an assistant of any kind. It would have been easier for him than for most men to obtain such assistance; but the strength of his predilections may be gauged from the fact that when he was at the Cape Observatory, where Sir D. Gill would gladly have put at his disposal a part of the readily available resources of the Observatory, he preferred his solitary methods. He not only took all the original negatives himself, but made all the enlarged reproductions of the early work, for distribution. It was only in later years, and with obvious reluctance, that he yielded to pressure and enlisted the services of a firm of professional photographers to make these reproductions. This trait was no doubt allied to others which led him to make rare collections of old manuscripts and other beautiful things. It was probably unknown to many of his scientific friends that Mr. McClean was at heart not only a man of science but an artist, whose collections, bequeathed with characteristic generosity to the Fitzwilliam Museum at Cam-

bridge, are described as the most notable bequest made to it since its foundation. And as an artist he could not bear the touches of an alien hand to his work. Probably also his interest went deeper than with the majority of men, for in some of his benefactions also he spent much personal time and trouble in the settlement of the details. Thus, when he determined to present a large telescope to the Cape Observatory he spent many months in an attempt to devise an object-glass of a special kind, working out the numerical calculations himself, and also designed a special form of mounting. And although he was compelled ultimately to give up the object-glass, his ideas are incorporated in the mounting.

Of his originality no better proof could be offered than his discovery of oxygen in β *Crucis*. Such discoveries are sometimes so immediately confirmed by others that it almost seems a matter of chance who should be the first to make them; but it was very different in this case. Even after the publication of full details it was many months before the announcement was received with anything but mistrust; and in his address on presenting our Gold Medal to Mr. McClean in 1899 the President referred to this particular achievement in the most guarded language. A minor illustration of Mr. McClean's originality is afforded by his method of dividing the heavens for his survey according to galactic latitude and longitude (instead of according to the co-ordinates in vogue, which unnecessarily import terrestrial relations); a method which brings out at once several important features of distribution; as, for instance, that the helium stars are mainly congregated in the two zones north and south of the galactic equator. Finally, a further reference may be made to one of his numerous benefactions—viz. the Isaac Newton Studentships, which aim at securing more *workers* for astronomy in this country as opposed to the provision of instruments to work with. That Mr. McClean was in full sympathy with the latter and more familiar form of benefaction he gave ample proof in other directions; but this did not prevent him encouraging workers by a method which is unfortunately only too rare. We must go back a century and a half to find a similar encouragement; for the Sheepshanks Scholarship at Cambridge is not only so small in amount as to have in itself little directive force, but differs from the Isaac Newton Studentships in being provided, as a memorial, by a number of persons. A better parallel to the studentships is to be found in the astronomical professorships at Oxford and Cambridge, founded in 1619 by Savile, in 1704 by Plume, and in 1749 by Lowndes. Since 1749 no noteworthy endowment of an astronomical career in this country has been made by an individual; and, though Mr. McClean's endowment only makes provision for the outset of a career, its directive force has already been abundantly manifested.

Mr. McClean received the honorary degree of LL.D. from the

University of Glasgow in 1894. He was elected a Fellow of our Society in 1877, and of the Royal Society in 1895. He served on our Council almost continuously from 1891, but could never be persuaded to accept office, nor to serve on the Council of the Royal Society. He married in 1865 Ellen, daughter of Mr. John Greg, of Escowbeck, Lancaster, and leaves three sons and two daughters. H. H. T.

WILLIAM GRANT MACGREGOR was born in 1838 in Strathspey, where a small branch of the clan had been long settled. In his sixteenth year he came to London, his parents apprenticing him to a commission merchant. He entered into business on his own account in 1877. In London he was attracted by Mr. Spurgeon's preaching, and for many years took an active part in the Sunday-schools, Bible classes, &c., connected with Mr. Spurgeon's Church, and was a trustee of the Stockwell Orphanage.

His interest in astronomy was derived from his kinsman Grant, the historian of astronomy, whom he assisted to translate Arago's *Popular Astronomy*. He was elected a Fellow of the Society on the 13th of May 1892. He was also a Fellow of the Royal Geographical Society, of the Royal Colonial Institute, and of several Scottish societies. He died on the 21st December 1903.

CAPTAIN WILLIAM NOBLE, the eldest son of William Noble, of Berwick-on-Tweed, was born in 1828. After being privately educated he entered the Army, from which he retired with the rank of captain. In 1851 he married Emily Charlotte, only child of Edward Irving, of H.M. 61st Regiment. After his retirement from the Army he settled at Forest Lodge, Maresfield, Sussex, giving a large part of his time to public duties. He was a justice of the peace for Sussex, Chairman of the Uckfield Bench, of the Uckfield Board of Guardians, and of the Rural District Council. He found in the execution of the duties attaching to these positions very congenial employment for which he was eminently fitted, possessing, as he did, a whole-hearted interest in the welfare of the district, a sturdy independence of character, and an active and business-like temperament.

Captain Noble set up an observatory at Maresfield with a good $4\frac{1}{2}$-inch equatorial and other instruments. He was a constant and regular observer, and frequently contributed short notes to the *Monthly Notices* on occultations, drawings of sun-spots, &c. For nearly forty years he contributed each fortnight to the *English Mechanic* an article, over the signature "A Fellow of the Royal Astronomical Society," in which he criticised with some freedom current astronomical events. It must be admitted that he was not entirely free from prejudice, but the transparent honesty of his purpose gave value to these outspoken utterances. At the same time he took pains to answer the questions of interminable correspondents and inform them on astronomical and other subjects.