would seem to have been derived from the mother's side.

At about the age of fifteen, Sarah Marks became acquainted with Madame Bodichon, a well-to-do lady, strong on the women's rights question, who sent her young friend to Girton College, Cambridge. Apparently, she then changed her name to Hertha. She took honours in mathematics. She is credited with the invention, during the period, of a sphygmograph and also of an instrument for rapidly dividing up a line into a number of equal parts. Through Madame Bodichon, she became acquainted with George Eliot and several other people of distinction. In 1884 she entered the Finsbury Technical College. I remember her coming. She not only came but was seen and soon conquered—Ayrton; and they married. As sole issue they had a daughter, who has her father's gift of tongue; she married a Christian, whilst his daughter by his first wife married a Jew. I often told him that he and his wife were an ill-assorted couple: being both enthusiastic and having cognate interests, they constantly worried each other about the work they were doing. He should have had a humdrum wife, "an active, useful sort of person," such as Lady Catherine recommended Mr. Collins to marry, who would have put him into carpet-slippers when he came home, fed him well and led him not to worry either himself or other people, especially other people; then he would have lived a longer and a happier life and done far more effective work, I believe.

Under her husband's inspiration, Mrs. Ayrton soon entered upon the study of the electric arc. Her work is recorded in the book on the subject which she published in 1902, in part a reprint of papers submitted to the Royal and other Societies. She was an indefatigable and skilful worker. Whatever the absolute value of her observations, her husband and his good friend Perry were the last not to make the most of her achievement, so probably the scientific halo with which they and others who fancied that women could be as men surrounded her was over-painted. Most of us thought, at the time, that they were ill advised in preferring her claim to the Royal Society; the nomination came to nothing on legal grounds. She was, however, elected into the Institution of Electrical Engineers and at her death was its only lady member. She also engaged in an inquiry into the formation of sand ripples and this led her, early in the War, when chlorine was first used as poison gas, to develop a fan-device for waving back the fumes. There is little doubt that she took too high a view of the practical value of the invention and was unwarrantably aggrieved at its rejection by the military authorities. She was awarded the Hughes Medal by the Royal Society in 1906.

Mrs. Ayrton was a very striking woman in appearance and of considerable personal charm, full of common sense; this kept her from being a militant suffragist, though she promoted the cause in every possible way. I never saw reason to believe that she was original in any special degree; indeed, I always thought that she was far more subject to her husband's lead than either he or she imagined. Probably she never had a thorough scientific equipment; though a capable worker, she was a complete specialist and had

neither the extent nor depth of knowledge, the penetrative faculty, required to give her entire grasp of her subject. Ayrton himself, though a genius, was in no slight measure partial in his interests: by heredity literary and artistic, educated intensively in the classical school, a born actor and therefore a good lecturer and public speaker, impelled into science through contact with Sir William Thomson, he was a worker chiefly at its technical and commercial fringe rather than in its depths: so he was not a good judge of his wife's scientific ability. His partner Perry was the solid member of the firm. In fine, my conclusion is, that *das ewig Weibliche* was in no way overcome in Mrs. Ayrton: nor could we wish that a thing so infinitely precious should be: she was a good woman, despite of her being tinged with the scientific afflatus.

HENRY E. ARMSTRONG.

DR. J. E. STEAD, F.R.S.

By the death of Dr. John Edward Stead, on October 31, at the age of seventy-two, Great Britain has lost one of its most famous metallurgists, a man who played a very honourable and a leading part in the development of scientific metallurgy, and is not unworthy to be ranked with the great names of John Percy, Lowthian Bell, and Roberts-Austen.

Dr. Stead was born in 1851 and was a younger brother of the late W. T. Stead. After the usual period spent at school, he was for a time an evening student at the Owens College, Manchester, in the early days at Quay Street. From there he passed to a steel works in the Middlesbrough district, where he served his apprenticeship on the practical side of iron and steel smelting, but he was only nineteen when he entered the laboratories of Pattinson, a consulting chemist and metallurgist in the district. Later the two men entered into partnership under the title of Pattinson and Stead, and he remained identified with the firm for the remainder of his life, a period of about fifty-two years in all. He became one of the best-known analysts in the north of England, and one can only conjecture how many large contracts were signed on the basis of Stead's analyses.

An incident related to the writer some twenty years ago by Dr. Stead will give some idea of how this man, with a very slight amount of what would be termed academic training, rose to a position of great power and trust, not merely in the Cleveland district where he lived, but also in the iron and steel industry of the whole country. He found on one occasion, in the early days of his association with Pattinson, that he had sent an incorrect analysis to one of the firm's clients. Without hesitation he wrote to explain that he had made a mistake and substituted the correct figures. The client in question was exceedingly angry, not because he had received an incorrect analysis, but because Stead had admitted that he had made a mistake. Apparently this is a serious matter where business is concerned. Stead retorted, "If I was unwilling to admit that I made mistakes, you would never know whether a result I sent you was correct or not." This was a new point of view, and the client was so much impressed by it, that he sent all his

analyses to Stead in the future, after having previously threatened to withdraw his custom.

It is not as an analyst, however, that Stead rose to fame. He was naturally of an inquiring mind, eager to discover truth in any form that he could, and in the course of forty-six years he published at least eighty papers before seventeen institutions, in which he covered a range of subjects in the metallurgy of iron and steel, such as few, if any other, men have attempted. If he could be said to have made one subject rather than another peculiarly his own, it was the influence of phosphorus on iron. This was perfectly natural, for the Cleveland ores are phosphoric, and phosphorus, at any rate in association with carbon, is the worst enemy of steel. It is not generally known that Stead played a very important part in the early days of the development of the Thomas-Gilchrist basic Bessemer process for the dephosphorisation of phosphoric iron ores, a process which enabled Germany to become the second largest producer of steel in the world, with all the consequences that have followed. One of the essential features of the process is the so-called "afterblow," when the blowing of air through the converter is continued after the complete removal of carbon. Stead was the first to advance the correct explanation of what takes place, namely, that phosphorus is removed during this period, but not until then, by iron oxide. Thomas and Gilchrist challenged this explanation and only accepted it in the following year when they obtained letters patent for the "afterblow."

Stead was one of the first men in Great Britain to realise the importance of Sorby's investigations, which led to the foundation of metallography as a science. With true vision he saw that here was a new experimental weapon for investigating the properties of all metals and alloys, and the majority of his investigations have lain in this field. Within the limits of this article it is impossible to give any adequate idea of their scope and variety, but this, at all events, may be said, that his contributions to our knowledge of the crystallisation phenomena observed in iron and steel, and the segregatory and migratory habits of solids in alloys, were such that he became one of the chief authorities in the world on these subjects. He made important contributions to the technique of microscopic metallography, and his method of heat-tinting specimens by oxidation became an accepted method for the micro-analysis of cast iron.

Living as he did to the age of seventy-two, it would have been very surprising if honours had not come to Stead. He became a member of council of the Iron and Steel Institute in 1895, a vice-president in 1910, and president in 1920. He received the Bessemer medal of the Institute in 1901. In 1910 he was president of Section B of the British Association at Sheffield. He also filled the office of president of the Cleveland Institution of Engineers. The majority of his papers were published before these two Institutions. He was given honorary doctorates of the Universities of Manchester, Leeds, and Sheffield, and he had been for twenty years a fellow of the Royal Society.

No man revealed himself more characteristically in his papers than Stead. He had a generous and

ardent mind, and he pursued the search for truth with a single-mindedness which was an inspiration to all who knew him. The willingness to admit that he was wrong when he was wrong, which is not so common a virtue as it should be, and to which attention has already been directed, made him an ideal opponent in scientific controversy. Characteristically enough, he was particularly generous to young workers in the field of metallurgy, imbuing them with something of his knowledge and enthusiasm, and encouraging them by generous praise. The writer recalls several such occasions in his own experience. During the last eighteen months Stead had been forced to live in retirement and indeed had become a physical invalid, but his mind remained clear and active up to the time of his death. He leaves behind him the memory of a life splendidly lived, which those who were privileged to know him will always cherish.

H. C. H. CARPENTER.

M. MAURICE LEBLANC.

By the death of Maurice Leblanc on October 27, the world loses one of its greatest engineers. He had striking originality. In conjunction with M. Hutin, he invented the *amortisseur* or damping coil, which when applied to alternators enables them to run steadily in parallel. He also perfected the method of converting induction motors into generators by driving their rotors at speeds greater than synchronism by prime movers. He ran them in parallel, the frequency of the supply depending only on a small alternator in the supply circuit, the function of which he compared with that of a *chef d'orchestre*. In recent years he devised a remarkable system for high-speed electric traction. The energy is communicated to the moving train without rubbing contacts by means of magnetic induction. He proposed to utilise alternating currents having frequencies of 20,000, the current being carried over the track by a series of tubular condensers adjusted to resonance. The currents in the locomotive circuits are converted to low frequency by thermionic valves. They then operate induction motors as in ordinary traction systems.

In the very difficult years 1912-1914 Leblanc filled the post of president of the International Electro-technical Commission with universal acceptance. His speech when resigning the office of president at the London meeting in 1919 was a powerful plea for nations and individuals to give up working exclusively for selfish ends. The lack of this in the past had led to the greatest catastrophe of all time. "From henceforth only productive work will be deemed honourable." He was elected an honorary member of the Institution of Electrical Engineers in 1915. His high ideals and singleness of purpose made friends for him in every country of the world.

A. R.

WE regret to announce the following deaths:

Mr. Thomas Pridgin Teale, F.R.S., the eminent surgeon and sanitarian, on November 13, aged ninety-two.

Dr. Boris Sidis, of the Sidis Psychotherapeutic Institute, Portsmouth, New Hampshire, known for his work on the psychology of suggestion and mental dissociation, on October 25, aged fifty-six.