magnetism—whether entirely upon the surface of the earth, or within it, or in external space—which seem to be the ultimate conclusions to which this theory has hitherto attained or is capable of attaining. This memoir presents a striking illustration of that happy union of analytical skill with philosophical power for which his later writings were so remarkable, and which puts them in striking contrast with the obscurity and extreme compression of some of his earlier productions.

Gauss was born on the 30th of April, 1777. After completing his education at the Collegium Carolinum, he proceeded to the University of Göttingen in 1795; he graduated at Helmstadt in 1799, and afterwards resided as a private teacher in Brunswick until the year 1807, when he was appointed Professor in the University of Göttingen, and Director of the Observatory; a situation which he continued to retain for the remainder of his life. He was twice married, and by his first wife, who died in 1809, he has left one surviving son, and by his second, two sons and a daughter, Theresa, to whom he was tenderly attached, who nursed him, when his health began to decline, with the greatest affection and care.

During the last year of his life the decay of old age began to manifest itself in a disease of the heart, and the usual symptoms which accompany it; and he died in great tranquillity on the morning of the 23rd of February last. "I assisted," writes the Baron von Waltershausen, one of the most distinguished of his pupils, in a letter communicating these facts, "with others of his friends and pupils, in placing his body in his coffin, in binding a laurel crown around his head, and in discharging with filial love and reverence the last honours of the great man, whose name is destined to take its place with those of Archimedes and Newton in the history of the exacter sciences." On the 26th of February, his body, which had lain in state in the Rotunda of the Observatory, was followed to the grave by the whole University, and by a vast multitude of friends and admirers.

George Simon Ohm was born on the 16th of March, 1787, at Erlangen in Bavaria, where his ancestors had been known as prosperous and skilful locksmiths for several generations. His father's intention was, that he, as well as his younger brother, Martin

Ohm, should learn the family craft; but having himself acquired an amount of knowledge—especially of mathematics—unusual in his station of life, which he had found useful to him in his business, he resolved that his boys should have the advantage of a superior education before entering on their future calling, and accordingly, after they had passed through the Elementary School, he sent them to the Gymnasium. With such opportunities and the example of their father, it is not to be wondered at that the talents of the two brothers were rapidly developed. A new career opened to them in 1804, when the celebrated mathematician Langsdorf having become acquainted with their extraordinary progress, pronounced the judgment that some day they would emulate the brothers Bernouilli. He prepared a certificate to this effect, which induced their father to relinquish his intention of bringing them up to his business, and to allow them thenceforward to pursue a scientific career.

George Simon Ohm entered the University of Erlangen when he had completed his sixteenth year, but he remained there only eighteen months, leaving it to give instructions in mathematics in Switzerland. In August 1806 he became a mathematical tutor in the Institute of Gottstadt near Nidau, in the Canton of Berne; after remaining here two years and a half, he went to Neufchatel, where he spent the next two years and a half as a teacher of mathematics. Towards the end of 1811 he returned to Erlangen, and, after taking his degree, entered on an academical course of life as a *Privat-docent* there. This position, however, was merely temporary, as well as a tutorship which he subsequently held at the "Realschule" of Bamberg, which was soon dissolved.

Ohm attained in 1817, for the first time, a suitable and permanent position as teacher of mathematics in the Great (Jesuits') Gymnasium at Cologne, where the peculiar faculty he possessed of representing the theory of mathematics in a comprehensive and attractive manner to the youthful understanding was soon recognized. Ohm, however, had an ambition higher than that of remaining a mere mathematical teacher; his genius led him on to travel into the less trodden regions of science, and to try his powers as an original inquirer. It was not long before he found a congenial sphere of action, and was led to discover the true explanation of the hitherto enigmatical phænomena of the voltaic current.

In 1826 he obtained a long leave of absence in order to proceed to Berlin to perfect and publish his new theory, which appeared in 1827 under the title "The Galvanic Circuit mathematically treated, by Dr. G. S. Ohm." When this work first appeared, it had not the fortune to attract notice from the leading scientific men of the day, nor did it gain for its author consideration or favour from the authorities then at the head of the affairs of education and learning in Prussia, by whom, indeed, he was received in a manner which showed an entire misapprehension of his scientific activity and of his great merits. His susceptibilities thus wounded, he did not delay a moment to declare that, after such a reception, it was impossible for him to retain the appointment he held at Cologne. With the deepest feelings of mortification and grief, he left the place, thrown back into private life with most precarious means of existence, and deprived of all the requisite resources for pursuing his investigations. Seven of the best years of his life were in this way lost to science; but from these adverse circumstances he was at last withdrawn in 1833, when the Bavarian government appointed him Professor in the Polytechnic School at Nuremberg.

Whilst Ohm was usefully employed in this new sphere, his theory of the voltaic circuit began to be appreciated both at home and abroad, and in 1841 the Royal Society of London awarded to him the Copley Medal, the highest honour in its power to bestow; and to mark still more its high estimation of the eminent services he had rendered to science, he was elected, in 1842, a Foreign Member of the Society. This judgment, it is acknowledged by his countrymen, had the effect of entirely removing the obstacles which had hitherto impeded his way; the conclusions of his theory became known as "Ohm's laws" in all elementary works on physics, and throughout Europe his position was recognized as among the most eminent philosophers of Germany.

Amidst his active duties as Rector of the Polytechnic School at Nuremberg, and Professor of Physics, he found time to make advances in the scientific career which his theory of the voltaic circuit had opened to him. Physicists have long been convinced that the various forces to which we ascribe the phenomena of Light, Heat, Electricity and Magnetism, must all have a common origin; transformations of one series of phenomena to another have even been

shown experimentally without the known facts having led to the discovery of their intimate connexion. To this important investigation Ohm determined to devote the remainder of his life. The peculiar views which he had adopted in his researches in electricity respecting the interior constitution of bodies and of the molecules of which they consist, appeared to him to throw a new light on the nature and co-relations of the forces referred to. Following out these ideas, he established the general properties, form, and arrangement of the molecules; he attributed to them simple and polar powers; he determined their relations to the various external actions, and thus gradually formed a complete system, from which he saw the phenomena of light, heat, electricity and magnetism evolve themselves.

Of this projected work on 'Molecular Physics,' only one volume has appeared, which was published in 1849 under the general title of "Contributions to Molecular Physics," vol. i., and with the special title of "Elements of Analytical Geometry of three dimensions according to the system of oblique-angled co-ordinates." This introduction he thought necessary, because the ordinary mathematical methods did not appear to him to apply themselves to his ideas with sufficient simplicity and conciseness. He dedicated this work to the Royal Society of London, "whose approbation," he says, "tempered his courage, which had previously been softened by disheartening treatment, to renewed efforts in the field of science."

Whilst Ohm was, with incessant industry, carrying out his great undertaking, he was, towards the end of the year 1849, unexpectedly called to fill the vacant place of Conservator of the Physical Collection at Munich. Agreeable as this appointment must have been to him, and in accordance with the new scientific direction he had taken, still the event is to be regretted, as the arrangement of the Museum and the construction of new instruments withdrew his attention from continuing and completing his great work. During this time he published a memoir of great interest on the phenomena of interference in uniaxal crystals.

In 1852 changes occurred which induced Ohm to relinquish the official position he had gained in Munich and to become Professor of Experimental Physics in the High School of that city. Not contented to restrict himself to the customary demonstrations and explanations, which would have cost him but little exertion, he pre-

pared for his lectures a text-book on Physics, in which many of the subjects were treated in a very original manner. This work was published in 1854.

To complete, within the limited time he saw before him, the labours he had undertaken, required unusual exertions, which his feeble constitution did not enable him to support. His friends remarked with regret the gradual sinking of his forces from the beginning of 1854; he however continued his lectures until a renewed attack of apoplexy suddenly terminated his life on the 7th of July, 1854. "Thus ended," says his biographer, "the noiseless life of a simple and easily contented, but highly gifted man, who lived solely for science, and who had neither sought nor found social advantages, honours, wealth, or what the world is accustomed to consider as chiefly contributing to happiness." About a year before his death, however, the Cross of the Order of Merit of St. Michael was conferred upon him, and he was also made a member of the newly-founded order of Maximilian.

Ohm was a man of small stature. His countenance, although usually earnest, expressed his good nature and modesty. He was little inclined to conversation, but what he spoke was the expression of his soul, always full of matter, and frequently enlivened with wit and sprightly humour. In his life and habits he was extremely simple, contented and temperate. He was fond of solitude, and to this feeling, as well as to the unfavourable circumstances with which he was surrounded at the commencement of his career, was it perhaps owing that he never sought to establish his domestic happiness by marriage.

Besides the works alluded to in this notice, he contributed twelve papers to the Journals of Schweigger and Poggendorff. Two of these relate to Acoustics, one to Physical Optics, and the remainder are on Electrical subjects. The latter consist principally of experimental verifications of his theory, some published before and some after the appearance of his mathematical treatise.

The particulars above stated are derived almost entirely from a detailed memoir on the life and writings of this eminent philosopher communicated to the Royal Academy of Sciences of Munich by Dr. J. Lamont.