



Wittag-Geppin

GÖSTA MITTAG-LEFFLER, 1846-1927.

MAGNUS GÖSTA MITTAG-LEFFLER, who died last year at the age of eighty-one, the oldest of our foreign members, was for many years the recognised leader of the Scandinavian school of mathematics.

Mittag-Leffler was a remarkable man in many ways. He was a mathematician of the front rank, whose contributions to analysis had become classical, and had played a great part in the inspiration of later research; he was a man of strong personality, fired by an intense devotion to his chosen study, and he had the persistence, the position and the means to make his enthusiasms count. He thus won for himself a position unlike that of any other Scandinavian mathematician, and one which it was a little difficult for anyone who had not met him in his own country to realise. I can remember well the occasion when he lectured for the last time to a Scandinavian Congress, at Copenhagen in 1925, and the whole audience rose and stood as he entered the room. It was a reception rather astonishing at first to a visitor from a less ceremonious country; but it was an entirely spontaneous expression of the universal feeling that to him, more than to any other single man, the great advance in the status of Scandinavian mathematics during the last fifty years was due.

Mittag-Leffler had been overwhelmed with honours; he was a doctor, for example, of four English or Scottish universities; he had been a president or vice-president of endless congresses; and he was an honorary member of almost every scientific society in the world.* He travelled continually, and there was no mathematician who was so familiar a figure abroad. But to the outside world he was, above everything, the editor of the 'Acta Mathematica,'† the famous journal which he founded, and, with the co-operation of a committee of the four Scandinavian countries,‡ edited for forty-five years.

Periodicals are the most important material facts in the mathematical world. The 'Acta' took its place in the front rank of mathematical periodicals from the beginning, and its rank and standard have never declined. It has always been the most completely international of all mathematical journals. All such journals are international to some extent; 'Crelle's Journal' made its reputation on the works of Abel, and the leading German periodicals of the

* He was a foreign member of the Royal Society from 1896 until his death.

† A fuller account of Mittag-Leffler's activities in connection with the 'Acta' will be found in Nörlund's notice of him in vol. 50. Prof. Nörlund very kindly allowed me to see the proof-sheets of this notice, and I have drawn from it freely. The portrait here reproduced is also copied from the same notice by Prof. Nörlund's permission.

‡ Including Finland.

present day, the 'Mathematische Annalen' and the 'Mathematische Zeitschrift,' are very largely international. The 'Acta' was always international in a more thorough-going sense than this. It would hardly have been practicable, in 1881, to support a mathematical journal of the first rank on Scandinavian mathematics alone; and Mittag-Leffler understood this, and set himself from the beginning a standard which, without the co-operation of mathematicians of all countries, it would have been quite impossible to maintain.

Two great mathematicians in particular, Poincaré and Cantor, contributed freely to the early volumes. It is difficult to realise to-day how Cantor had to struggle for recognition. The mathematicians of his time, however, were singularly slow to understand the overwhelming importance of his work; and Mittag-Leffler, a younger man, was one of the first to recognise it, and to apply Cantor's ideas successfully in the region of "ordinary" analysis. In Mittag-Leffler's last published paper he recalls this with very justifiable pride.* But Mittag-Leffler was always a good judge of the quality of the work submitted to him for publication. Even in his later years, when most of the editorial work was delegated to others, he retained that curious sense which enables the great editor to feel the value of work at which he has hardly glanced, and it was this gift which enabled him to carry the heavy responsibility which he had assumed in a way which would hardly have been possible to any other mathematician. It was a heavy responsibility in more ways than one, for the finances of the 'Acta,' like those of other journals, were imperilled by the war, and there was a period when Mittag-Leffler had to supplement the Government subventions heavily himself. Like other journals, the 'Acta' has overcome its troubles, and Mittag-Leffler could no doubt feel, when the last three volumes were dedicated to him as a *Festschrift* on his eightieth birthday, that the future of his great foundation was secure.

Mittag-Leffler's own work is occupied almost entirely with the general theory of functions analytic in Weierstrass's sense. He was an excellent writer. His account of the foundations of the theory of elliptic functions, modelled, no doubt, on Weierstrass's lectures which he had attended in Berlin two years before, published first in Helsingfors in 1876, and translated into English in 1923 in the 'Annals of Mathematics,' is a really admirable piece of exposition, and makes one regret that he never wrote a treatise on a larger scale. He occupied himself on various occasions with fundamentals in the theory of functions. For example, he gave a proof of Cauchy's theorem in 1875, which marked at the time a very definite advance. Like Goursat after him, he divides the contour into elementary contours by a network, and argues directly from the

* A short note on a very interesting historical article by Schönflies ["Die Krisis in Cantor's mathematischem Schaffen," 'Acta Math.,' vol. 50, pp. 1-23 (1927)]. This article reproduces a number of Cantor's letters to Mittag-Leffler.

definition of the derivative in every mesh; but he assumes what amounts substantially to uniform differentiability, and so misses what is really characteristic in Goursat's proof. He also wrote a number of memoirs on linear differential equations.

His best-known and most characteristic work, however, is concerned with the problem of the analytic representation of a one-valued function (or one-valued branch of a function) with assigned singularities, and falls into two halves associated with the periods of his life following on the years 1877 and 1900. It was in 1877 that Mittag-Leffler first published the famous "Mittag-Leffler's theorem" of the textbooks, a theorem suggested, of course, by Weierstrass's factor-theorem, but in no sense a corollary of it. In a later memoir—his first contribution to the 'Acta,' in 1884—Mittag-Leffler gave various generalisations of his theorem, of which treatises such as those of Forsyth and Osgood give a full account. In the second series of memoirs, the first of which appeared in 1900, we find the problem of analytic continuation envisaged in an entirely modern form. Mittag-Leffler considers the general problem of continuation for an element of any analytic function regular, say, at $z = a$. He introduces for the first time the idea, now well established as of fundamental importance in all such investigation, of the "star" (*Hauptstern*) associated with a ; the region obtained by removing from the plane the further segments of all radii issuing from a and passing through singular points. He solves in various manners and in explicit form the problem of representing the function by an analytical expression convergent throughout the whole interior of the star. Some of these solutions are series of polynomials in z , while others are limits of associated functions, such as

$$\lim_{a \rightarrow 0} \sum_{n=0}^{\infty} \frac{c_n z^n}{\Gamma(1 + \alpha n)},$$

where we suppose that a is zero and that $\sum c_n z^n$ is the Taylor's series of $f(z)$. Representations similar to the last, but involving slightly different convergence factors, such as $n^{-\alpha n}$, have also been used with much effect by other writers, such as Lindelöf and Le Roy. A glance at Bieberbach's article in the 'Enzyklopädie der Mathematische Wissenschaften' (II C 4) is enough to show the range of later investigations which have their root in Mittag-Leffler's researches.

Mittag-Leffler had two homes between which he divided his time in Sweden. His principal residence was in Djursholm, in the suburbs of Stockholm. Here was his library, the finest mathematical library in the world, perhaps—at any rate for a working mathematician—and now in the hands of the Mittag-Leffler Institut and the Swedish Academy of Sciences. All books and periodicals were there (or all, at any rate, that any sane man could want), and a colossal collection of "separata"; and if one got tired one could read the correspondence

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of all the mathematicians in the world, or enjoy the view of Stockholm from the roof. He had also a country house at Tällberg, some two hundred miles to the north, in the beautiful and rather primitive Dalarne country. It was a delightful experience to stay there, and there perhaps Mittag-Leffler appeared at his best, a most entertaining mixture of the great international mathematician and the rather naive country squire. He was a strong nationalist, in spite of his internationalism, as anyone who lived in so beautiful a country well might be; and he loved his house and his garden, and his position as the landowner of the countryside. Even his tennis court, "the most northerly tennis court in the world"—that shapeless mass of disintegrating rubble, with holes in which the ball remained stationary where it pitched—he regarded with an entirely disarming pride. I am sure there can be no one who has ever stayed at Tällberg who is not saddened by the thought that he will never stay there again.

Mittag-Leffler played a very great part in the history of the mathematics of his time. He had exceptional opportunities, and exactly the blend of qualities required to take advantage of them to the full. There have been greater mathematicians during the last fifty years, but no one who has done in his way more for mathematics.

G. H. H.
