THE NAPIER TERCENTENARY CELEBRATIONS.

LORD MOULTON ON THE EVOLUTION OF LOGARITHMS.

LORD MOULTON, one of the Lords of Appeal, formally inaugurated the Napier tercentenary celebrations in the Synod Hall, Edinburgh, yesterday afternoon in the hall of the Edinburgh Students' Union. Lord Provost Inches presided, and was supported on the platform by a number of the foreign and other distinguished visitors whose names were afterwards intimated. There was otherwise a large attendance.

The Secretary, Dr Cargill Knott, read the following telegrams:—

From Professor Volterra, Professor of Mathematics at Arcieia, near Rome, representing the University of Rome—Unite with you in celebration Tercentenary of immortal Napier. Regret that unforeseen circumstances do not allow me to be present.

From Commandants Verde, Spezia—Respectful greetings from the Meteorological Observatory, Spezia.

From Rector Kostanecki, Krakow—From after the Senates of the Jagellonian University of Krakow I send a message of warmest congratulations to the President and Fellows of the Royal Society of Edinburgh on the occasion of the Tercentenary celebration of the publication of John Napier's splendid discovery.

From Professor Bassel, Charkoff—The Soviet Mathematique of Kharkof associates itself with the celebration of the tercentenary of the famous inventor of Logarithms. It has elected Professor Sreklof to represent it.

From Professor Witkowski, and General Secretary Ulanowski, Krakow—President and Council of the Imperial Academy of Science, Krakow, desire to present their greetings to the President and Fellows of the Royal Society of Edinburgh on the occasion of the tercentenary celebration of the publication of John Napier's splendid discovery.

LORD MOULTON'S DISTINGUISHED CAREER.

The Lord Provost in introducing Lord Moulton said that the Lord Justice-General was one of the brilliant episodes in Lord Moulton's distinguished career. The ordinary man would regard him as a learned Judge, dispensing justice and equity in the House of Lords; but those met to do honour to a man of science and mathematical deeper. It was not every Lord of Appeal who could do justice to the memory of John Napier of Merchiston. But in Lord Moulton they had one whose close intellectual love was mathematics, and no lover of mathematics could fail to admire the art of logarithm. In his undergraduate days, Lord Moulton gained every mathematical honour within his reach, and he finally completed his student's career as Senior Wrangler and First Smith's Prize man. Having done so, he remained a few years at Cambridge as fellow and lecturer, and then, attracted by the wider and more attractive field of politics, he forsook the quiet cloisters by the Cam, and pitched his tent by the swirling Thames. One permanent monument marked his stay on the bridges. As editor of the second edition of Boole's Calculus of Differences, he practically wrote almost the larger part of the book. (Applause.) This subject, it should be noted, had close affinity with the conveniences of logarithms as well as other kinds of mathematical tables. Thus historically, as authors, John Napier and Lord Moulton joined hands. (Applause.) It was worthy of mention that even in the engrossing duties of a steadily growing legal practice Lord Moulton found time for research work in science. In conjunction with the late Sir William Spottiswoode, he made investigations in the striking discharge through rarefied gases, results were published by the Royal Society of London, and constituted an important link in the development of modern views on the nature of electricity. Lord Moulton possessed two singularly well fitted Lord Moulton was to open a congress of mathematicians, who had been brought together to do honour to the memory of the great Scottish man and citizen, the sage of Merchiston. (Applause.)

LORD MOULTON'S ADDRESS.

Lord Moulton, who was received with applause, said he felt fully sensible of the honour that had been done to him in asking him to preside over, on this occasion, the tercentenary of the invention of logarithms by Baron Napier of Merchiston. That name was a glory to the land, and its bearer prominent among that small band of thinkers who had subjugated the material forces of nature to the powers of the human mind as a practical instrument. The world's public interest had been of late so concentrated upon Napier that not been but rather added to the difficulty of his task that day. There were but few months in which not every centre of learning discourses had been given and papers read on his life and works. Every fact known about him had become a commonplace. They were all aware that he was born in 1550 and died in 1617, that he lived at Merchiston near Leppa, that he was suspected of black magic, that he proposed wonderful and futile methods for the relief of the king's exchequer, and that was known left him very imperfectly disclosed, that he chose to show him strong and self-reliant, of solitary habits of thought and untiring industry, and he was content with such a delineation of the man of whom he was about to speak. Nor did he feel more drawn in the direction of mere subtlety. How greatly he admired Napier and how desirous he was that his merits and his labours should be appreciated would sufficiently appear from the fact that he had undertaken the duty of his address to-day. What new contribution could he bring either to the knowledge of Napier's work or to the appreciation of its merits which so many skilled mathematicians had already worked at the subject and made full utterances thereon?

A SORT FROM THE MUSE.

There was one aspect in which it had occurred to him he might perhaps, by his treatment, make a contribute, even though it be but a widow's mite. The mathematician differs more from the poet than a Sole from the blue. No previous work had led up to it, nothing had foreshadowed it or heralded its arrival. It stood isolated, beckoning to us from human thought abruptly without borrowing from other a sense of following known lines of thought. It reminded him of those islands in the ocean that rise up suddenly from great depths, and which stand solitary with deep water close around them their shores. In such cases they might believe that some convulsion had thrust them up suddenly with water-reading force. Does such it be with the human thought? Did this come as a revelation to Napier, bursting on him as a lightning flash, or was it the result of slow growth, the evidences of which were now obliterated? The undoubted fact that Napier worked for some twenty years at logarithms before he published his first book relating to them seems to describe on this point. He must have been a slow and gradual evolution, even though that which remained furnished so few traces of the earlier work. Was it possible to form any of what he had left them and out of the circumstances of the time to build up his history of the evolution, to reconstitute the process of discovery by deciphering the half-effaced records of its growth? Is there that in the mind of man which, find something to interest them, and at all events he should be able to appreciate the effort? Perhaps he might claim wide experience in what he might perhaps term the infancy of ideas. In the course of his service as the Bar he had given many theories of studying inventors and their inventions. He learnt on the one hand that pioneer inventions were rarely made in the way he always supposed they have supposed they had been. The man grasping in the dark for the way he devises many things guided by trivial and immaterial indications which he had not yet learnt to disregard. It was only after the light had been thrown that he saw that he would have been the direct path. And on the other hand he had learnt how difficult it was to trace once the day had broken to put oneself back into the twilight and see two things with the hazy and unrecognised outlines that in a way he possessed, and which made recognition then so impossible. Such experiences had, he thought, made him to some degree equal to the task of tracing on the probable course of a discovery where the terms were not too absolutely obliterated, and he had used what skill he had gained from such experience in trying to picture to himself by what steps Napier advanced from the darkest night which existed when he first took up the problem to the full daylight, in which he finally gave it to the world. (Applause.) Lord Moulton then proceeded to discuss the question as to what Napier to work on the lines he did, seeing there was no antecedent work to suggest it, and to indicate what, in his view, were the different stages of the discovery. Some of his points were that Napier, seeing that the trigonometrical tables enabled the product to be found without actual multiplication, conceived the idea of constructing special tables which would do the same for any two expedients manner; that originally Napier contemplated the use of more than repeated multiplications by a factor very close to unity, so that each multiplication reduced very slightly the number operated on; that the idea of "progressing" signifying "the number of the ratio," preserved that idea in the second stage of his discovery; that the notion of multiplying by a factor gradually gave way to the idea of taking away an aliquot part from the number arrived at by the preceding operation; and that this led him to pass from the idea of fluxion to the geometrical representation of the quantity by a line, and to the conception of "motions were perfectly represented by repeatedly cutting off of the same fraction of the diminished length. Further, that at this stage Napier took simple but obvious step, which ultimately proved of momentous importance, and established the proposition that the logarithms of progressions are equally differences. That step was the very key to the most interesting stage of his discovery, and to his being then ready to commence his calculating tables.

NAPIER'S TENACITY OF PURPOSE.

What deeply impressed him (continued Lord Moulton) was his tenacity of aim, combined with his receptivity of new ideas for attaining it. From first to last it was a table of logarithms of sines that he proposed to make, and he did not permit himself to be turned aside from that purpose even when it was completed. His concept evidently widened as he proceeded, and he must have been sorely tempted to cut short the enormous labour of the task to larger schemes. But he wisely resisted the temptation. He saw that he must first create an actual table and give that to the world, or his task was unperformed. Would that other inventors had been equally true to their ideals.

A MEMORY OF MR BARBAGE.

In illustration of this point, Lord Moulton gave the following reminiscence:—

One of the sad memories of my life was a visit to the celebrated mathematician and inventor, Mr Babbage. He was very advanced in years, and his memory was failing him. He took me through his workrooms. In the first I saw the parts of the original calculating machine, which had been made, but which was left in an incomplete state, and had even been put to some use in the form in which it remained. Others have not finished it, because in working at it I came on the idea of my analytical machine, which would do the work in a simpler way. Indeed, the idea was so much simpler that it would have taken more work to complete the calculating machine than to construct my attention to the analytical machine. After a few minutes' talk, we went into the next room, where he showed and explained to me the working of the elements of the analytical machine. I asked if I could see it. "I have never completed it," he said, "because I hit upon an idea for a simpler and more powerful form of the method, and this rendered it useless to proceed on the old lines." Then we went into the third room. There he scattered his drawings about. I saw no trace of any working machine. Very unwisely I expressed my sympathy. He received the dreadful answer, "It is not constructed yet. I have the working out in my head, and have time to construct it altogether than it would have been to complete the analytical machine from the stage at which it was left." I took leave of him with a heavy heart. When he died a few years later not only had he constructed no machine, but the wealth of a large and long continued scientific men who were deputed to pronounce upon the value of his work that all was so incomplete as to be incapable of being put to any useful purpose."

THE PERSISTENT EFFORT OF A GREAT MIND.

But, Lord Moulton continued, so soon as the discovery had actually seen the light, and its claim to practical usefulness enthusiastically received by all who learned of it, Napier's great mind most justifiably to destroy the scaffolding which had been so serviceable in the erection of his building. If they looked at the last step taken in his endeavour to trace out the path by which Napier had arrived at his discovery, however, he can had not been to diminish the greatness of his achievement or to make it less wonderful. As it is, all perhaps the greatness of his work. As it stood in his written work is well-nigh unscanny, and the result of a mind which, in addition to his full knowledge, and any traces of his early efforts that remained were left, so to speak, by himself unnoticed. He was not aware of them, though it were due to magic. It took the examination of a mathematician of the present day to think of him as more human—as the persistent effort of a great mind to perform a task which it had deliberately set itself. He saw the step by step, it pursued to the end. At the outset of his progress, he had to find out in the most possible task—that it was not a vain chimera. When that fear had been dispersed, it must have encouraged him and confirmed him in his concentrated achievement. But he allowed himself to make considerable use of the knowledge which insight into the subject and further suggestions of devices whereby those difficulties could be overcome. It was as the work of a man that he thought of him. The fascination of reading of the early methods with anything of his due was lost on since, or even with logarithms as they were now conceived of. The mind of Napier was to him to think of his work