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Prof. F. Kaiser.
M. Paul A. E. Laugier.
Prof. F. M. Schwerd.

MARY SOMERVILLE (*née* FAIRFAX) was born at Jedburgh on December 26, 1780, and died on November 30, 1872, at Naples, aged nearly ninety-two years. In considering her education, we have not to mention important seminaries, where skilled teachers make it their chief business to impart to others the knowledge for which they are themselves eminent, but to speak only of studies pursued in the calm of a quiet home. This, rightly understood, is perhaps the most remarkable feature of her career. There are few mathematicians so eminent as she deservedly was, in whose fame great public schools and universities do not in some degree partake. But we owe almost to accident the discovery of the powers of Mary Fairfax's mind, while the gradual development of those powers proceeded under the guidance of tutors unknown to fame, and with access only to such assistance as could be given by the friends of her own family.

Mrs. Somerville has herself described how it chanced that the peculiar powers of her mind came first to be recognised. She was in the habit of working at her needle in the window-seat, while her brother took his lessons in geometry and arithmetic. Fortunately (in her case) the work which is regarded as most suitable to the capacity of women leaves the mind unoccupied; and consequently there was nothing to prevent Mary Fairfax from attending to the lessons intended for her brother. She gradually became interested in the subject of these lessons, and took care not only to be present regularly, but to study her brother's books in her own room. It happened that, on one occasion, young Fairfax failed to answer a question addressed to him, and his sister involuntarily prompted him. The tutor was naturally surprised that the quiet Mary Fairfax should have any ideas beyond the needlework which had apparently engaged her attention; but, being a sensible man, he was at the pains to ascertain the degree and soundness of her knowledge; and, finding that she had really grasped the first principles of mathematics, he "took care that she should have liberty to go on in her own way." If a boy had shown similar fitness for mathema-

tical research, anxious attention would have been devoted to the choice of books and teachers, school and university; but the case of a girl showing such tastes seemed to be adequately met by according to her the privilege of following her own devices. We shall never know certainly, though it may be that hereafter we shall be able to guess, what science lost through the all but utter neglect of the unusual powers of Mary Fairfax's mind. We may rejoice that, through an accident, she was permitted to reach the position she actually attained; but there is scarcely a line of her writings which does not, while showing what she was, suggest thoughts of what she might have been.

While studying mathematics "in her own way," she found a difficulty which for a time threatened to interfere with her progress. She was unable to read the *Principia*, because she could not understand Latin. In this strait, she applied, "after much hesitation," to Prof. Playfair. She asked if a woman might, without impropriety, learn Latin. After ascertaining the purpose which the young lady had in view—possibly in doubt lest she might follow in the steps of Anne Dacier—Prof. Playfair told her that it would not, in his opinion, do her any harm to learn Latin in order to read the *Principia*. It is noteworthy, as having probably a bearing on the course which Mrs. Somerville's reading subsequently took, that Playfair was one of the few in this country who at that time appreciated the methods of the higher mathematical analysis, and had formed a just opinion of their power—"a power, however," as Sir John Herschel well remarks, "which he was content to admire and applaud rather than ready to wield." His excellent review of the *Mécanique Celeste* probably gave (as Herschel suggests) a stronger impulse to the public mind in the direction of the higher analysis than he could have communicated by any researches of his own.

It was not, however, as a mathematician that Mrs. Somerville first became known to the world. A subject of research, exceedingly difficult and only to be pursued successfully under very favourable conditions, was undertaken by her during the life of her first husband, Captain Greig, son of High Admiral Greig of the Russian Navy. She sought to determine by experiment the magnetising influence of the violet rays of the solar spectrum. "It is not surprising," says Sir John Herschel on this subject, "that the feeble though unequivocal indications of magnetism which she undoubtedly obtained should have been regarded by many as insufficient to decide the question at issue." Nevertheless it was justly regarded as a noteworthy achievement that in a climate so unsuitable as ours any success should have been attained in a research of such extreme difficulty. That she achieved, and, what is more, deserved success, will be inferred from the words in which Sir John Herschel indicates his own opinion of the value of her results: "To us," he says, "their evidence appears entitled to considerable weight; but it is more to our immediate purpose to notice the simple and rational

manner in which her experiments were conducted, the absence of needless complication and refinement in their plan, and of unnecessary or costly apparatus in their execution, and the perfect freedom from all pretension or affected embarrassment in their statement."

In 1832 Mrs. Somerville published the work on which, in our opinion, her fame in future years will be held mainly to depend. The *Mechanism of the Heavens* was originally intended to form one of the works published by the Society for the Diffusion of Useful Knowledge, though it soon outgrew the dimensions suited for such a purpose. Indeed, it is remarkable that either Mrs. Somerville herself or Lord Brougham, at whose suggestion the work was undertaken, should suppose it possible to epitomise Laplace's *Magnum Opus*, or so to popularise it as to bring it within the scope of the Society's publications.

It will be well, in weighing the value of the book, to consider it first with reference to the purpose of its author, though a judgment based on that consideration alone would not be a fair one. These, then, are the words in which Mrs. Somerville presents the scope and purpose of her work:—

"A complete acquaintance with physical astronomy can only be attained by those who are well versed in the highest branches of mathematical and mechanical science: such alone can appreciate the extreme beauty of the results, and the means by which these results are obtained. Nevertheless, a sufficient skill in analysis to follow the general outline, to see the mutual dependence of the several parts of the system, and to comprehend by what means some of the most extraordinary conclusions have been arrived at, is within the reach of many who shrink from the task, appalled by difficulties which perhaps are not more formidable than those incident to the study of the elements of every branch of knowledge, and possibly overrating them by not making a sufficient distinction between the degree of mathematical acquirement necessary for making discoveries and that which is requisite for understanding what others have done. That the study of mathematics, and their application to astronomy, are full of interest, will be allowed by all who have devoted their time and attention to these pursuits; and they only can estimate the delight of arriving at truth, whether it be the discovery of a world or of a new property of numbers."

It cannot be doubted that Mrs. Somerville here indicates her belief in the possibility of presenting her subject in a form suited to the capacities of a large number of readers, and to some extent advocates this as her object. Whether she succeeded or failed in this purpose must therefore be the first question to engage our attention. Sir John Herschel considers that she succeeded, "for all those parts of" her subject, at least, which the work "professes to embrace, that is to say, the general exposition of the mechanical principles employed,—the planetary and lunar theories, and those of *Jupiter's* satellites, with the incidental points

naturally arising out of them." With the utmost respect for the authority of one who was so thorough a master of the subject which Mary Somerville endeavoured to popularize, we venture to express a different opinion. We find it impossible to come to any other conclusion than that, as respects the main purpose of her work, Mrs. Somerville failed entirely; though we hasten to qualify this statement by the remark that in our opinion success was altogether impossible. We believe, in fact, that neither Mrs. Somerville nor Sir John Herschel thoroughly apprehended the difficulty of conveying to the general reader clear ideas respecting even the elements of the subjects they severally endeavoured to expound. But we feel bound to add that Mrs. Somerville's failure, inevitable from the very nature of her task, would in any case have been brought about by the manner in which the task was accomplished. It will presently be seen that in saying this, we are, in fact, touching on the most remarkable and distinguishing quality of Mrs. Somerville's mind.

There are two essential requisites in a treatise intended to introduce a difficult subject to general readers. First, there must be a clear apprehension of the position of such readers, of what they can and of what they cannot understand, and of the form in which what is written for them may most usefully be presented. It is not too much to say that if just ideas had been entertained by Mrs. Somerville on this point, the attempt to present the *Mechanism of the Heavens* in a popular form would never have been made. But secondly, it is essential that in any work of the kind, each statement—each sentence, in fact—should be presented in terms so precise as to be absolutely unmistakable. This is not so necessary in advanced treatises,—indeed, it is too well known how large a proportion of our works on advanced science are wanting in strict precision of expression. But it is absolutely necessary in works intended to popularize science. It is a somewhat remarkable circumstance that in the *Mechanism of the Heavens*,—the boldest attempt ever made, perhaps, in this direction,—not only is precision of expression not a notable feature, but, on the contrary, the most striking fault in the work is the inexactness of the language. Even Sir John Herschel, whose perfect familiarity with the subject of the work, would tend to render the fault less striking to him, was nevertheless struck by it: "The most considerable fault we have to find," he wrote, "with the work before us consists in an habitual laxity of language, evidently originating in so complete a familiarity with the *quantities* concerned as to induce a disregard of the *words* by which they are designated, but which, to any one less intimately conversant with the actual analytical operations than its author, must infallibly become a source of serious errors, and which, at all events, renders it necessary for the reader to be constantly on his guard."

These words form the penultimate sentence of Sir John Herschel's critique. We have preferred to speak first of the sub-

ject touched on, so as to pass without reservation to a more pleasing topic,—the real and unquestionable value of Mrs. Somerville's chief work. And after all, the good qualities of the work are intrinsic, while its main fault relates to a purpose which the work never could have fulfilled, no matter how carefully the fault had been avoided.

It is in this sense,—regarding the work apart from its special purpose, and judging of it only as a contribution to advanced scientific literature,—that we may fairly say, with Sir John Herschel, that the work is one of which any geometer might be proud. There is, indeed, ample evidence of the disadvantage under which Mrs. Somerville laboured, in the want of thorough mathematical training; but so much the more wonderful is it that she should have completely mastered her subject. Every page indicates her appreciation of the methods employed by Laplace and Lagrange. Where she does not strictly follow the *Mécanique Céleste*, she evidences a clear recognition of the purposes to be subserved by adopting a different course. We would not be understood as commending all the departures thus made, on the contrary, there are cases where it appears to us that on the whole it would have been preferable to have followed the processes of the *Mécanique Céleste* more closely, while there are others where certain more modern processes might perhaps with advantage have been introduced. But even in such instances we recognise in the course pursued by Mrs. Somerville the decision of one perfectly familiar with the subject in hand. And many of the changes must undoubtedly be regarded either as improvements, or else as altogether desirable when the scale of Mrs. Somerville's treatise is taken into account. Amongst instances of the former kind must be classed the method employed in the investigation of the equations of continuity of a fluid; amongst instances of the latter, we would specially cite the treatment of the theory of elliptic motion, in the opening chapters of the second book.

If, however, we were asked to point out the feature of this work which in our opinion most strikingly indicated the powers of Mrs. Somerville's mind, we should unhesitatingly select the preliminary dissertation. In this we have an abstract of the Newtonian philosophy such as none but a master-mind could have produced. Apart from its scientific value—and it has great scientific value—it is a work of great literary merit. If it is not in plan and purpose altogether original, inasmuch as it must be regarded as to some degree an abstract of Laplace's *Système du Monde*, it is, nevertheless, as Herschel has well remarked, "an abstract so vivid and judicious as to have all the merit of originality, and such as could have been produced only by one accustomed to large and general views, as well as perfectly familiar with the particulars of the subject."

Three years after the appearance of the *Mechanism of the Heavens*, Mrs. Somerville published the work by which she

is probably best known to general readers. The *Connexion of the Physical Sciences* was, we believe, written at the suggestion of Lord Brougham, as an expansion of the admirable introduction to the *Celestial Mechanism*. It is a work full of interest, not only to the student of advanced science, but to the general reader. In saying this we indicate its chief merit and its most marked defect. It is impossible to conceive that any reader, no matter how advanced or how limited his knowledge, could fail to find many most instructive pages in this work; but it is equally impossible to conceive that any one reader could find the *whole* work, or even any considerable portion, instructive or useful. The fact was that Mrs. Somerville recognised, or, which is practically the same thing, wrote as if she recognised no distinction between the recondite and the simple. She makes no more attempt at explanation, when speaking of the perturbations of the planets or discussing the most profound problems of molecular physics, than when she is merely running over a series of statements respecting geographical or climatic relations. It would almost seem as though her mind was so constituted that the difficulties which ordinary minds experience in considering complex mathematical problems had no existence for her. A writer, to whom we owe one of the best obituary notices of Mrs. Somerville which hitherto has appeared, tells us that the sort of pressure Mrs. Somerville underwent from her publisher as the earlier editions of the *Connexion of the Physical Sciences* "convinced her of her own unfitness for popularising science. When there was already no time to lose in regard to her proof-sheets, she had hint upon hint from Mr. Murray that this and that and the other paragraph required to be made plainer to popular comprehension. She declared that she tried very hard to please Mr. Murray and others who made the same complaint, but that every departure from scientific terms and formulas appeared to her a departure from clearness and simplicity; so that, by the time she had explained and described to the extent required, her statements seemed to her cumbrous and confused. In other words, this was not her proper work."

Respecting her two other works, we shall merely remark that the *Physical Geography* appeared in 1848, and the *Molecular and Microscopic Science* in 1869, when she had reached the advanced age of eighty-eight years.

We may be excused for regarding Mary Somerville's life, in these pages, with reference rather to her astronomical and mathematical researches than to her proficiency in other branches of science. In this aspect of her career it is difficult, great as was the reputation she deservedly obtained, not to contemplate with regret those circumstances, the effects of unfortunate prejudices, whereby she was prevented from applying the full powers of her mind to the advancement of science. It is certain that no department of mathematical research was beyond her powers, and that in any she could have done original work. In mere mental grasp

few men have probably surpassed her; but the thorough training, the scholarly discipline, which can alone give to the mind the power of advancing beyond the point up to which it has followed the guidance of others, had unfortunately been denied to her. Accordingly, while her writings show her power, and her thorough mastery of the instruments of mathematical research, they are remarkable less for their actual value, though their value is great, than as indicating what, under happier auspices, she might have accomplished.

We have mentioned that Mrs. Somerville was twice married. By her first marriage she had one son, Mr. Woronzow Greig, since deceased. A few years after Captain Greig's death she married her cousin, Dr. Somerville, by which marriage she had three daughters, two of whom survive her. The latter years of her life (twenty-three years, we believe) were passed in Italy. It has been said by one who was well acquainted with the circumstances that "the long exile which occupied the latter portion of her life was a weary trial to her. She carried a thoroughly Scotch heart in her breast; and the true mountaineer's longing for her native country sickened many an hour of many a tedious year. She liked London life, too, and the equal intercourses which students like herself can there enjoy; whereas, in Italy, she was out of place. She seldom met any one with whom she could converse on the subjects which interested her most; and if she studied, it could be for no further end than her own gratification. It was felt by her friends to be a truly pathetic incident that, of all people in the world, Mrs. Somerville should be debarred the sight of the singular comet of 1843; and the circumstance was symbolical of the whole case of her exile. The only Italian observatory which afforded the necessary implements was in a Jesuit establishment, where no woman was allowed to pass the threshold. At the same hour her heart yearned towards her native Scotland, and her intellect hungered for the congenial intercourse of London; and she looked up at the sky with the mortifying knowledge of what was to be seen there but for the impediment which barred her access to the great telescope at hand. With all her gentleness of temper, and her lifelong habit of acquiescence, she suffered deeply, while many of her friends were indignant at the sacrifice."

We shall venture to quote, in conclusion, some remarks of Sir Henry Holland on features of Mrs. Somerville's character and life which have been hidden from general knowledge:— "She was a woman not of science only," he tells us, "but of refined and cultivated tastes. Her paintings and musical talents might well have won admiration, even had there been nothing else beyond them. Her classical attainments were considerable, derived, probably, from that early part of life when the gentle Mary Fairfax—gentle she must ever have been—was enriching her mind by quiet study in her Scotch home. . . . A few words more on the moral part of Mrs. Somerville's character; and

here, too, I speak from intimate knowledge. She was the gentlest and kindest of human beings—qualities well attested even by her features and conversation, but expressed still more in all the habits of her domestic and social life. Her modesty and humility were as remarkable as those talents which they concealed from common observation. . . . Scotland," he justly adds, "is proud of having produced a Crichton. She may be proud, also, in having given birthplace to Mary Somerville."

R. A. P.

NATHANIEL BEARDMORE was the second son of Joshua and Marianne Dorothea Beardmore, and was born at Nottingham on the 19th of March, 1816. His father, an independent gentleman, shortly afterwards removed to London and then to Chudleigh, in Devonshire. Here he was educated, and at the age of sixteen was sent to Plymouth to study with Mr. George Wightwick, architect, for six months, and was then articled to Mr. James Meadows Rendel, civil engineer, for five years. At this time he evinced much interest in the study of practical astronomy, and the construction of a Newtonian telescope became a great feat of ambition with him. A brother engineer who shared to some extent in the same pursuits remembers well the perseverance that he displayed, and in the matter of specula his was superlative. The metal, the moulds, the melting and mixing were of course essential, so also the grinding and polishing. Failures were numerous, and many a night were these operations carried on until morning hours with crucibles on a kitchen grate. The landlord of his lodgings being pressed into the service with a pair of bellows, the unflagging movement of which was absolutely necessary to obtain the melting point for the amateur, whose zeal became shared if not comprehended by the veteran of seventy years. Of course experience brought knowledge, and it was found that regulus of antimony was not absolutely essential to a reflecting surface. A telescope was, however, produced, though probably the experience got in the process was the only result of value. Soon after the expiration of his pupilage he entered into partnership with Mr. Rendel, but the connexion terminated in 1848. For the first few years of his professional life Mr. Beardmore resided principally at Plymouth. In 1843 he removed to London, and in 1856 took a private residence at Broxbourne, in Hertfordshire, retaining offices in London. In the earlier part of his career he was engaged in various questions connected with engineering, but of late years he confined his attention almost entirely to the practice of hydraulic engineering, and had attained the position of one of the first hydraulic engineers of the day. Under his direction the *régime* of the River Lea was entirely remodelled; and at the time of his death he was engineer to the Public Works Loan Commissioners, the River Thames Conservancy Board, the Essex Sewers Commissioners, besides being consulted in all the more important questions of drainage

and water supply. In the year 1862 he brought out a "Manual of Hydrology," an extension of a smaller treatise called "Hydraulic Tables," published in 1850. This speedily attained l wide circulation, and is, in fact, the standard handbook of al engaged in practical hydraulic engineering.

Mr. Beardmore was a member of the Council of the Institution of Civil Engineers, and a member of the Smeatonian Club. He was elected a Fellow of the Royal Astronomical Society on January 8, 1858, and at one time frequently attended the meetings. He was also a Fellow of the Geological, Geographical, and Meteorological Societies, and of the last Society he was President in the years 1861 and 1862.

Mr. Beardmore was a man of rare uprightness and genuine goodness. His ready humour and originality rendered him popular wherever he went, and his courteous hospitality will long be remembered. In private life he was a man of most simple habits, disclaiming all ceremony, of a reserved and retiring nature amounting almost to shyness, but ever ready with kind advice given both professionally and privately in a generous spirit which pervaded every action throughout a life of usefulness. His health had been failing for two years, when he was seized with congestion of the lungs, the result of a cold, and he died on the 24th of August, 1872.

Mr. Beardmore married in 1841, Mary, eldest daughter of Mr. J. F. Bernard, of H.M. Civil Service, and had ten children, of whom eight survive.

Benjamin Godfrey, M.D., F.R.C.S., was born at Romsey, Hampshire, in November 1829. Having served his time as articled pupil to a firm of surgeons in his native town, he proceeded to London, and entered at Guy's Hospital, where he passed through the usual curriculum, and in 1852 obtained his diploma. In the same year he graduated M.D. in the University of St. Andrews. Having married, he settled at Enfield, where for twenty years he carried on a practice which, small at first, steadily increased until it became one of the largest for miles round. He was eminently fitted for his profession, both by natural qualities and acquired skill. Amidst unceasing calls upon his time he found opportunities for continuing his studies and acquainting himself more especially with the most recent and valuable additions to the literature of medicine. His patients, therefore, enjoyed the benefit of every new method, proved to be successful, of combating disease and alleviating pain.

Dr. Godfrey was elected a Fellow of this Society on February 12, 1858, and was also a member of various other learned societies, but he was able to attend but few of their meetings. He was an occasional contributor to the scientific journals, as well as the author of two small medical works on Vaccination and on Diseases of the Hair.

After a very brief illness, Dr. Godfrey succumbed to the heart

disease against which he had bravely struggled, and on the morning of November 22, 1872, he died at the early age of forty-three. For his sunny disposition and truly Christian character he was loved and trusted by a large circle of friends. More than two thousand persons of all classes assembled in the Enfield cemetery to witness the last sad ceremony, and thus to testify their affection and respect for the departed. Enfield will not soon forget Dr. Godfrey. A public subscription has been started, with the view of erecting a handsome monument to his memory.

Richard Hodgson, who died at Hawkwood, Chingford, Essex, on the 4th of May, after a very long illness, in a great measure induced by his untiring exertions in the cause of the Debenture-holders of the London, Chatham, and Dover Railway, was born in Wimpole Street in 1804. He was educated at Lewes, passed some time in a banking house in Lombard Street, and eventually became leading partner in the firm of Hodgson and Graves, the publishers in Pall Mall, from which he withdrew in 1841, and thenceforth gave up his time to scientific pursuits. First taking up Daguerreotype (then in its infancy), he introduced many improvements in the manipulation of the process, was very successful as an amateur in portraiture, and in obtaining magnified representations of microscopical objects, which have rarely been surpassed. He also spent some time in endeavouring to print from the silver Daguerreotype plate, by submitting it to chemical treatment, and proceeding, as is usual in copper-plate printing. Though he had some fair results, the process was too delicate and uncertain for general use, and he abandoned it to devote himself more exclusively to the microscope and telescope. In 1852 he built an observatory at Claybury, in Essex, in which a 6-inch refractor was mounted equatoreally. This was afterwards removed to Hawkwood, and a transit-room added, which now contains the 4-inch instrument formerly in the possession of Dr. Lee, of Hartwell.

In 1854 he designed the diagonal eye-piece for observing the whole of the Sun's disc without contraction of the aperture of the object-glass, a description of which appeared in the *Monthly Notices* for December of that year.

For many years he was a constant observer of the Sun, and made a series of drawings of many solar spots. Whilst so engaged, at 11.20 A.M. on the 1st of September, 1859, he was fortunate in witnessing the remarkable outbreak in a large spot which was simultaneously observed by Mr. Carrington at Redhill. He was elected a Fellow of this Society on the 14th of April, 1848, a member of Council on the 12th of February, 1858, and he filled the office of Honorary Secretary from 1863 to 1867. He was also a Fellow of the Royal Microscopical and Meteorological Societies.

Professor Adam Sedgwick was born at Dent, Yorkshire, on

the 22nd of March, 1785. He entered Trinity College, Cambridge, in 1804, and graduated as Fifth Wrangler in 1808, the late Lord Langdale and Dr. Blomfield, Bishop of London, being his contemporaries ; the former as Senior, and the latter as Third Wrangler. In 1810, he was elected to a Fellowship of his College, which he retained to the time of his death. Mr. Sedgwick at once took an active part in the direction both of his College and University, and he filled at one time the office of Vice-Master of Trinity. He was during one year Proctor of the University ; and in this usually unpopular office, though he conducted it with great strictness in all essential points, he adapted himself so well to the feelings of the University students that he was exceedingly popular. His natural fondness for the study of geology, which in those days was scarcely known in England as a science, obtained for him, in 1818, the Woodwardian Professorship of Geology in the University, which had been held since 1788 by Professor Hailstone. It has been remarked by Professor Phillips that "his attention to geology was speedily awakened, and became by degrees a ruling motive for the long excursions, mostly on horseback, which the state of his health rendered necessary in the vacations. It was not, however, so much his actual acquirements in geology as the rare energy of his mind, and the habit of large thought and expanding views on natural phenomena, that marked him out as the fittest man in Cambridge to occupy the Woodwardian chair vacated by Hailstone. Special knowledge of rocks and fossils was not so much required as a well-trained and courageous intellect, equal to encounter theoretical difficulties and theological obstacles which then impeded the advance of geology." For the long period of nearly fifty-three years he remained the honoured occupant of this Chair, relieved only during the last two years of his life when his physical infirmities no longer enabled him to give his usual lectures, by Professor Morris, who in 1871 was appointed his deputy.

Professor Sedgwick's contributions to geology were numerous. They were mostly communicated to the Geological Society, the Cambridge Philosophical Society, or to the British Association. In the Catalogue of Scientific Papers, published by the Royal Society, thirty-nine memoirs are placed separately to his name ; fourteen in conjunction with Sir Roderick Murchison, and two with Mr. W. Peile. His first acknowledged publication was read before the Cambridge Philosophical Society in 1820, on the physical structure of the Devonshire and Cornish formations, and it contained the record of his observations made in the preceding year. He was much interested in researches connected with the geological formation of the south-western district of England ; and as early as 1819 he saw clearly that the Plymouth fossil corals were not to be identified with those of the mountain limestone, but that they were of an earlier epoch. Fifteen years afterwards, Professor Sedgwick found a co-worker in Sir R. Murchison, in conjunction with whom he was again occupied in

researches connected with the geology of Devonshire. At the meeting of the British Association held at Bristol in 1836, a joint paper was read on the carbonaceous strata between Dartmoor and the north-western coast of Devon, in which was pointed out for the first time the true geological position of the several deposits. In a subsequent memoir published in the *Transactions of the Geological Society*, these two great geologists gave a complete account of the district, and they not only attempted to describe the successive formations north of Dartmoor, but also to bring them into comparison with the formations which expand from the southern side of the Dartmoor granite to Start Point, and to the other headlands of the south coast of Devon. In 1838, the country north of Dartmoor was again surveyed by Professor Sedgwick, and in the following year he was engaged with Sir R. Murchison in adopting the final classification of the older sedimentary rocks of our two south-western counties.

Perhaps one of Professor Sedgwick's greatest works was his examination of the geological formation of North Wales, which was however the subject of an unfortunate controversy with his colleague Murchison. It appears that while Murchison was actively working out the succession of the strata in Shropshire and the adjacent part of Wales, Sedgwick was examining the country from Snowdon to the Berwyn Hills, and establishing the true succession of the strata to which he gave the name of Cambrian. Murchison, however, considered that the strata on which he had been working, and to which he had assigned the name of Silurian, was identical with that to which Sedgwick had given the name of Cambrian. On the authority of Murchison, Sedgwick at first accepted this arrangement, which was afterwards found to be erroneous. Though it was proved that Professor Sedgwick was correct in his original judgment, Murchison continued to assert for some time the correctness of his views, still claiming the upper Cambrian of Sedgwick as a portion of his own lower Silurian. Hence arose the controversy between these two distinguished men. Professor Sedgwick, however, on his part was only anxious to clear his scientific reputation from any slur arising from an error for which he was not responsible. Now that the two great geologists have been removed from us, it is but justice to the memory of Professor Sedgwick to allude to a subject which was the cause of much bitterness of feeling at the time, and to remark that his original opinions have been fully confirmed by subsequent examinations.

In 1851, the Council of the Geological Society awarded to Professor Sedgwick the Wollaston Palladium Medal "for his original researches in developing the geological structure of the British Isles, of the Alps, and of the Rhenish Provinces." Sir Charles Lyell, in presenting the medal, observed that "it was impossible within the brief limits of a single speech to enumerate all the Professor's various labours; but he referred especially to his memoirs on the magnesium limestone of the north of England,

on the trap-rocks of Durham and Cumberland, on the fossiliferous strata of the north of Scotland and of the Isle of Arran, on the mountains of Cumberland, of the adjacent lake district, and of North Wales, his essays on slaty cleavage, on the true age of the strata of Devon and Cornwall, and on the Alps, and the Rhenish Provinces, as worthy of all praise and valuable contributions to the treasures of British science."

It is not required, in this very brief sketch of the labours of Professor Sedgwick, to enter into any detail of the various geological researches which occupied his attention during his long career; but we may truly remark, that no member of the University ever laboured to a greater degree than he did to elevate the character of Cambridge as a school for the natural sciences. The time, money, and talent which he expended on the formation of the Woodwardian Geological Museum can only be duly appreciated by a careful examination of the choice collections which are not only noted for their excellence and rarity, but also for the perfect and systematic manner with which the specimens are arranged. To this storehouse of science he has himself contributed many thousands of rock specimens, chiefly British, besides a valuable series of organic remains.

In April, 1871, Professor Sedgwick resigned the active duties of his Chair, which he had so worthily filled for more than half a century, his increasing years and infirmities preventing that attention to his ordinary lectures, which he to the last was anxious to give. He, however, felt always interested in the scientific inquiries which were carried on around him, and he also derived much pleasure in occasionally corresponding with his friends of former years. He was popular as a lecturer, for his style was energetic, philosophical, and clear; and notwithstanding his great age, he was as remarkable for his humour and anecdote as when in middle age. It has been truly written of him that, "For high moral courage, for honesty and singleness of purpose, for generosity of nature, and for a hatred for all that is mean and base, no name ever stood higher than that of Adam Sedgwick. Indeed, he was beloved by all who had the privilege of his friendship. In his declining years he had the satisfaction of feeling and knowing that he had not lived in vain, and that, besides lending a helping hand towards the elucidation and popularisation of geology as a science, he had been, during half a century of hard labour at Cambridge, the teacher and trainer of many first-rate practical geologists, several of whom had done their appointed tasks, and had passed away before him, to whom they looked up as their master."

Professor Sedgwick became a Fellow of this Society in 1830, but he has never contributed either to the *Memoirs* or *Monthly Notices*. He was, however, none the less interested in astronomy, especially in former years, as those who have been intimately acquainted with him have frequently testified. He was one of the oldest surviving Fellows of the Royal Society, having

been elected in 1821. He was also a Fellow of the Geological Society, and, having served on the Council, was elected to the Presidential Chair in the years 1829–30–31. Professor Sedgwick was in holy orders, and was Canon of Norwich, which preferment he has held since 1834.

The Professor had been ailing for some time, and for many weeks preceding his decease he had been in a precarious condition, no hopes being entertained of his recovery. During the last few days of his life his weakness increased; and on the morning of January 27, 1873, in the eighty-eighth year of his age, he quietly passed away, regretted by not only the members of his college, with whom he had so long dwelt, but by the scientific world generally.

When the intelligence reached England that our esteemed and respected Associate, M. DELAUNAY, had lost his life by the upsetting of a pleasure-boat near Cherbourg, a deep and general regret was felt by his co-workers in astronomy, and especially by the Fellows of this Society, who had little more than two years previously so cordially welcomed his presence among them. Shocked at the time, as we all were, by the suddenness of the calamity which had deprived us of the services of so distinguished an astronomer, we can scarcely even yet realise the extent to which our science has been the loser by his melancholy and premature death.

Charles Eugène Delaunay was born at Lusigny, in the Department of the Aube, in the year 1816. Of his early life little is recorded, till at the usual period he entered the Ecole Polytechnique at Paris, where he soon became one of the foremost pupils in the school. Being at the head of his class in 1836, he passed in that year into the Ecole des Mines. While here his vacation reports and journals on the coal-seams in the valley of St. Etienne and Creusot, as well as those on the principal iron and steel works of France, gave a remarkable evidence of that clearness of thought and skill in theoretical speculations, which have been so marked in all his subsequent investigations. While he was still a pupil at the Ecole des Mines, his former masters, having full confidence in the originality and power of his mathematical knowledge, proposed his appointment as teacher of geodesy at the Ecole Polytechnique. Though Delaunay was willing to accept the offer, certain objections were made by the managers in consequence of the anomaly of a pupil of one school holding a tutorial position in the other. The council of the school, at the head of which was M. Cordier, appreciating the great talents of young Delaunay, obtained, however, a special sanction for him to accept the office. He thus obtained the position of a teacher, and afterwards of a professor, in the school from which he had only lately passed with so much honour. At a subsequent period he was also appointed a professor in the Ecole des Mines.

It was part of the curriculum of the Ecole des Mines to give

a preparatory course of instruction for the benefit of engineers, both for those attached to the Corps des Mines and those connected with the mining industry of France, and thus a void was filled up in the subjects taught which were not included in the course of study at the Ecole Polytechnique. From 1845 to 1850 Delaunay was one of the most successful of the professors in this section, having classes for the teaching of descriptive geometry, stereotomy, machine drawing, analytical mechanics, and elementary physics. His manner of imparting knowledge was so clear and so well appreciated by the pupils, that these classes became the most popular division of the school. In 1850 Delaunay attached himself exclusively to the Ecole des Mines, and, like his predecessors, Lamé, Regnault, and Sénarmont, was appointed to successive grades in the Corps des Mines, becoming engineer-in-chief in 1858. In 1867 he was raised to the first class of his rank.

In 1841, M. Delaunay published his first memoir entitled, *Sur la distinction des Maxima et des Minima dans les questions qui dépendent de la Méthode des Variations.* This was followed by other important works on various subjects, such as on the theory and precession of the equinoxes; theory of the tides; theory of the motion of the Moon; elementary treatises on astronomy and mechanics; and a large number of miscellaneous papers in the *Comptes Rendus*, in the *Connaissance des Temps*, and in the *Journal de l' Ecole Polytechnique.* His first memoirs exhibited great mathematical power, and foreshadowed the scientific rank which he soon attained among geometers. Fortunately his attention was drawn to astronomical questions, in the discussion of which he became so completely engaged that his whole leisure time was devoted to this object. His treatise on the theory of the tides was an important work, and it was about this period that the question of the lunar theory first began to occupy his mind. His elementary books on astronomy and mechanics are excellent text-books for schools, in which he showed the rare talent how to popularise science without lowering it.

Delaunay's great work on the Lunar Theory is, however, that which has made his name so universally known among us, and for which this Society had the honour of electing him one of its Associates in 1862. Few of us, however, can properly estimate the magnitude of this voluntary labour of Delaunay. Most of us know to what extent an exact acquaintance of the motion of the Moon affects questions in astronomy and navigation; and we also know that there are very great difficulties presented in the process of determining the values of the co-efficients of the numerous lunar inequalities. If we were to express the motion of the Moon by analytical formulæ, in which no sensible term is neglected, from which tables could be formed in which all empiricism was to be excluded, we should then have some faint notion of the immense work which Delaunay had undertaken to investigate. The necessity of carrying the approximation farther than had been previously done, increased the labour to an enormous extent.

It will be unnecessary in this very brief sketch to enter into the peculiarities of Delaunay's great work on the Lunar Theory. It was only in February, 1870, that Professor Adams presented to him, in the name of the President, the Gold Medal of this Society, as an acknowledgment of the high appreciation which is entertained for his work in this country. On that occasion, Professor Adams gave, with great minuteness, his testimony to the great value and importance of Delaunay's researches on the Lunar Theory, entering at the same time into a complete history of the subject, and pointing out in what Delaunay differed from those who had already published treatises on the theory. To this valuable address of Professor Adams, which is given *in extenso* in Vol. XXX., No. 4, of the *Monthly Notices*, anyone who wishes to acquaint himself with the details of the process adopted by Delaunay in his research is referred.

From the year 1846, M. Delaunay devoted all his available time to the carrying out of this important work. After fourteen years of assiduous labour, he published in 1860, the first volume, entitled *La Théorie de la Lune*, forming one of the volumes of the Memoirs of the French Institute. During this interval, he, in separate memoirs, published papers on several questions relating to the theory, notably that on the secular acceleration of the mean motion of the Moon, which at this time was a subject exciting much controversy. The magnitude even of this supplementary work may be conceived from an extract from an interesting review of the state of this controversy in 1859, by the Rev. R. Main, then President of the Society. "The reader, who desires to see the exact expression for the acceleration arrived at by M. Delaunay, must consult the work referred to, as it is too long for insertion here, consisting, as it does, of *forty-two* terms. Thus much may be said of it, that it takes in every possible term as far as the eighth order, including those terms depending on the inclination and excentricity of the lunar orbit ; and that all the terms calculated by Mr. Adams are in exact accordance with it." In 1867, the second volume appeared in continuation of the first, completing by far the most difficult portion of the work. The third volume, of which the contents have, for the greater part, been prepared for some time, will bring this great undertaking to a conclusion so far as concerns the theory.

"This enormous labour, which has occupied M. Delaunay for nearly twenty years, has been performed by him without assistance from anyone. Indeed, from the nature of the calculations which are required, it would not have been easy to obtain any effective assistance. In order to ensure accuracy, M. Delaunay has omitted no means of verification, and he has performed all the calculations, without exception, at two separate times, with a sufficient interval between them to prevent any special risk of committing the same error twice in succession.

"The volumes before us are perfect models of orderly arrangement. Notwithstanding the great length and compli-

cation of the calculations, the whole work is so disposed that any part of it may be speedily examined with the utmost readiness by anyone who may wish to test its accuracy.

"Finally, the analytical expressions which have been obtained for the Moon's co-ordinates are converted into numbers, by substituting for the elements the most accurate numerical values which the comparison of theory with observation has made known. * * * The work is complete in itself; in it the very difficult and complicated problem of determining the Moon's motion is attacked by a perfectly original method, and that one as powerful and beautiful as it is new. The work has been planned with admirable skill, and has been carried out with matchless perseverance. The result is an enduring scientific monument of which our age may well be proud." *

M. Delaunay considered truly that the plan which he had laid down for himself, would remain incomplete, until the analytical expressions of the theory were reduced into the practical form of tables. The preparation of lunar tables representing his theory has therefore been going on under his direction. The numerical calculations have been made for a considerable portion, those for the longitude being finished and in the printer's hands, while the remaining portion is far advanced. The Bureau des Longitudes took this part of the work under its patronage, and obtained the necessary funds from the Government, so that in a few years hence we might have expected its completion, for it was hoped that the new duties imposed upon Delaunay at the Observatory would not materially impede the progress of the calculations. But all is now in doubt. The master-mind has been suddenly taken from this labour of love, and it is not yet certain whether the calculations are far enough advanced to be intrusted to other hands. May we indeed have some hope that they are left in such a condition that others can interpret them, and thus preserve our science from an irreparable loss. In any case we can adopt with sincerity the words of M. Puiseux, Member of the Bureau des Longitudes :—"Quoique l'auteur ne soit plus là pour y mettre la dernière main, il ne sera sans doute pas impossible de terminer ce monument scientifique. Espérons pour la gloire de l'astronomie française, que ce service sera rendu à la science, que ce suprême hommage ne manquera pas à notre illustre confrère."

In 1870, M. Delaunay was appointed Director of the Observatory of Paris, in succession to our distinguished Associate, M. Le Verrier. Installed in his new office, Delaunay was soon convinced of the importance of the numerous improvements made in the condition of the Observatory since the death of Arago; and many times he has been heard to express his adhesion to the various innovations introduced by his predecessor. He had not, however,

* Address of Professor Adams on presenting the Gold Medal of this Society to M. Delaunay. *Monthly Notices*, vol. xxx. pp. 131, 132.

long been resident at the Observatory when the terrible war broke out between France and Germany, which was intensified by the disasters consequent on the prolonged siege of Paris. His whole time and thoughts were now concentrated on the best means to be adopted for the preservation of the Observatory from the effects of the bombardment. All his delicate instruments were dismantled and stowed away in sheltered places, and all observations were suspended. Even all this foresight and care nearly failed, for, during the last days of the Commune, their troops took possession of the building and grounds, which they turned into a military station. Although a few small instruments were destroyed, no very serious damage was done; but in the last moments of their power the soldiers threatened to set fire to the Observatory, making preparations to do so, when the rapid approach of the Versailles troops happily saved the building and its valuable contents from destruction. After the conclusion of peace the Observatory was soon restored to its former condition, and the usual observations were resumed.

Although France can boast of having had among its mathematicians some of the greatest of astronomers, yet there has been a complete absence in that country of those numerous public and private observatories which are to be found in England and Germany, and even in Italy. No one was more sensible of this deficiency of means for the practical advancement of astronomy in France than Delaunay. Seeing thus the importance of an increased number of observatories in France, he, in conjunction with M. Le Verrier, made an application to the Government for the pecuniary assistance which would be needed to establish a certain number of astronomical and geodetical stations in different parts of the country. These observatories were intended to be established according to a joint plan arranged by M. Delaunay and the Bureau des Longitudes. We owe, also, to Delaunay the independence of the Observatory of Marseilles, which had formerly only been a branch of the Observatory of Paris, the foundation of an Observatory at Toulouse, and the project for an Observatory at Besançon.

When, in 1854, the administration of the Observatory of Paris was separated from that of the Bureau des Longitudes, several of the members of its staff, who were naturally "of the school of Arago," retired to a common residence in the Rue Nôtre Dame des Champs, where they established a small observatory. Delaunay, whose sympathies and habits were akin to those of Mathieu and Laugier, occupied an apartment in the same house. Hence arose that undivided friendship which lasted through life. It was here where he carried on most of his researches; he seldom went out, except to give his accustomed lessons at the Ecole des Mines or the Sorbonne. At five in the morning he was often at his work, never finally quitting it till late in the evening. It was while passing his life in this peaceable, and, to him, happy manner, that he was called by the late Emperor to

the control of the Observatory of Paris. He considered it to be his duty to accept the charge, but it was at a sacrifice of some peace of mind that he did so. In the early part of his directorship he often looked with sorrow on his late modest apartment, to the many hours consecrated to his researches, either within its walls or at his small country residence in Champagne. Delaunay soon, however, saw that he had now a public duty to perform. He perceived that the rapid advancement of astronomy required corresponding efforts, on the part of a great national establishment like that under his direction, to meet the demand for observations suitable to the present state of the science. Had his life been spared, he would no doubt have succeeded in making the Observatory the great centre of astronomy in France. Shortly before his death he remarked: "We are going to do many things; the Observatory intends to devote all its energies to the re-observation of Lalande's Catalogue; to continue the ecliptic star-charts commenced by Chacornac; to observations of double stars; and finally we are making preparations for new determinations of the longitude of Brest, Greenwich, and Neuchâtel." The observation of the minor planets during the second half of the lunation, according to the original convention agreed upon by the Astronomer Royal and M. Le Verrier, has been continued by M. Delaunay with great success, excepting only during the siege.

M. Delaunay had the misfortune to lose his wife a few years after their marriage, leaving an only son, Gaston Delaunay, now principal guardian of the forests of Vitry le François. His aged mother has survived him, and his devotion to her was well known. The moment when it was possible for him to leave Paris after the siege, his first thought was of his poor old mother, of whom he had heard no tidings since the investment of Paris by the Germans. He hastened to Ramerupt, and in person related all his cares and anxieties, and then returned to his duties of reconstruction with a lightened heart.

Delaunay was a member of several of the learned societies; he also had received the honorary degree of Doctor in Science. He was a member of the Academy of Sciences of Paris, the chair of which he had only lately filled. He was a foreign member of the Royal Society, and, as we have already remarked, an Associate of the Royal Astronomical Society.

The circumstances of Delaunay's death will ever remain a sad episode in the history of astronomy. In his full mental power, but needing some temporary recreation, he left the meeting of the Bureau des Longitudes on Tuesday, July 30, 1872, for the purpose of spending a few days on the coasts of Normandy, in company with his cousin, M. Millot, Controller of the Post. On Sunday, August 4, he wrote from Bayeux that his health was excellent, that he intended passing one or two days at Cherbourg, and return to Paris on Thursday following. On Tuesday morning a telegram was received in Paris in these words:—"Hier, à

Cherbourg, un canot monté par quatre personnes a chaviré dans la rade. Les quatre personnes ont peri; l'une d'elles est M. Delaunay, Directeur de l'Observatoire de Paris. Son corps a été retrouvé à l'île Pelée, à cinq kilomètres de Cherbourg." Thus, with his cousin and two boatmen, our distinguished and lamented Associate suddenly met his death at the age of fifty-six, amid the regrets of the whole scientific world, and in the full powers of that gifted intellect which had been so long devoted to the successful development of some of the most important branches of mathematical astronomy.

It is a singular fact that the family of M. Delaunay have, on former occasions, been called to mourn the loss of relations by drowning. Delaunay himself had a natural dread of the sea, and indeed of ships and boats of all kinds. Having this great aversion for boating, he must have been enjoying a great buoyancy of health and spirits at Cherbourg to have accompanied M. Millot on this fatal excursion. His friends cannot understand how he could have been prevailed upon to form one of the party, as the loss of his father and brother was ever present in his mind on an occasion of this kind. His father perished in the presence of his wife and son while bathing in an open river near Troyes; while his brother shared a similar fate some years afterwards, also while bathing, very nearly at the same spot as his father. E. D.

Professor Frederik Kaiser was born at Amsterdam on the 10th June, 1808, of German parents, whom the events of the Continental war had led to take up their residence in Holland. At the early age of seven years he had the misfortune to lose his father, but this loss was to a great extent repaired by the kind care of his uncle, J. F. Kaiser (who spelt his name Keyser, erroneously in the opinion of his nephew). This gentleman, who had left his native place, Nassau-Dietz, early in life, and settled at Amsterdam, was a great lover of astronomy, and made many observations which were published in the *Connaissance des Tems*, Bode's *Jahrbücher*, and other places; and also took a principal part in a determination made in the year 1806 of the difference of longitude between Amsterdam and Utrecht by gunpowder-signals. Having no children, he adopted his eldest nephew, the subject of our notice, who was one of a family of eight, and encouraged his youthful taste for science, superintending his education with truly paternal solicitude until his own death in 1823. Three years after this, while still but eighteen years of age, young Kaiser was appointed observer at the Leyden Observatory, at the recommendation of his uncle's friend, Prof. Moll.

The University of Leyden had possessed a small observatory from the year 1632, but that to which our late Associate was appointed dated from 1816–17, when the Government of the Netherlands, soon after its deliverance from the French yoke, felt it incumbent upon them to found a building for astronomical

observations, but unfortunately resolved upon a restoration of the University Observatory, although warned that it could never be but a makeshift. In the year 1822, the King, William I., presented this establishment with a large reflecting telescope, from the use of which great expectations were entertained. But it was in reality a very inferior instrument, the maker having acquired a reputation he by no means deserved, and no observations of any delicacy or advantage to modern science could be made with it. The vexation this caused to Prof. Ekama, who then occupied the chair of astronomy at Leyden, in all probability accelerated his death, which took place early in 1826. He was succeeded by Prof. Uylenbroek, under whom Kaiser entered upon his duties at the Observatory. He found everything in very bad condition, the instruments either old, broken, or utterly wanting in proper appliances for accurate observations. To make any such measurements or determinations was out of the question, and Kaiser was obliged to confine himself chiefly to occultations, and other casual phenomena. Uylenbroek's attention was absorbed in his professorial duties, virtually occupying the chair of Physics as well as of Astronomy, both which he taught with great diligence and success till 1837, when, on the death of his coadjutor, the Professor of Physics, he devoted himself entirely to that subject, and resigned the teaching of astronomy and the direction of the Observatory to Kaiser. From this time a new epoch in Dutch astronomy commenced. Kaiser's treatise on Halley's comet had already attracted notice, and he had now influence enough to have some good instruments procured for the Observatory, whilst the papers which he published from time to time kept up an increasing interest in astronomy amongst his countrymen. Thus he had the satisfaction of obtaining in 1856 provision in the Budget for the building and equipment of an entirely new observatory. This was completed in 1860, and furnished with instruments in 1861, notably with a meridian circle by Pistor and Martins, and two parallactically-mounted refractors by Merz (one of these being provided with an Airy's double-image micrometer by Simms). In 1866 Kaiser was further empowered to publish the *Observatory Annals*, the first of which appeared in 1868. It is unnecessary to dwell here upon the valuable contribution formed by these volumes to the progress of astronomy; they have obtained, as is well known, for the present establishment at Leyden, a very high rank amongst the observatories of the world, which we trust it will long continue to maintain. Unfortunately not long after astronomy in Holland had thus been placed upon a stable foundation, and a noble beginning of regular observing work commenced, the strength of Prof. Kaiser began to fail. In the spring of every succeeding year he suffered with a painful disease in the chest, and was compelled to desist temporarily from night exposure. In November 1871, at a time when he thought his health had considerably improved, he was occupying himself with some measures of

planetary diameters, when he was seized with a sudden hæmorrhage; and this time he did not rally from the attack, as he had done on previous occasions. Through the winter and spring he was gradually sinking, and this was accelerated by a severe loss which he sustained on the 25th of May, and which affected his spirits very seriously—the death of his wife, with whom he had lived in uninterrupted harmony for a period of forty-one years. At last he quietly passed from this life on the 28th of July last, having just entered his seventy-fifth year. His mother had died at a very advanced age two years previously. He left one daughter and three sons; the well known Dr. P. Kaiser being one of the latter. W. T. L.

Paul Auguste Ernest Laugier was born at Paris on the 22nd of December, 1812. He was the son of André Laugier, a distinguished chemist in the beginning of the century. He became a pupil in the Ecole Polytechnique, from whence in 1834, in the second year of his studies, he was appointed to the Observatory of Paris as a pupil astronomer, an office which had just been created at the instance of M. Arago. Under the direction of this distinguished astronomer, and assisted by the friendly counsel of MM. Bouvard and Mathieu, he soon became a skilful observer, and one of the most active assistants at the Observatory. Although employed in the frequently harassing daily routine of the ordinary observing work, he found time and zeal enough to undertake a special series of observations of the solar surface. In 1841 he presented to the Academy of Sciences a Paper, "On the Movements of the Solar Spots," a brief abstract of which appeared in the *Comptes Rendus* for 1843. In this memoir, Laugier gave as the result of his research, that the solar spots had a peculiar motion of their own, independently of that produced by the motion of the photosphere in the neighbourhood of the spot, and that the time of rotation of the Sun on its axis determined from the observation of several spots is not, from this cause, always accordant. Although convinced himself of the reality of his solar results, Laugier at this time was one of those modest men who have too little confidence in their powers, to venture laying any deduction that is novel before the criticising eyes of their fellow-workers; hence this memoir was never published in its entirety. It has been remarked by M. Faye, that "others have followed in his track; a new branch of science has taken birth on the ground which he had broken, and which is being rapidly developed. It is not, however, the less true that we owe the first germs of it to the unfinished memoir of Laugier, and it is at this moment a melancholy satisfaction for me to have waited until now, before making it public."

The numerous duties which necessarily fall upon a young and active observer at a large Observatory, would have been a sufficient excuse for devoting his leisure hours to other and less scientific occupations. His love for astronomy, however, would not

allow him to do this. He made himself acquainted with the method of calculating elements and ephemerides of comets. He was also the discoverer of a telescopic comet in the constellation *Draco* on the 8th of October, 1842. In a few days after the discovery he published the elements of its orbit. For this joint work, as discoverer and calculator, the Academy awarded him the Lalande Astronomical Prize in 1843. Besides devoting much attention to the observation of this comet, Laugier presented several important papers to the Academy, notices of which are inserted in the *Comptes Rendus*. Among these are the following, "On the orbit of Halley's Comet at its appearance in 1835;" "On the Comet discovered at Marseilles by M. Gambart," and "On the ancient appearances of Halley's Comet, especially that observed by the Chinese Astronomers in 1378."

M. Laugier left the Paris Observatory in the beginning of 1854, in company with others who were connected with the family of M. Arago, the late Director. The loss of the use of the instruments at the Observatory was felt by him exceedingly, principally because many subjects on which he was engaged were still unfinished, and the fear that arose in his mind that he might never have the means of bringing them to a successful conclusion. Laugier soon found, however, that his fears were groundless. He found ample time and material for continuing his researches at his residence in the Rue Nôtre Dame des Champs. The writer of this notice saw him here in the summer of 1854 occupied on the reduction of the observations which formed the material for his important memoir, "Sur la détermination des Distances Polaires des Etoiles Fondamentales." A remark made by him at this time deserves to be recorded as a striking illustration of the great respect he entertained for the long and continuous series of fundamental observations made at Greenwich. On a passing allusion being made to the *Greenwich Observations*, several volumes of which were near him, he exclaimed, with considerable animation, "No books in my library are so precious to me as these records of the skill, order, and continuous labour of my *confrères* at Greenwich." The important memoir on the N.P.D. of fundamental stars was published in 1857, and forms a part of Vol. XXVII. of the *Mémoires de l'Académie des Sciences*. The observations were made at the Paris Observatory with the mural circle of Gambey, in the interval between the end of 1851 and the date of M. Laugier quitting the Observatory, owing to the changes in the *personnel* which took place on the appointment of M. Le Verrier as Director. At this time, however, the observations were nearly completed. The memoir is divided into two sections. In the first, he gives a description of the mural circle of Gambey, and a detailed account of the processes used in the reduction of the observations; while in the second he discusses the N.P.D. of 140 stars published in the principal star catalogues, by combining the different results into a normal catalogue, with which he compared the separate N.P.D. given in

each, including the results of his own determination. The comparison shows that the mean error of M. Laugier's N.P.D. for all the stars is only $\pm 0''.447$, a sure proof of the general excellence of his observations.

In the *Comptes Rendus* for 1853, are papers by M. Laugier on a new and very accurate determination of the latitude of the Observatory of Paris from the meridional observation of circumpolar stars, and a catalogue of nebulæ observed during the years 1848 and 1849. On many occasions, Laugier afforded considerable assistance to Arago in his physical researches, including those on photometry and magnetism. In 1847, he investigated the proper motion of three stellar clusters formerly observed by Messier. He was also the author of an excellent treatise on a portable meridian-circle to be used for the determination of geographical positions. This work was published under the authority of the Dépôt Général de la Marine.

In June, 1843, Laugier was appointed an assistant-member of the Bureau des Longitudes, in the room of Savary, and he became a titular member in 1862. After the death of Arago in October, 1853, and the consequent divided interest of the Bureau des Longitudes and the Observatory, the preparation of the *Connaissance des Temps* and the *Annuaire* became almost the only important duty left to the care of MM. Mathieu, Laugier, and other active members of the Board. Since 1861, Laugier undertook a very important part of the calculations of the *Connaissance des Temps*, especially those portions which could not well be intrusted to ordinary computers, such as the section containing eclipses of the Sun and Moon, the tides, and occultations of stars by the Moon. Through his suggestion also, the eclipse-maps, similar to those found to be so useful in the *Nautical Almanac*, were inserted. He was in the habit of making for many years observations of the magnetic inclination and declination for publication in the *Annuaire*.

M. Laugier was elected in 1843 a Member of the section of Astronomy in the French Academy of Sciences, and an Associate of the Royal Astronomical Society in 1848. For some years preceding his death, he held the office of Examiner at the Naval School at Brest, where he was ever anxious to encourage a taste for scientific pursuits. He always felt an infinite pleasure in recommending the young marine officers to the notice of the Bureau des Longitudes, whenever they showed any skill in nautical science.

M. Laugier married the daughter of M. Mathieu, and the niece of Arago. For some years his health had not been satisfactory, ever since, in fact, the death of his son, a youth of great promise. The premature loss of his brother in February 1872 —a man also distinguished in science, and only lately chosen a Member of the Academy of Sciences in the section of Medicine— for whom, on account of their difference of age, he had almost a parental tenderness, had a great effect upon his spirits, and the

combined stroke evidently tended to shorten his days. His death took place at Paris on the 5th of April, 1872, in the sixtieth year of his age. He succumbed at last to a severe attack of gout of several days' duration. His loss was felt in the salons of science, which were thus deprived of the society of one whose whole life was a model of uprightness. His manner was calm and reserved, apparently approaching to coldness, but those who knew him best have spoken of his goodness of heart, and of the honesty of purpose which guided him in all the relations of life. No more appropriate conclusion to this brief sketch can be given than that contained in the following remarks by the lamented Delaunay, who, alas! was so soon to follow him,—"Laugier was truly a friend of mine. For the last eighteen years we have lived in the greatest intimacy. Living under the same roof, occupying ourselves on similar researches, we were always in each other's society. Our lives were bound up together, we were as one individual. It is from this daily intercourse with him that I have been able to appreciate all that was good and honest in his heart; all that was right-minded in his judgment. I naturally sought his counsel under all circumstances. Never have I found his advice in fault; never have I had cause to regret following it. Laugier will no longer exist among us, but he will never cease to live among my most cherished remembrances." E. D.

Dr. Friedrich Magnus Schwerd was born at Osthofen, near Worms, on the 8th of March, 1792. His father was a clerk in a court of justice, and his amount of early education was not very great. As a boy he was very fond of wandering in the solitary woods and meadows; but also showed indications of extraordinary mechanical talent. When he was fifteen years old, his parents removed to Frankenthal, and here his regular education may be said to have commenced. A Catholic priest, named Heinrich, instructed him in French, Latin, Mathematics, and Logic; and his clear elucidation of the subjects he taught left a lasting impression on the mind of young Schwerd. Somewhat later he had the opportunity of studying the use of astronomical instruments under the Abbé Bary at Mannheim. After passing at Mayence the examination of the Ecole Normale of Paris, he was appointed on the 2nd of January, 1814, by the French Government to a vacant tutorship at the Ecole Secondaire at Speyer. When the Palatinate became part of the kingdom of Bavaria, its educational institutes were reorganised, and Schwerd was raised in October 1817 to the rank of Lyceal Professor (at the Gymnasium.) On the establishment of a Lyceum at Speyer, in 1836, he was made Professor of Mathematics and Physics there; an office which he continued to hold for the remainder of his life, though he resigned that at the Gymnasium in 1864.

The health of Professor Schwerd was first shaken in the year 1868, by a violent attack of inflammation of the lungs, from which however he recovered, and those who saw him afterwards actively