extreme specialisation for insect-pollination, and one of the latter in the Grasses, well adapted for pollination by the wind. Disregarding the teleology, we believe there is a substratum of truth in the following lines:

They tell us that the homely corn that grows,
From russet stem and leaf, our daily bread,
Was once a lily; which by various steps
Of menial work, became degraded thus;
It left its high-born sisters in their robes
Of gorgeous idleness to clothe itself
In this plain dress for common household use.
Its bright-hued petals, nectar cup, and store
Of fragrance sweet, that insect lovers wooed,
It sacrificed; and only wandering winds,
That have no sense of beauty or delight,
Now woo its sober blooms with heedless sighs.
But for this noble humbling of itself
God has more highly honoured it, to be
The chief support of human beings, made
In His own image—rulers of the world.

(*To be continued.*)

Biographical Byways.[1]

By Sir ARTHUR SCHUSTER, F.R.S.

10. HERMANN HELMHOLTZ (1821–1894), HEINRICH HERTZ (1858–1894), AND RÖNTGEN (1845–1923).

THE names of Helmholtz and Hertz remain connected together in my mind probably because, when I met them towards the end of their lives, the conversation with both mainly turned on the nature of cathode rays. Hertz adhered to the idea that they consisted of vibrations, while Helmholtz from the beginning stood up for the corpuscular theory, and was rather sore that the idea did not originate in his own laboratory. During the few months I was working there, at the end of 1874, Goldstein was engaged in the important researches which the Royal Society has recognised by the award of the Hughes Medal. His experiments, which showed that the rays emanating from a cathode were strongly repelled by an adjacent parallel electrode, were sufficient to convince Helmholtz that the rays consisted of a projection of negatively electrified matter, but Goldstein did not fall in with this view. "Of course," said Helmholtz to me a few years later, "as soon as Stokes became acquainted with Crookes's experiment he guided him into the right path."

In his early years Helmholtz seems to have been very sensitive to criticism. Roscoe used to relate how he found him once in great distress, complaining that his whole scientific career was endangered because some one had thrown doubt on one of his conclusions.

The Physical Laboratory of Berlin in 1874 contained only three or four rooms, with about a dozen students engaged in researches on a number of subjects mostly suggested by Helmholtz. In his daily rounds he used to discuss scientific problems freely with each in turn. He was as quick as Kelvin in being able to shift his mind quickly from one subject to another, but, in contrast with Kelvin, there was always a good deal of the *Grand Seigneur* in his attitude, and the title of *Excellency* bestowed upon him was borne with great dignity. He relaxed to some extent in his annual visits to Pontresina, where I received much encouragement from him in my early attempt to form some consistent theory of the passage of electricity through gases.

Her Excellency—his second wife, and a member of the South German aristocracy—was fond of society and gave weekly musical parties at their home in Berlin. She was of a highly strung and nervous temperament. During one of their visits to England they were staying with Roscoe at Manchester, and one morning she came down to breakfast complaining that she had been very ill during the night. She woke her husband, saying: "Hermann, I am going to die." "That is easier said than done," replied Helmholtz, turning round to sleep again. At one of his visits to Roscoe, he was accompanied by his daughter. The conversation turned on the possibility of flying. "It would be beautiful," said Miss Helmholtz; "one could escape so easily from one's chaperon; but then perhaps girls would be put into cages."

The intimate relations which Helmholtz maintained with Kelvin are referred to in the biography published by Königsberger. I may quote here the passage from a letter written by Helmholtz to his wife while on a visit to Lord Kelvin:

> "The former (James Thomson) has a good brain with clever ideas, but he will not listen to anything except about engineering and talks about it at all hours, day or night, so that no other subject of conversation has a chance in his presence. It is amusing to watch each of the brothers (William and James) insisting on explaining something to one another, and neither of them listening to what the other says. But the engineer is more persevering, and generally gets his own way.
>
> "In the meantime I have seen a number of new and ingenious appliances of William Thomson's, and had two interesting days here in consequence. But Thomson's thoughts follow each other so rapidly, that one can only obtain the necessary explanations about the working of his instruments, etc., by a series of questions to which it is difficult to get an answer. How his students can understand him is beyond me, as they cannot permit themselves to make the efforts to keep him to the point, which I could venture upon. All the same, a number of students were working in the laboratory and seemed to know what they were doing. . . . Thomson's experiments did for my new hat. He set a heavy metallic disc, balanced on a point, into rapid rotation, and in order to show me how the disc became immovable by the spin—he struck it with a hammer. The disc revolted against this treatment and flew off to one side, projecting the iron stand in the opposite direction. The stand split my hat and carried it away. The disc happily did no damage beyond breaking some glasses."

As is well known, the original suggestion that Hertz should undertake the experimental demonstration of the propagation of electrodynamic waves according to Maxwell's theory came from Helmholtz. The research could be undertaken only by one who possessed exceptional abilities both on the theoretical and experimental

[1] Continued from p. 306.

side. The merit of the execution belongs to Hertz alone. Towards the end of 1888, he communicated his first decisive success in obtaining waves of comparatively short length so that he could, by means of a parabolic mirror having an aperture of two metres, form a parallel beam and confirm previous results. Helmholtz wrote in answer: "I was much pleased with your latest feat. It concerns things at the possibilities of which I have nibbled for years in the hope of finding a hole by which to enter. I am therefore familiar with your line of thought, and its great importance is quite clear to me." In the same year Hertz had the choice of accepting a professorship at Berlin or Bonn, the vacancies occurring through the deaths of Clausius and Kirchhoff. Hertz decided for Bonn, and Helmholtz, approving the choice, writes: "Whoever is still able to carry out extensive scientific work is well advised to keep away from large towns." The great appreciation of Hertz's work by Helmholtz is shown by the unusual course he took in proposing the posthumous award of a certain prize to Hertz. He justified the proposal on the ground that it may "discharge a debt of the nation, inasmuch as Hertz during his lifetime had been much less honoured by his countrymen than by other nations."

In my own intercourse, I found Hertz to be a man of extreme modesty. During one of my visits to him, he received the news of some distinction the Academy of Sciences of Vienna had bestowed upon him. He seemed worried by it. "Too many honours," he said, "are as bad as too few. They do not add to the pleasure and only create jealousies." With regard to the fundamental question of cathode rays, he attached great importance to an experiment he had made, which showed that they could pass through gold leaf, and looked upon this as telling in favour of waves; to which I could not agree.

I am told that in early youth Hertz gave expression to weird ideas with regard to possible happenings if some of the ordinary circumstances of life were changed.

It is sad to think that the illness which led to his death was probably aggravated, if not caused, by the unsanitary state of his laboratory, which, as I am told, had been built and used as a hospital for certain contagious diseases.

The succession of experimental discoveries leading, through Hertz, to the important researches first of Lenard and then of Röntgen is well known. I never spoke to Röntgen, and hearing of his presence in another hotel during one of my visits to Pontresina, I called on him. He was not at home, but I saw his wife, who received me in a friendly manner. The call was never returned, though amends for this want of courtesy were made a few months later. Returning to Manchester from a short Christmas holiday at the end of the same year, I called at the laboratory on my way home from the station. On looking at the accumulated correspondence, I opened a flat envelope containing photographs which, without explanation, were unintelligible. Among them was one showing the outlines of a hand, with its bones clearly marked inside. I looked for a letter which might give the name of the sender and explain the photograph. There was none: but inside an insignificant wrapper I found a thin pamphlet bearing the title "Über eine neue Art von Strahlen," by W. C. Röntgen. This was the first authentic news that reached England of the discovery of the so-called X-rays. I sent a translation of the paper to NATURE, where it appeared on January 23, 1896.

Obituary.

SIR EDWARD THORPE, C.B., F.R.S.

ALTHOUGH Sir Edward Thorpe had been unwell for some considerable time, yet his well-known energy and virility were so remarkable that it came as a shock to his many friends to learn that he had passed away on Monday, February 23, at his beautiful Devonshire home by the sea, Whinfield, Salcombe. It was an ideal residence in his retirement, for he could there enjoy his favourite relaxation of yachting, and take any one of his three yachts out to sea for a sail just as readily as taking a walk, which the hilly roads and paths of South Devon had latterly rendered a matter of difficulty for him.

Carrying my mind back to the year 1885, when I had already been two years as a Royal Exhibitioner at the Royal College of Science, South Kensington, I remember the gratification with which we students learnt that our retiring professor of chemistry, Sir Edward Frankland, was to be succeeded by Prof. Thorpe, whose reputation at the Yorkshire College, Leeds, had gone before him. I had previously studied under Sir Henry Roscoe at the Owens College, Manchester, where Dr. Thorpe had held his first appointment as demonstrator on Sir Henry's staff, and this fact, together with a personal introduction to the new professor from the latter's father-in-law, Dr. John Watts, proved a bond of attachment, which, after my third year as student, but working in the research laboratory, led to collaboration with Prof. Thorpe in several years of research on the oxides and other compounds of phosphorus, and to a demonstratorship and lectureship which lasted eight years, indeed, until Sir Edward, in 1894, left South Kensington to become Principal of the Government Laboratories.

Sir Edward was born in the Harpurhey suburb of Manchester on December 8, 1845, his father, Mr. George Thorpe, having been a merchant of that city. At the close of his student days at the Owens College he went to study under Bunsen at Heidelberg, carrying with him a letter of introduction from Prof. Roscoe, who had himself been a pupil of Bunsen. Moreover, young Thorpe was entrusted with a present from Roscoe to Bunsen, namely, some well-formed crystals of potassium and sodium, which Roscoe had placed in separate bottles under rock-oil, as usual with the alkali metals. In the throes of packing, the young student economised space by placing both metals in one of the two bottles, the crystals being sufficiently different to be distinguishable. After presenting his letter, he duly brought forth the bottle, removed its paper covering, and ceremoniously presented it to Bunsen as containing unique specimens of potassium and sodium crystals. The great chemist looked hard at the bottle and then at his visitor, who then first realised that something was wrong. For, instead of metallic crystals beneath the rock-oil, there