GEORGE MINCHIN MINCHIN. (1845–1914).

George Minchin Minchin was born at Valentia Island (Kerry), May 25, 1845. When he was about nine years old, his mother died, and he was taken to Dublin for its educational advantages, being much with his uncle-in-law, Mr. David Bell, a Shakespearean scholar and a schoolmaster. From Mr. Bell he probably derived some of his literary skill, but his mathematical ability soon attracted attention. In January, 1862, he entered Trinity College, Dublin, under Dr. Shaw as tutor. In 1865 he obtained a University scholarship in mathematics, A. W. Panton being second. In the same year he got the Lloyd Exhibition in mathematics, pure and applied. In 1866 he and Panton obtained gold medals in mathematics, and began to take an interest in experimental physics. In 1871 and 1872 he was awarded the Madden Premium instead of a Fellowship. He was elected a Fellow of the Royal Society in 1895, and he died March 23, 1914.

In the spring of 1875 he was appointed Professor of Mathematics at the Royal Indian Engineering College, Coopers Hill, the late Sir George Chesney being then president. In 1888, Sir George, having occasion to testify to Minchin's capabilities, wrote, among other things, as follows:—.

"There is one point on which I may usefully testify from an experience of ten years as head of Coopers Hill, and that is to his remarkable gifts as a lecturer. He combines in a peculiar degree the power of lucid explanation, and of interesting his pupils in subjects which, under ordinary handling, may easily be made dry and repulsive. Over and over again when visiting his lecture room with the intention of staying only a few minutes, I have found myself sitting out the whole lecture, so interesting, and indeed charming, did I find his demonstrations on the black-board of the processes of both pure and applied mathematics."

By universal testimony his teaching was clear, broad, and enthusiastic, and he was most popular with the students, not only inside but also outside the lecture room. Among other claims to their liking, he was one of the best lawn tennis players in the College, and his extraordinary exhibition of energy and skill in the lawn tennis of those days, which consisted chiefly in long spells of lobbing from the back line, always attracted a gallery. He was in fact a keen athlete, and in his younger days played cricket for the Gentlemen of Ireland.

He is best known as a mathematician and writer of classical text-books in Mathematics, the most famous of which is his 'Statics,' which is a model of elegant scholarship and clearness of exposition, and upholds the best traditions of the great Dublin School. Alfred Lodge, one of Minchin's colleagues at Coopers Hill, says that, "His various mathematical papers exhibit the same qualities of clear, accurate reasoning and elegance of exposition. He could never tolerate a slipshod argument or a carelessly written sentence. If any one came to him for assistance in a mechanical problem, he was always ready

to work out the solution, apparently without effort, on any scrap of paper that was handy, but always with scrupulous neatness, and without either hurry or hesitation: he never seemed to have to search for a method or to consult a book."

But he was by no means solely a mathematician; his interest in experimental physics was always very keen; and the writer first made his acquaintance in or about the year 1875, when Minchin came to University College in his spare hours to work in the then comparatively new laboratory which Prof. Carey Foster had there started. He went through a certain course of training in physical measurements, but his chief interest lay in original investigation, and he was always trying experiments, both in the laboratory there, and at Coopers Hill. He was a bachelor then, and the writer often went to visit him at the College, spending the night in a room which had been cleared for the occasion by the removal or piling up of numerous bird cages; for he was a great bird lover and had a collection of small birds which, if not large, was more than sufficient for an ordinary bedroom.

He was an early riser, and his books were mostly written before breakfast. He was also a notable correspondent; and the letters he received from George F. Fitzgerald, like all else written by that remarkable man, together with Minchin's replies, ought to be of interest if made accessible.

His best known physical investigations were probably those on the effect of light on metal plates coated with specifically absorbent chemical compounds; he found that aniline and other highly coloured dyes were able to make platinum plates electrically responsive to light, and he succeeded in making them fairly sensitive. These experiments went on until he arrived at a kind of coherer effect in these cells, and developed them into what he called "impulsion cells," with which he afterwards detected Hertzian waves.

Another electrical investigation, in which he persuaded the writer to co-operate, had reference to the application of the properties of selenium to the electrical transmission of views and pictures. His idea was to use a multiple cable consisting of a great bundle of insulated wires in parallel, to coat the ends with a film of selenium, to throw a picture upon the film, and to cause the distant end to reproduce, by action on a photographic film, the luminous intensity corresponding to each wire, thus developing a reproduced picture as a kind of mosaic. The chief difficulty seemed to lie in obtaining a transparent conductor. Electrolytes were tried, but they introduced difficulties of their own, and it cannot be said that our efforts met with success.

A metrical invention about which he was enthusiastic, and in the development of which he must have spent a good deal, was an absolute sine-electrometer; that is to say, a kind of trap-door electrometer with a light aluminium trap-door hanging vertically and examined by a microscope; the guard and opposed plates, fixed together, being tilted by a micrometer screw until the trap-door, if electrified, came back to its original sighted position. It is no doubt a metrical variety of the gold-leaf electroscope, and it can be made extremely sensitive. Such an instrument has since been developed further by others, and is now in use, being made by the Cambridge Instrument

Company in a form called the Wilson-Kaye tilted gold-leaf electrometer; though I am not sure that the absolute voltage can be calculated from its dimensions, as Minchin intended.

These examples are given as some indication of the less known work of Minchin, for there is no need to emphasize the value of his mathematical text-books. An article on his photo-electric discoveries will be found in 'The Photographic News,' vol. 35, pp. 57 and 61, being the number for January 23, 1891. He exhibited occasionally at the Royal Society's Conversazioni. He wrote papers sometimes on general subjects, which were often full of humour: and he was not above composing humorous scientific poems. Sir George Greenhill says of Minchin: "I think 'genial' will express in a single word the impression of Minchin's nature. He dearly loved a scientific rally, and to take part in a discussion, where his remarks were put together with rhetorical skill."

To give a better idea of Minchin's enthusiasm for laboratory work, I have asked Commander Rollo Appleyard, R.N.V.R., to jot down some reminiscences of the years during which he acted as his voluntary assistant; and here follows an abbreviation of what he writes:—

The seven years, 1885–1892, during which I held a junior appointment in the department of physics at the Royal Indian Engineering College, Coopers Hill, brought me into constant association with him. He was the most senior, I the most junior of the educational staff; but, in our enthusiasm for experiment, such differences were forgotten.

From the top of Coopers Hill, the Physical Laboratory looked out across and along the Thames Valley—miles and miles. Physics was accorded there a lecture theatre, a preparation room, a main laboratory, and a small optical laboratory. Most of Minchin's experiments were carried out in the small room. This could be darkened by means of folding wooden shutters. There was a lawn and a garden of roses outside it, and through the garden was a path which led to the college woods and across Runnymead to the boat-house. You must picture him there early on a summer's morning, looking out sometimes to watch the blackbirds and the wagtails on the lawn. Upon a slate table, firmly built into a solid brick and cement foundation, is the Clifton electrometer. It was carefully dried and "charged" last night by his kindly host Prof. Stocker, just after the last student left the laboratory. The "spot" is as steady as a rock, for there is no mechanical vibration to disturb the laboratory table at Coopers Hill. Now a warning bell informs the professor that a class of students is waiting for a lecture on Applied Mechanics. There begins a series of forced marches between the blackboard in his lecture room and the electrometer in the laboratory. Noon at last arrives. The paraffin lamp is blown out, the cap and gown are replaced by a straw hat and a suit of flannels, and away go the professor and his racquet to the lawn tennis courts. This is not because he is tired of his experiments, but because students are now coming in for their laboratory work. At about four o'clock they depart, and the professor and his racquet return, until dinner time. Briefly, such was his life, day by day, year by year.

He had at last produced an impulsion cell which was exceptionally sensitive to light, and he had for some time known that the sensitiveness varied in a capricious manner when an electric gas-lighter was "sparked" near such a cell. Moreover, in the course of some experiments which Mr. W. G. Gregory was carrying out, in the preparation room, with an induction coil and a Hertz oscillator, which you had shown us how to make, it was found that the sensitiveness of the photo-electric cell was affected, although several thick walls intervened. Then we rigged up an oscillator on the lawn in the garden

upon a table, with an induction coil connected to it, and this apparatus we took back step by step across the lawn up to the edge of the wood, and the cell responded, though weakly. It was regarded by us as a most uncanny phenomenon. Upon this occasion Prof. Minchin used a horizontal antenna.

Later we tried to make the electrometer close an electric light switch and we succeeded.

The task he set himself to perform in the laboratory was to examine a vast series of substances for their photo-electric effects, particularly with regard to E.M.F. He was aware of the discovery by Willoughby Smith of the effect of light in altering resistance. He knew also what Shelford Bidwell and Becquerel had done; but he was intent upon something even more subtle. Those of us who worked with him and beside him, urged him to try apparatus upon a large scale with a view to a result of practical utility. This we could not persuade him to do. His was the higher motive. With extreme patience, year after year, he continued the same kind of research, with no thought other than the advance of truth.

Minchin applied his photo-electric cells to measure the light of stars, and, in a paper read before the Royal Society in 1895, he communicated some interesting and promising results which he had obtained at Mr. Wilson's observatory, Daramona, using a 2-ft. reflector in conjunction with a specially arranged photo-electric cell. The relative magnitudes of Regulus, Arcturus, and Procyon, as thus measured, were found to be in good agreement with those determined by other photometric methods. When Coopers Hill College closed he moved to Oxford, for the sake of the telescopes and laboratories, and there to the last, making use of Prof. Townsend's laboratory, he worked at the physical problems which were the deepest interests of his life.

Concerning his mathematical work at Oxford, Prof. E. B. Elliott says—"His communications to the Oxford Mathematical and Physical Society were of the nature of instructive lectures on the behaviour of the functions of analysis—elliptic integrals for instance, and Bessel's functions—illustrated by very carefully prepared graphs. He was a very interesting conversationalist—full of ideas on all manner of subjects, with strong feelings and an Irishman's fire under restraint. His methods of work must have been most painstaking. In reading he seemed to accept nothing without making it his own by thought and independent investigation. I have his copy of Jacobi's 'Fundamenta Nova,' and it is full of his own manuscript. When he studied it (probably in early days) he must have gone on the principle of learning the subject by doing everything over again for himself in his own way. His patience must have equalled his keenness. To trust in authority and accept a conclusion without himself reasoning up to it was abhorrent to him."

Minchin's lectures often flashed with Irish wit, even his sarcasms being good-humoured and enjoyable. His students were enthusiastic about his personality, and one of them wrote thus in the 'Pioneer Mail' of India, April, 1914:—"Every Coopers Hill man in India will see with regret the news of the death of Prof. George Minchin, F.R.S., for those who did not know him personally must have known him by reputation. Mathematician,

man of imagination, inventor, an admirable lecturer with a natural turn for the elucidation of difficult subjects, added to the soul of a poet and the heart of a boy—his was indeed an extraordinarily gifted and many-sided nature. To the outside residents of Egham Mr. Minchin may merely have appeared as the most enthusiastic lawn-tennis player and cricketer about the College. The newly joined Professor would probably gather that his peculiar sphere was the common room. Few would guess at first sight that behind his bonhomie lay a heart-whole devotion to science and knowledge . . . . His friends will cherish the memory of a singularly lovable man ; and there must be many in this country who would acknowledge that they came out to India stronger in mind and spirit for having come under the influence of his fine teaching and unobtrusive example."

To sum up: Minchin was an able mathematician, a brilliant teacher, and a genial comrade.

O. J. L.