the reading of the papers, it was proposed that the society or-
ganize a general session, extending over several days, to be
held during the Summer vacation. Such a meeting will be held
this year in Brooklyn on Aug. 20, 21, and 22.

"Prof. Arthur Cayley."

OBITUARY.

Prof. Arthur Cayley.

Prof. Arthur Cayley, the distinguished mathematician, and since 1863 Sadlerian professor of pure mathematics at Cambridge University, England, died there on Saturday, at the age of seventy-four years.

Glance over almost any good treatise in any language, upon no matter what branch of the higher mathematics, written within the last quarter of our century, and as you turn its leaves your eye will fall now and again upon the name of Cayley. He was compacted intellect, and some of his discoveries were as if the roof of some vast hall in the Mammoth Cave had been broken through and had admitted a ray of daylight. Yet the undisputed supereminence of the man in the mathematical world did not come from any acknowledgment that he was beyond all comparison the brightest mathematical genius of the age. That certainly would be saying too much. Still, all mathematicians ranked him as first among their living number, and that for various reasons.

In the first place, it was he, beyond gainsaying, who worked that mighty change in the status of algebra which ensued upon the opening up of the theory of invariants. True, Avonhold, Boole, and others had a little before Cayley strolled over the ground; but they did so without recognizing upon what gold-mine they trod. It must be granted, too, that Cayley in his earliest paper upon the subject committed an error so serious as to arrest the development of the subject for many years, and that, having discovered his fault, he aggravated it by not announcing the truth; so that the German Gordan was the first to take the next following step, and Clebsch and Gordan, in an epoch-making book, following a method much less laborious, if in some respects less thorough than that of Cayley, were the first to greet the new ruling spirit of analysis. But, notwithstanding the loss of such great opportunities, Cayley, with the wonderful Sylvester by his side, and subsequently with other efficient lieutenants, was able to overcome the disadvantage, and so put into evidence the superiority of his original method that nobody anywhere now seriously denies his authorship of the theory of invariants.

What is an invariant? It is an algebraical expression signifying, not our measure of the form to which it belongs, but a real intrinsic property

of that form independent of all measurement. That there were such expressions, or even such properties, or that mathematics had anything to do but to count and to measure, was barely and dimly discerned before Cayley. Remarkable, too, is the circumstance that the number of the fundamental invariants of any form is limited; so that all that can ever possibly be discovered about it is wrapped up in a few algebraical formulae. That much we may say, without quite converting our columns into a treatise on algebra. If it is not very clear, it will at least serve to indicate the basic, the very real, and at the same time the singularly ideal nature of Cayley's great find.

In the second place, Cayley made a discovery of a closely similar nature in the field of analytical geometry—a discovery which has revolutionized our conception of space, and especially of measurement. Namely, he it was who discovered and named the geometrical "Absolute." The "Absolute" is a particular surface—say, a firmament in the midst of the heavens, to which no object from our neighborhood can in any finite time, by any finite speed of motion, be carried, nor from it be removed. And every proposition involving measurement is equivalent, at bottom, to an intersectional property of that surface. This is certainly without exception the most wonderful discovery ever made in analytical geometry.

In the third place, we may reckon among Cayley's prime achievements the theory of matrices, which is the true foundation of multiple algebra, and is closely allied with work which goes down beneath the foundations of invariants, and promises more insight into mathematics than even the two great products of his genius just mentioned.

In the fourth place, if he succeeded in extracting no fourth nugget worthy to be placed on the same shelf as those three, yet the amount of excellently well-done investigation which he accomplished, that nobody else could have performed half so well, was simply stupendous. Besides a volume on 'Elliptic Functions' and numerous résumés for encyclopaedias—statements so luminous, elegant, and masterful that one does not wonder few editors cared to place them side by side with their own stuff—Cayley's strictly scientific papers (mathematical, every one) will fill ten or a dozen stoutish quarto volumes. The seventh appeared in 1894.

In the fifth place, the conscientious finish, the high polish of everything that left his hands, was more than admirable; it was estimable. Like a notable housewife, he never spared mental elbow-grease, but would clean out all corners of the analytical edifice that had long gone neglected; and that although nobody looked into them—all the more, indeed, that nobody looked into them—well knowing nothing was to be gained from such laborious tasks but the satisfaction of his own sense of good housekeeping.

In the sixth place, in erudition Cayley easily distanced every other mathematician in the world. He was a mathematical encyclopaedia, had read everything, remembered everything, and had everything stored away in its proper place in his memory, whence it could be brought out the instant it was wanted.

To these reasons for the homage paid him by all mathematicians we must add one more, the charming amiability of his character, his ambition to be useful, his indifference to appearing brilliant. But the above by no means completes—it hardly begins—the account of what was interesting in the man

and in his opinions. We will try to give some hint of the nature of the interest he excited in those who came close enough to discern his mental features. But first let us say a few words by way of biography.

The Cayleys were anciently a great family. The evidence is reasonably good that they held the Honor of Cailli, near Rouen; and Roger de Cailli was one of the mighty in the reign of Henry II. That Norman family, and later Sir Hugo de Cayly, Knight of Owby, and others in the thirteenth and fourteenth centuries, held chiefly in Norfolk, but had other property in York, where a younger branch settled, and, becoming rich, in the sixteenth century purchased the estates of Brompton, where they are still seated. Sir William Cayley of Brompton was created a baronet in 1661, for his services to the crown during the great rebellion. His fourth son's fifth son was Cornelius Cayley, who (born 1692) became recorder of Hull, and who wrote his own life, and some other books. Cornelius's fourth son, John, born in 1730, was consul-general and merchant at St. Petersburg. John's fifth son, Henry, likewise a merchant of St. Petersburg, seems to have been united to a Russian lady somewhat late in his middle life. She was sent to England for her confinement; and so it happened that the great algebraist was born at Richmond, Surrey, in the year 1821 and on August the 16th. Thus Russian was Cayley's mother tongue, and his physiognomy and cast of mind had much that was Russian. His physiognomy was most striking. The shape of the head was extraordinary--rather flat, and seeming to have a cornice above it; the intensity of the gray eyes, which seemed to be looking through whatever opaque thing might be near to him, was unparalleled. The handsome but rather small nose and the perfectly unaffected and smilingly watchful mouth seemed boyish in their unsophisticated interest in things. But what a curious catlike intensity, as if just pouncing on a truth!

Several of the Cayleys have shown decided scientific ability. Some of the inventions of Sir George are extremely intelligent. Arthur's genius was most pronounced from his earliest youth. He entered Trinity College, Cambridge, at the unusually early age of seventeen; but, although he had redoubtable competitors, his supremacy in everything was unquestioned throughout his undergraduate career. For Cayley was an extraordinary linguist too, and is said to have been able to talk well most of the European languages, including Hungarian. He was senior wrangler and first Smith's prize man in 1842. He had, after the last day of the examinations, already mounted upon the coach-box in the dusk of evening to return home when the tripos list was handed up to him, showing the results of the contest. He stuffed it into his pocket, willing to await the light of morning to learn his fate, knowing what it ought to be, and quite content with that.

Decidedly averse to taking holy orders, Cayley must needs follow a profession. He became a conveyancer, a species of barrister whose task in the then state of English records and of English law was far from simple. Cayley executed its functions with his many-faceted perfection. He acquired the reputation of being, perhaps, the best conveyancer in England. His instruments were used in the offices as models. Meantime he was educating withal that power of comprehensive statement, omitting no detail, yet subordinating what naturally is subordinate, which stamps all Cayley's mathematical writings as with a trade-mark. His practice became lucrative, and was rapidly becoming exceedingly so. Yet throughout this period he jealously

reserved his hours for mathematical investigation, and even condescended to the mathematical mastership of Rugby, lest his pedagogical faculty might rust.

Meantime, the Lucasian professorship, the regular mathematical chair in Cambridge, had become vacant and had inevitably and properly been filled by Stokes, one of the very first mathematical physicists of Europe, and a little earlier than Cayley. Men who cared for the university, and for its proper fulfilment of its great rôle, began to cast about to see whether Lady Sadler's funds could not be so utilized as to bring Cayley back. At first but a very meagre provision could be offered him. Yet he promptly abandoned the highway to wealth upon which he was then travelling and returned to Cambridge. Subsequently, by the withdrawal of a yound man entitled to a fellowship, Trinity was enable to reëlect Cayley, and the Sadlerian revenues became a little more respectable. It was a miserable pittance compared with what he relinquished; but never would Cayley admit any element of sacrifice was involved in the action. He was scarcely civil to his old profession, saying law was the art of expressing things with the greatest prolixity, mathematics that of expressing things with the utmost compactness. The Sadlerian professorship was created for him in 1861, but was not put upon a permanent footing till 1863. He held it till he died. He was twice married, but had no children.

He always remained a man of remarkable practical ability, solving questions of conduct with promptitude and unerring accuracy. But a life more completely severed from the world of matter would be difficult to find in any hermitage. Cayley was carried, as by a mighty tide, into Plato's way of thinking. For him, as for Plato, this world was but a cave shutting out the splendors of the world of ideas. Were you to ask him which seemed the most real to him, an invariant or a lac of rupees, he might not care to cast precious verities to be trampled under foot; but for him the money, and all it could bring, would be but as shadow to substance compared with the algebraical form. Look over his elementary expositions. You will never find him apologizing for the paradoxical statements of the analyst, or in any degree explaining away expressions about infinity or about the imaginary. The square root of negative unity was not to his mind the less true because no instance of it was to be found in the world of sense; it was, on the contrary, the world of sense which was miserably restricted and only half the truth.

Cayley did not parade such ideas. They were esoteric doctrines which he well knew the man of gross peripheral sense could not reach to, both from a deficiency of intellectual tension and from a deficiency of spiritual tension. One might meet him often without guessing such ideas inspired his soul. For him, however, they were the most real of things. To know him so as to perceive the springs of his life was a great lesson in singleness of heart.