Introduction

> In all work of a biographic character it is important to make copious reference to as many as possible of the generally-recognized virtues, vices, good points, foibles, peculiarities, tricks, characteristics, little weaknesses, traits, imperfections, fads, idiosyncrasies, singularities, morbid symptoms, oddities, faults, and regrettable propensities.
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> E. Clerihew, *Biography for Beginners* (1905)

Given his international fame at the beginning of the twentieth century it is surprising that William Crookes was not the recipient of a 'clerihew' that alighted on one of his perceived foibles or characteristics such as the well-waxed moustache that gave him a somewhat foreign appearance.[1] Most scientists are specialists and are remembered and commemorated for one singular achievement or area of investigation. There are notable exceptions. William Crookes, like Albert Einstein, was one of these. He is remembered chiefly for five things: the discovery of thallium in 1861, the invention of the eye-catching and puzzling radiometer in 1875, his brilliant experimental work on cathode rays using the eponymous Crookes tube in the 1870s, his dire prediction in 1898 that mankind would starve unless chemists worked out how to 'fix' the abundant supplies of nitrogen in the atmosphere, and for his seemingly unorthodox interest in spiritualism in the 1870s. This biography will demonstrate that he had many other interests that deserve commemoration, including work on the rare earth elements and radioactivity, a strong commitment to improvements in public health, the invention of new glass mixtures that when made into spectacles prevented glare, and the weekly production of a digest of chemical news and information that was read by chemists all over the world. All this was combined with an active business career.

Sir William Crookes (1832–1919), the 'most flamboyant character in British science',[2] was virtually unique among Victorian scientists in combining a business career with scientific research. To be sure, many chemists, like Frankland, Ramsay and Roscoe, took out patents and earned additional income through consultancies, but this was very much a part-time avocation to their principal positions as university teachers. Others, like Huggins, Joule and Rayleigh, had incomes from family businesses that were run largely by others. But Crookes had to earn his living daily as a working journalist, analyst, consultant, expert witness, gold-mine owner, director and speculative investor in stocks and shares. He was always alive to the possibility that his current investigation might solve a practical or economic problem. His work in a laboratory in his own house and not in an academic institution, like Lavoisier's

1 J.J. Thomson (1936), 377. Crookes adopted the moustache after returning from South Africa in 1896.

2 Keller (1983), 12.

in the eighteenth century, was part-time – though from the mid-1860s onwards he had a series of permanent assistants to ensure the continuity of his research and that routine manipulations and readings were conducted during his absences from home earning a living. That living was made principally as a science journalist and editor and by business enterprises ranging from water analysis, sewerage schemes and gold mining to the design of electric light bulbs.

Much of his research involved what has been termed 'commercial science'. It was this that paid for the 'professional science' he conducted in his spare time. He founded and edited the weekly *Chemical News* in 1859, and he was also closely involved in the editing of the popular *Quarterly Journal of Science* between 1864 and 1879. Both these journals were a commercial success, unlike *The Electrical News*, a journal he modelled on *Chemical News* in 1875 that collapsed after only 20 weekly issues. Crookes' long life was one of unbroken scientific and business activity. These interests collectively made him a well-known Victorian and Edwardian personality. He received many public and academic honours, including a knighthood (1897), the Order of Merit (1910) and the presidency of the Royal Society (1913–15). Although by 1900 younger chemists and physicists obviously thought Crookes had sown his wild oats beyond his allotted years, he remained active in mind and body almost to the end. He would only feel old, he said, if his imagination failed. The imagination, he believed, was the wonderful endowment given to the trained scientist of being able glimpse the future. With this 'most exquisite faculty' in a human's mental equipment, one could peer beyond the veil and claim kinship with divinity.

Crookes was more eclectic in his interests than any other Victorian scientist and he ranged over pure and applied science, economic and practical problems, and psychic research, and this encouraged him to write for a variety of audiences. Crookes published his work in both 'high' and 'low' science and general journals. While his major experimental researches were almost exclusively published in the *Transactions* and *Proceedings* of the Royal Society (curiously, he published only two papers in the *Journal of the Chemical Society*, despite his chemical background), he regularly wrote popular science articles for other journals, such as *The [British] Popular Science Review* in the 1860s. His diverse interests collectively made him a well-known personality within the late-Victorian scientific community. Each of his brilliantly illustrated lectures to the Royal Institution and his presidential addresses to the Chemical Society (1887), the Institution of Electrical Engineers (1891), the Society for Psychical Research (1897) and the British Association for the Advancement of Science (1898) proved tours de force and were widely reprinted or reported. Such was the worldwide furore over his British Association address, which was concerned with the desperate need to fix atmospheric nitrogen to solve the world's food shortages, that it was twice reprinted, as well as being reported in the world's newspapers. Communication through the scientific and popular press was clearly important for Crookes. Nowhere is this clearer than in the disputes surrounding his psychic research.

The most controversial aspect of his entire career was his investigation of mediums in the 1870s and 1880s. Following the death of a much-loved brother at sea (which also led him into a libel action), Crookes attended seances, becoming interested in the kinetic, audible and luminous phenomena that could be witnessed at the fashionable seances of the period. To the disgust of certain members of the scientific community, Crookes was persuaded that the mediumship of some practitioners was perfectly genuine. In 1870 he subjected the famous medium Daniel Home to a number of tests, and convinced himself that Home possessed a psychic force that could be used to modify gravity, produce musical effects, and perform feats unknown to science or to conjuring. When the Royal Society rejected Crookes' papers on the subject on the grounds that the experimental conditions were not sufficiently exacting, he reported them extensively in his own *Quarterly Journal of Science*, from where they were reprinted by the burgeoning spiritualist press. Encouraged by the latter's support, he reported his sensational authentication of Florence Cook's materialization of a phantom called Katie King exclusively in *The Spiritualist*. Convinced that he had uncovered an unknown relationship between heat and gravity as a result of his work with mediums, Crookes was led to improve the air pump and to the creation of the lightmill or radiometer. In this popular instrument, a system of vanes, each blackened on one side and polished on the other, is set in rotation on a pivot in an evacuated space when exposed to radiant energy. The interpretation of the apparent attraction and repulsion resulting from radiation, which Crookes initially attributed to a psychic force, proved intensely controversial. Differing interpretations supported by Stokes, Maxwell and dozens of other leading physicists filled the pages of *Philosophical Magazine* and *Nature*, spilling over into *The Spiritualist* and *English Mechanic*, as well as European and American popular-science journals.

It is the reconciliation of Crookes' strange and unorthodox investigations and statements in the 1870s with his much praised and influential experimental work in chemical physics that makes him an intriguing subject for a biographer, and this was recognized by publishers when Crookes became President of the Royal Society in 1913. Like many a celebrity, Crookes had planned to write an autobiographical memoir that would preface a collected edition of his psychic investigations and scientific publications.[3] In this he was greatly encouraged by the publisher Fisher Unwin, but the outbreak of war and his wife Ellen Crookes' poor health and death in 1916 prevented the intention becoming reality. Unwin had already tentatively contracted the physicist and inventor Edmund Edward Fournier d'Albe to write the biography. Fournier d'Albe (1868–1933), a Franco-Irish physicist, inventor of the octophone and an assistant of Oliver Lodge's at the University of Birmingham, had a standing interest in the occult.[4] For several years he had acted as the secretary of the Dublin section of the Society for Psychical Research. In the early 1900s he had published a highly speculative work of metaphysics, *Two New Worlds*, which inventively used the new knowledge of radioactivity and atomic structure to argue for continuity between a physical and spiritual universe. This had been followed up by an even stranger speculation concerning immortality based both on his previous metaphysical speculations and the evidence of materialization established by Crookes in his work with Katie King. Fournier d'Albe, in 1908, thought Katie King was an

3 Crookes is still revered by the spiritualist community. The library of the Spiritualists' Association of Great Britain in Belgrave Square in London is named the Crookes Library. See Stemman (1972).

4 For Fournier d'Albe, see *Who Was Who*, vol. 3 (1929–40).

example of an 'objective and *bona-fide* character of supranormal occurrences'. The spirit might either have been a real entity 'living' in the atmosphere above the earth, or Florence Cook's double by the externalization of her soul! By 1921, however, when he compiled an adverse report on the mediumship of the Goligheer circle in Belfast, he had become sceptical of physical mediumship.[5] Given his interest in the occult and in the new physics of matter that had emerged largely as a result of Crookes' research on the radiometer, Unwin must have thought him the ideal biographer.

Soon after Crookes' death in April 1919 Unwin gained access to an estimated 40,000 letters and documents that Crookes had carefully amassed during his long and active career. This huge cache of documents had already been subjected to filleting by members of Crookes' family. Mindful of their father's scientific reputation, it appears that the family deliberately and hurriedly destroyed as much of Crookes' correspondence on spiritualist matters as it could identify. Crookes' laboratory assistant, James Gardiner, who had worked with Crookes for nearly 40 years, was given a year's salary upon Crookes' death and had no say in what he called the executors' regrettable decision to destroy 'an immense volume of correspondence and notes'. He recalled Crookes' methodical habits and his rule never to destroy a paper; 'every note connected with his activities from the commencement was indexed and stored in boxes with the greatest care'.[6] Unfortunately, he reflected, Fournier d'Albe, whose biography of Crookes appeared in 1923, had only seen what the executors selected after consigning the rest to a paper mill. Gardiner believed Fournier d'Albe would have made fewer mistakes if he had been able to make his own selection. What these 'mistakes' were Gardiner unfortunately did not specify. He also suggested that Fournier d'Albe had revealed matters that Crookes would not have wanted to see in print – no doubt the references to Crookes' disappointment with the careers his children had chosen. In fact, despite the prior destruction of materials relating to spiritualism, Fournier d'Albe had the last laugh and with Irish astuteness he identified the extent of the missing correspondence from names left in the letter index file to which he had access. On the other hand, it does not seem that evidence of any scandal was deliberately suppressed by the executors' decision. When he reviewed Fournier d'Albe's memoir in 1924, Gardiner observed that nothing new of significance over and above what was already known about Crookes' spiritualist activity was found in the biography. 'This will be disappointing,' he stated, 'but it is in no way connected with the destruction of the documents referred to. It is a fact that no such investigations were attempted after 1881, except a few attempts at so-called Spirit Photography, and these gave results that were capable of very simple [i.e. rational] explanation.'

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5 Fournier d'Albe (1907) and (1908). The latter includes two photographs of Katie taken by Harrison in 1874. Fournier d'Albe (1922). Fournier d'Albe also translated Albert von Schrenck-Notzing's sceptical findings on materialization into English. Schrenk-Notzing (1920).

6 Gardiner's review of Fournier d'Albe (1923) in Gardiner (1924), 355. Lord Rayleigh also referred to Crookes as scrupulously orderly and tidy, docketing everything. Strutt (1936).

While Gardiner undoubtedly revered Crookes and wished to guard his master's reputation as a rational scientist, because Gardiner was at Crookes' side daily from 1882 until the day of his death, we can take this as explicit evidence that there were and are no hidden spiritualist secrets waiting to be unveiled. Nevertheless, in 1962 Trevor Hall published a study of Crookes' spiritualist activities in which he made the sensational claim that for several months during 1874 Crookes had had an affair with the pretty young medium Florence Cook. Although supported by the doughty and highly sceptical anthropologist and psychic investigator Eric Dingwall, Hall's book was soon subjected to minute and damaging analysis and criticism by, among others, George Medhurst, Molly Goldney and Mostyn Gilbert. Despite severe criticisms, Hall's book had huge popular appeal and became the subject of radio and television programmes. While Hall brought Crookes back into public consciousness, the image conjured up was that of an investigator who had used 'science' to cover up an adulterous affair. A new biography was clearly called for, and readers may be puzzled why it has taken another 40 years.

Armed with 40,000 documents and a deadline, Fournier d'Albe found no need to undertake additional research. The recovery of a so-called 'unpublished chapter' of his book entitled 'Chapter XIV. Utilisation of Sewage' (now at the Royal Institution) reveals how Fournier d'Albe prepared copy for the printer by pasting original letters from Crookes' correspondents, or file copies of Crookes' letters to correspondents, into his typescript. Although this chapter was not published as it stood, much of its content was subsequently reworked into other published chapters. The rest of the biography was presumably prepared in the same way before going to a secretary for retyping, although it is also possible that the whole manuscript was sent to the printer in this scissors-and-paste form. The existence of the 'unpublished chapter' has had the unfortunate consequence of suggesting to potential biographers that the remainder of the printer's copy with hundreds of complete letters attached might still exist and deterred them from writing. It is now my own view that this was mistaken. What most probably happened was that, following the printing of Fournier d'Albe's biography, the pasted letters were removed from the printer's copy and returned to Crookes' married daughter, Mrs Alice Cowland, Fournier d'Albe's principal family contact. Although documentation is lacking, it must be assumed that Mrs Cowland returned the 40,000 documents (less those pasted into the draft chapter) to her two brothers, Bernard and Lewis, who had been appointed her father's executors. Over the next decade the brothers disposed of the materials to the Science Museum and Royal Institution, as well as to auction houses. A great deal was also probably destroyed as of no interest.[7] The draft chapter, with its letters dealing largely with commercial science, was somehow overlooked and remained in Mrs Cowland's possession until she gave it to Mrs Marjory Francis, the daughter of William Crookes' son Joseph. When she emigrated to the West Indies, Mrs Francis left the 'unpublished chapter' in the hands of a cousin, a descendant of one of Crookes' uncles. In this manner

7 The most important of the documents were undoubtedly the laboratory notebooks given to the Science Museum and Royal Institution. Much time and energy has been spent by me and others on a futile search for the other materials put at Fournier d'Albe's disposal. It now seems to me that this is a false trail and chimera.

the draft chapter, as well as other oddments connected with Crookes, came into the hands of Mrs Francis's nephew, Sir Charles Dixon Kimber (b. 1912), during the early 1970s.[8]

Kimber, a politician, market gardener and landlord, is proud of his Crookes connection and was keen to see a new biography published. In the early 1970s Kimber joined forces on a scientific biography with an Oxford chemist, David J.W. Robbins. At the same time, in America, Robert K. DeKosky, whose Wisconsin University doctorate had involved a detailed study of Crookes' work in chemical physics, also began work on a biography. Both projects were soon abandoned, mainly on the grounds that the treasure trove of Crookes' papers used by Fournier d'Albe could not be found. My own involvement in Crookes studies had begun in the mid-1960s while I was studying nineteenth-century ideas concerning the complexity of the chemical elements. In 1967 I was asked to compile the Crookes entry for the multi-volume *Dictionary of Scientific Biography*. Soon after this 10,000-word notice had appeared in 1970, I learned from the former journalist and psychic researcher Mostyn Gilbert that he was planning a study of Anna Eva Fay and Mary Rosina Showers and their dealings with Crookes. Although tempted by his offer of collaboration, any thoughts of producing a longer memoir were displaced by the demands of teaching and the attractions of other research projects. It was only 30 years later, following my retirement in 1998, that I was able to return to Crookes and embark on the present study. This has involved expanding my *DSB* article and examining Crookes' extensive business interests in mining, coal-tar chemicals, sanitary engineering, water analysis and electric lighting, as well as making a fresh study and assessment of his scientific work in chemistry and physics, and of his extraordinary involvement in paranormal phenomena.

Although, for the reasons previously given, I have not had the benefit of having 40,000 documents in front of me, Crookes' more than 800 publications, the laboratory notebooks and the large correspondence that is to be found in various libraries in Britain and America have proved more than sufficient to satisfy a biographer. The delay has also meant that I have been able to benefit greatly from several significant studies of particular aspects of Crookes' researches that have been written by professional historians of science since 1970. A satisfactory biography of a scientist has to combine an account of the subject's life and upbringing, family and personality with an account and analysis of the subject's scientific practices and beliefs, as well as those of his contemporaries. All this must be related against a background of the social, institutional and professional context in which the subject lived.[9] The aim of my biography is do all these things by placing Crookes' scientific activities in the context of the business of making a living from science – something many of his academic contemporaries frowned upon. Given Crookes' work habits, a strictly chronological approach to his life is not possible. His assistant James Gardiner recorded how there were two phrases Crookes would never allow himself or his

8 Kimber's father, Sir Henry Dixon Kimber, married Lucy Ellen Crookes, the youngest daughter of George William Crookes, in 1910. *The Times*, 9 December 1910. G.W. Crookes was descended from one of Crookes' uncles, George Crookes (1802–77).

9 Compare Rocke (2001), introduction.

assistants to use – ‘cannot’ and ‘near enough’. Crookes drove himself hard, working day in, day out at his science and businesses. Another of his common sayings, apparently, was that ‘a man could not be really happy unless he had just a little more to do each day than he could possibly finish’.[10] Given such working habits, any synchronous study of daily research, writing, editing and business activities would be difficult to effectuate and ultimately it would also be tedious. I have preferred instead to follow a rough chronological order, but to break this as necessity demands by treating Crookes’ academic and commercial research programmes thematically. This means that there are some occasional repetitions of fact, though their reprise occurs in new contexts. The aim, above all, has been to produce a readable life story of a chemical physicist who was regarded from overseas as one of the ‘plus pures gloires de la science anglaise’.[11]

The Crookes who emerges in my portrait is that of a scientific entrepreneur who, like the proverbial cat, had a dozen lives. Educated mainly at home until he entered the Royal College of Chemistry in 1848, Crookes began as a photographer before dabbling in various areas as journal editor, translator, businessman and director of public companies, inventor, expert witness, spectroscopist, analytical chemist and lecture demonstrator. As both an editor and as an independent researcher, he was intensely jealous and proud of his reputation. As a skilled experimentalist, he revelled in his powers of observation and, as J.J. Thomson once observed, he was often more interested in exploration for its own sake than the outcome of an investigation.[12] His lack of formal education meant that, unlike his contemporaries from Cambridge, he had no advanced mathematics and his knowledge of physics was elementary. Again, as J.J. Thomson observed admiringly, rather than critically, Crookes picked up his physics as he wanted it for the research he had in hand, relying on the advice of George Stokes and Clerk Maxwell ‘when he got into difficulties on theoretical questions’.[13] For Thomson, Crookes’ powers of observation were extraordinary, especially in the way that he isolated abnormalities and systematically tried one thing after another in order to make the unusual easier to observe, understand and explain. ‘He was like an explorer in an unknown country, examining everything that seemed of interest, rather than a traveller wishing to reach some particular place, and regarding the intervening country as something to be rushed through as quickly as possible.’[14] There was nothing subtle about Crookes’ experimental method – it was test it and see, change a variable, and test and see again. The brilliant demonstrations involving the radiometer effect and electric discharge phenomena were culled from hundreds of individual experiments and tests on different materials, different positions, different pressures and so forth. While the method was simple, the execution was terribly difficult, involving the intricate blowing of specially shaped glass vessels and the patient engineering of consistent vacuums.

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10 Gardiner (1919), 169.
11 Berthelot (1919), 805.
12 J.J. Thomson (1936), 378.
13 Ibid.
14 J.J. Thomson (1936), 379.

His commercial sense led him into such diverse areas as gold mining, the development of disinfectants, sewage disposal, electric light illumination, glass making and nitrogen fixation, while his chemical training led him to the determination of the atomic weight of thallium, the element he discovered in 1861, the separation and identification of the rare earth elements, and the investigation of radioactivity. As editor of *Chemical News* for half a century, he ran campaigns on patent laws, food adulteration, river pollution, public health, the endowment of research, and electrical illumination – his own home being the first in London to be lit by electricity. His pride and conviction that he possessed unique powers of investigation also led him to spend a good deal of his time in the investigation of psychic and spiritual phenomena. Privately a deeply religious man, he believed that the science and technology of his day had reached a pitch where it could be used to investigate bizarre and irregular phenomena, whether occurring inside or around a medium, inside and around an evacuated glass tube, or in the myriad spectra of the elements. There was a strong thread of mysticism in Crookes' character and he eagerly embraced the occult.[15] It was in order to enhance his powers of understanding that he joined several of the 'mystical' organizations that attracted many middle-class men and women during the late-Victorian period. His involvement in a French occult organization and his membership of the Theosophical Society, the Hermetic Order of the Golden Dawn, the Psychical Research Society and the convivial Ghost Club were all additional means by which he sought to penetrate nature's secrets and to understand his own place in the great scheme of the universe. Although active participation in the occult seems to have been unusual behaviour in a Victorian scientist, an interest in mysticism and the occult was part and parcel of modernism and its search for an understanding of the 'self' that was, among other things, to lead to psychoanalysis.[16]

It was not until he reached his forties that Crookes ceased struggling to forge a career in science. Nevertheless, his life demonstrated how it was possible for someone to rise to a position of honour and power in science without the benefit of a university education or academic position. He was also singularly fortunate, unlike most Victorians, in enjoying robust health for most of his life. The widespread presence of poisonous thallium dust in his first home laboratory and of radioactive emanations in his Notting Hill laboratory that, under modern health and safety legislation, inhibits scholars from examining his laboratory notebooks left him totally unscathed. Despite a somewhat austere and secretive temperament no doubt engrained from priority disputes and business dealings, Crookes was never a recluse. He was much given to dinners and 'at homes', society functions and clubs. On the other hand, in contrast to many of his contemporaries, Crookes had few or no interests outside pure science and technology. He appears to have ignored what was happening in contemporary literature, music, painting, theatre and other aspects of culture that the Victorian middle classes aspired to. Nor, despite much self-education, did he (unlike many other aspiring scientists who lacked the benefits of an Oxbridge education, such as John Phillips, Thomas Huxley and John Tyndall) go in for cultural self-improvement. Although he quoted poetry, these were literary

15 J.E. Reynolds (1920), 147.

16 Owen (2004).

flourishes provided by his close friend Alice Bird; and although his Notting Hill house possessed landscape paintings and a fine library, the paintings were all mundane wall coverings and his large book collection was strictly a working reference library of volumes on chemistry, physics and spiritualism. In the whole of his surviving correspondence there is only one reference to his going to the theatre, albeit with reluctance in order to accompany some young visitors.[17] This narrowness of vision explains why Oliver Lodge, who shared Crookes' interest in spiritualism, was never impressed with him as a man.

If, despite his well-tailored clothes, striking beard and waxed moustache, and permanent cigarette, Crookes lacked charisma in company, it was obviously different when he was lecturing and demonstrating and writing up his results for publication. On the platform or at the demonstration bench he became the great experimental chemist blessed by flashes of inspiration and insight that seemed daringly speculative at the time. As an audacious thinker, he excelled in expressing ideas that engraved themselves upon the audience by clarifying them with experiments at once simple and beautiful. They seized the imagination so that once seen they were never forgotten. Given the pride he took in his own work and abilities, and his deep vein of mysticism, it is not surprising that Crookes used a Maltese cross to cast a shadow in his eponymous Crookes tube, or that he adopted a punning Latin tag as his business motto and later as his heraldic device. For, from wherever Crookes (*crux*) stood, light (*lux*) appeared to be shone on the darkest and most mysterious recesses of nature:

> Visions of beauty and splendour,
> Forms of a long lost race,
> Sounds and faces and voices,
> From the fourth dimension of space;
> And on through the Universe boundless
> Our thoughts go lightning shod,
> Some call it Imagination,
> And others call it God.[18]

17 Crookes to H.E. Armstrong, 14 March 1905, IC archives.

18 Quoted by Crookes in a dinner speech in 1913. Fournier d'Albe (1923), 398. From Crookes' reference the author was probably the parasitologist Ronald Ross, though the poem does not appear in Ross (1910).