

KARL ELBS, 1858-1933

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Let fame, that all hunt after in their lives,
Live register'd upon our brazen tombs
And then grace us in the disgrace of death;
When, spite of cormorant devouring Time,
Th' endeavour of this present breath may buy
That honour which shall bate his scythe's keen edge
And make us heirs of all eternity.
Shakespeare, *Love's Labour's Lost*, I, i, 1

A chemist's labors are not lost (at least if he follows Faraday's second and third instructions) (1), but they are often not remembered or, if so, not properly attributed. It has been argued that scientific work should be published anonymously as it is the work that matters, not the name of the scientist. But there are many arguments against this both from the point of view of human nature (see epigraph) and also because of the importance of making links in the history of science.

Karl Elbs was not in the first-rank of chemists of all time, but he was among those at the top of his profession in his own time. How has his memory survived? Elbs' life illustrates the point that sometimes what one supposes to be one's best achievements are not in fact those that endure.

A brief curriculum vitae follows: 1858, born, Alt-Breisach/Baden; 1880, D. Phil., Univ. Freiburg; 1883, Habilitation, Univ. Freiburg. 1887; Ausserordentlicher Professor, Univ. Freiburg. 1894; Ordentlicher Professor and Direktor des physikalisch-chemischen Laboratoriums, Univ. Giessen. 1913; Professor der Leitung des chemischen Laboratoriums, Univ. Giessen. 1929; retired. 1933; died, Giessen. His mentor for his doctorate at the University of Freiburg was Adolph Claus (1838-1900), discoverer of phenazine and the author of

two books on organic chemistry (1866 and 1871). Elbs' dissertation on derivatives of amarine resulted in two publications with Claus in 1880 and 1883. By 1887 he had published 19 papers and was appointed to a professorial post at Freiburg. In 1894 (9 papers and 2 books later), he moved to the University of Giessen (now Justus-Liebig-Universität Giessen) where he remained until his retirement in 1929.

Among Elbs' most famous colleagues were Franz Fischer (1877-1947), co-inventor of the Fischer-Tropsch synthesis of gasoline from coal, who worked with Elbs on the electrosynthesis of Pb(IV) compounds, and Otto Schönherr (1861-1926), who collaborated with Elbs on optimizing the electrosynthesis of peroxyulfates. He later moved to BASF to develop a practical method for the oxidative fixation of nitrogen (Luftverbrennung).

Elbs was best known in his own time as one of the founders of quantitative electrochemistry. Electrochemistry, discovered by Davy and Faraday, and brought into prominence by Kolbe, was developed as a quantitative science by Elbs, Gatterman, Löb, Tafel, and Haber. Elbs and his students studied the reduction of aromatic nitro compounds extensively, with particular attention to variation in voltage, current density, and electrode material. The reduction of ketones also received much attention. Other important areas of electrochemistry that were studied included the formation of peroxyulfates, the iodination of aromatics, the formation of Pb(IV) compounds, and the synthesis of iodoform. His work is still referenced in current organic electrochemistry textbooks. Brockman (2) cited Elbs' work on 81 pages out of 339. On page 2 he states (2):

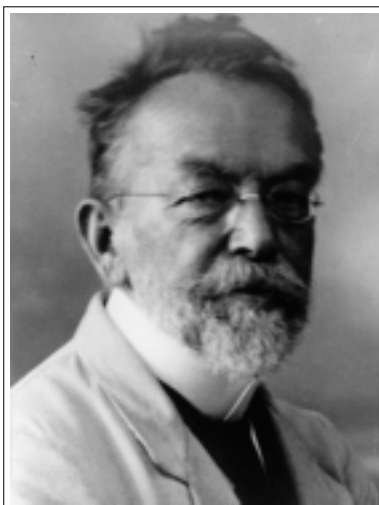
But at the very end of the 19th century, the quantitative relations [of electrochemistry] were brought into prominence by Elbs, Haber, and others.

Glasstone and Hickling (3) likewise give many references to the work of Elbs, particularly in Chapter 5 on "Organic Reduction Processes" and in Chapter 7 on "The Polymerization of Anions." Fichter (4) published a valuable compilation of organic electrolytic reactions; Elbs' work is cited on 72 pages (out of 308). Later reviews of organic electrochemistry still contain many references to Elbs' work, although with decreasing frequency. Swann (5) and Allen (6) contain many such references. Finally, the gigantic (1,550 pp) 3rd edition (1990) of Lund and Baizer's *Organic Electrochemistry* (7) still retains six references to Elbs' papers on the reduction of nitrobenzene, azoxybenzene, and various ketones. (The 4th edition of this standard work lacks an author index.) Elbs' name does not appear so frequently in more general histories of chemistry. I have examined most of the relevant titles listed by Partington (1, pp xvii-xxi). Elbs is cited in only two (8, 9).

The other side of Elbs' fame lies in the fact that two organic reactions bear his name. (The 12th edition of the Merck Index lists 425 "Organic Name Reactions;" 57 chemists are associated with more than one. Emil Fischer wins first place with six). These are the Elbs Reaction and the Elbs Oxidation. Both merited chapters in *Organic Reactions* (10, 11). The Elbs Reaction is a cyclodehydration of *o*-methyl- or *o*-methylene-substituted diarylketones to yield anthracenes, while the Elbs Oxidation is the reaction of peroxydisulfate ions with phenolate ions to give (principally) the phenol *p*-sulfate. The Elbs Reaction was developed by Elbs between the years 1884 and 1890 from the original observations of Behr and van Dorp. The Elbs Oxidation dates from an 1893 paper in which *o*-nitrophenol was converted to nitrohydroquinone.

Another measure of how a scientist is remembered is through a search of the Online Science Citation Index. This index records citations in papers published since 1980. Elbs' papers are cited 52 times. The figure shows a plot of the numbers of papers (books are excluded) published by Elbs as a function of the year of publication. Superimposed on this is a plot of the num-

ber of times that papers published in a particular year were cited. Frequently cited papers and their subject matter are (in order of frequency): the synthesis of nitrohydroquinone, *J. Prakt. Chem.*, **1893**, 48, 179-185 (19 times); oxidative coupling of two molecules of vanillin, *J. Prakt. Chem.*, **1916**, 93, 1-9, 18 times); syntheses of 2-substituted benzo-1,2,3-triazoles, *J. Prakt. Chem.*, **1924**, 108, 209-233 (17 times); benzotriazoles (the original paper), *J. Prakt. Chem.*, **1903**, 67, 580-584 (12 times); homologs of anthracene, *J. Prakt. Chem.*, **1890**, 41, 1-32 & 121-151 (6 times). The first and last are descriptions of what are now known as the Elbs Oxidation and the Elbs Reaction.



Karl Elbs

In addition to about 80 papers, Elbs was the author of one of the first compendia summarizing methods for the preparation of organic compounds (in two volumes), a small, very popular book on storage batteries (five editions), and a text book detailing laboratory methods for various electrolytic preparations. The latter was published in two German editions and also in French and English translation (see Appendix 1).

Appendix 2 lists the chief sources used for this historical account. Biographers Foerster and Brand both published papers with Elbs.

I end with a quote (in translation) from Brand's obituary.

Elbs was a splendid and uncommonly energizing teacher whose lively lectures enthralled all of his listeners. He had the utterly amazing gift of describing even the most complex procedures in a simple and understandable manner. He took great care in the writing of formulas, which he wrote clearly and understandably on the board. When administrative and testing duties occupied less of his time, Elbs visited the laboratory, sometimes even twice per day, for the express purpose of helping his students. He discussed in detail the exercises on the board with them. Everyone who worked in Elbs' institute will fondly recall these energizing and profitable hours. Professor Elbs was an upright, genuinely patriotic man who openly expressed what he considered to be just and right without ever giving offense. His modest character never allowed him to step into the foreground and he did not look for outside honors.

A preliminary account of this paper has appeared (12).

Envoi

“Those ignorant of the historical development of science are not likely ever to understand fully the nature of science and scientific research. This can be said in support of the view that scientists should not restrict their studies entirely to the present edifice of knowledge.” (13)

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REFERENCES AND NOTES

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15. J. S. Fruton, *A Bio-Bibliography for the History of the Biochemical Sciences since 1800*, American Philosophical Society, Philadelphia, PA, 2nd ed., 1992, 100.

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Appendix 1. Books by Karl Elbs

Die Synthetischen Darstellungsmethoden der Kohlenstoff-Verbindungen, J. A. Barth, Leipzig, Vol. 1, 1889, 294 pp; Vol. 2, 1891, 474 pp.

Die Akkumulatoren, Barth, Leipzig, 1st ed., 1893; 2nd ed., 1896; 3rd ed., 1901; 4th ed., 1908; 5th ed., 1919, 48 pp.

Übungsbeispiele für die Elektrolytische Darstellung chemischer Präparate, Knapp, Halle, 1st ed., 1902; 2nd ed., 1911. French translation by E. Leriche, Dunod, Paris, 1903; English translation by R. S. Hutton, Arnold, London, 1903, 99 pp.

Appendix 2. Chief Sources of the Biographical Material

A. G. Debus, Ed., *World Who's Who in Science from Antiquity to the Present*, Marquis, Chicago, IL, 1968, 517. This source lists a nonexistent book, *Die Anthrachinone*, 1900, evidently taken from the *Neue Deutsche Biographie*, **1959**, *4*, 436.

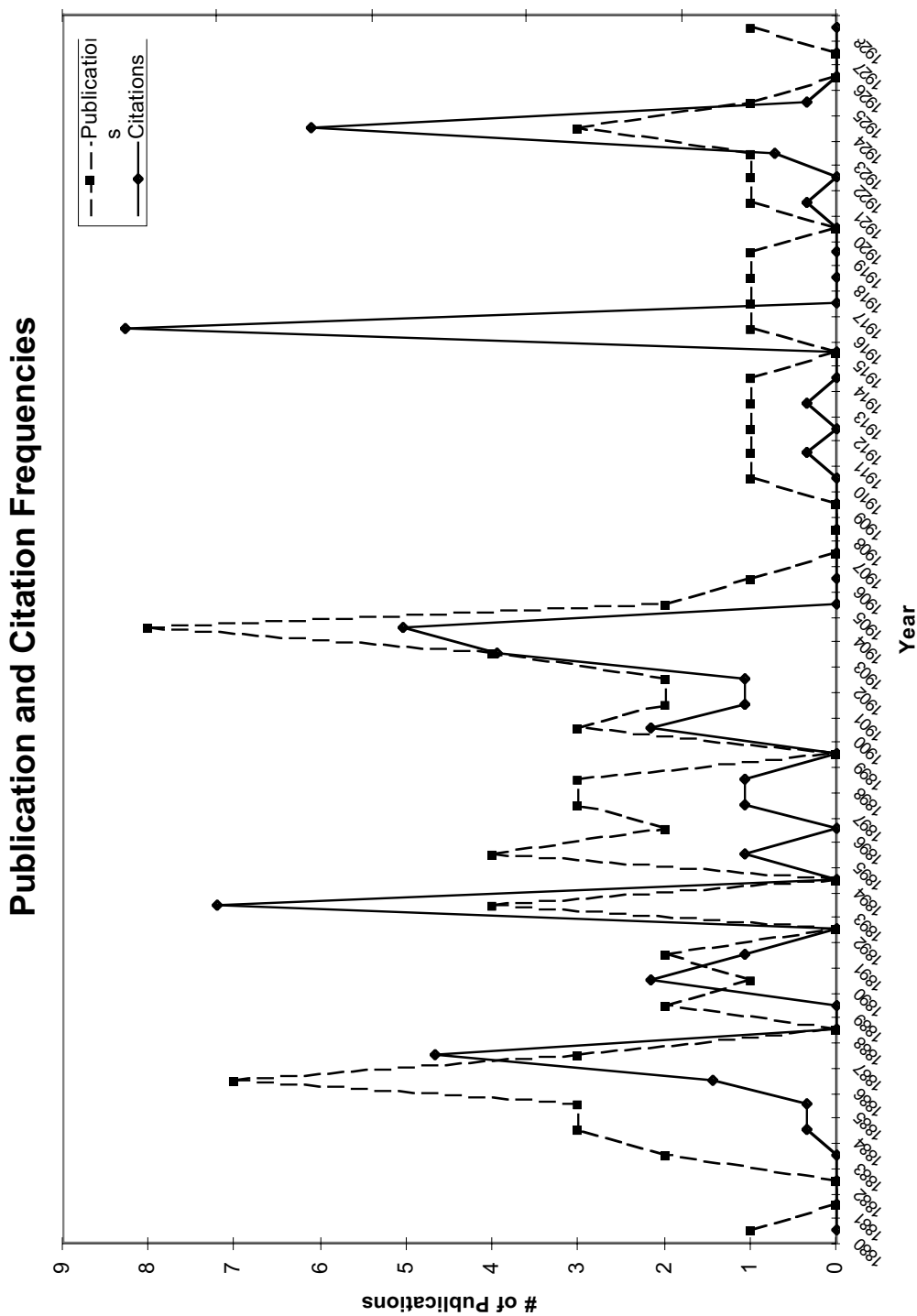
J. C. Poggendorff, *Biographisch-literarisches Handwörterbuch*, **1904**, *4*, 374; **1925**, *5*, 333; **1936**, *6*, 652.

F. Foerster, *Z. Elektrochem.*, **1928**, *34*, 420a-420b (70th birthday).

E. Weitz, *Ber. Dtsch. Chem. Ges.*, **1933**, *66*, 74-75 (Obituary).

K. Brand, *Z. Elektrochem.*, **1933**, *39*, 923-926 (Obituary).

Other biographical details can be found in Hans Steil's extensive account of Elbs' career (Ref 14), which focuses on personal details and includes hitherto unpublished material. This account is part of a two-volume work celebrating 115 distinguished scholars from all fields who held positions at Universität Giessen in the first half of the 20th century. I am indebted to Prof. Joseph Fruton (Ref. 15) for this somewhat obscure reference, which I otherwise would have missed.



Legend for Figure 1: The dotted line gives the number of Elbs' publications, excluding books, as a function of the year of publication. The solid line shows the number of times publications for a particular year were cited in the period 1980 to mid-2003, according to Science Citation Index.