

Ida Freund: Teacher, Educator, Feminist, and Chemistry Textbook Writer

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Abstract— *In the nineteenth century the importance of the following women textbook writers deserves recognition: Jane Marcet (Chemistry and natural philosophy); Mary Somerville (Physical sciences); and Mrs Lincoln Phelps (Biology and chemistry). They were all prolific writers who were recognised in the highest scientific circles.*

Ida Freund, in the early twentieth century, was another textbook writer in this tradition. She wrote two major chemistry books but these were virtually her total life's work. However a well known historian of chemistry said that her work "is to be classed among the really great works of chemical literature".

This paper will focus on the life and work of this great woman chemist and educationalist, whose ideas on physical and chemical change and of the value of practical work in teaching chemistry put her ahead of her time.

1. INTRODUCTION

IDA Freund's life and work is not widely known, so her story is worth telling. Ida Freund's two books relate to chemical change as was the doctoral thesis of the writer of this study. Some comparisons can be made between her work and the work of Henry Edward Armstrong (Palmer, 1998). However they expressed opposite views on science education issues (Brock, 1996, Footnote 71: Jenkins, 1979, p. 175). Brock (1996) indicates that Armstrong supported *heurism* whereas Freund opposed *heurism*. The problem here is that Armstrong was far from consistent in defining *heurism* and that Freund's painfully careful experimentation was hardly suited to science teaching for all. However both were extremely competent chemists with a passion for experimental work. Jenkins indicates that Armstrong and Freund also had opposed views on domestic science curricula. In this case Armstrong's views were probably not soundly based on experience: it was a part of his personality to express strong views about 'everything'. Ida Freund had a wide variety of skills that would have enabled her to give instruction in domestic science had she wished to

do so, but as will be seen later she was not supportive of domestic science curricula.

Ida Freund enjoyed a varied life in spite of physical handicaps; her determination to succeed transcended her disabilities. Little biographical detail is available. No biography or autobiography is available. A Cambridge University Scholarship (URL: [Ida Freund Memorial Prize](#)) is named after her. The two books that she wrote and the regard in which she was held by colleagues and students are her memorial. Some information about her can be found in dictionaries such as Oglivie and Harvey, (2000) and Oglivie (2004), though many, such as Cooney (1996), Kass-Simon and Farnes (1993) and Yount (1997), do not mention her. Other sources include an article (Hill and Dronsfield, 2004) and Benfey's introduction (Benfey, 1968) to the 'Dover' reprint of her book *The study of chemical composition*. She is mentioned in some of the histories of the Cambridge women's colleges, such as Gardiner (1914), Welsh (1914) and Grimshaw (1979). The preface by Hutchinson and Thomas to Freund's book *The experimental basis of chemistry: suggestions for a series of experiments illustrative of the fundamental principles of chemistry* is a personal tribute by kind friends. There are also a number of obituary notices and various studies of women chemists (Rayner-Canham, and Rayner-Canham, 1998, pp. 69-71; Fara, 2005, pp. 156-159) are helpful. Patricia Gould has provided the author of this study with information about Freund whilst Gould (1997b) was researching women physicists of the period. A brief vignette of Freund's very interesting life follows.

2. EARLY LIFE

Ida Freund was born in Vienna, Austria on 5 April 1863, but she was left an orphan when young and was raised by her maternal grandmother there (Shorter, 2005, p. 181). She attended a state school and then trained for teaching obtaining the Austrian State Diploma for teachers. After this her grandparents died one after the other in spite of Freund 'nursing them tenderly' (Gardiner, 1914, p. 34). So, in 1881, at the age of eighteen she came to England to keep house for her uncle Ludwig Strauss, a violinist.

Her uncle had influential friends who

recommended that she be sent to Girton. He agreed as he had long recognised her talents, so she prepared for the 'Little-Go' examinations at a private institution. Greek, Latin and mathematics were all new to her. In July 1882 she was admitted to Girton College, Cambridge (Anon, 1948), but it can hardly be said that this was what she wanted – in fact she bitterly opposed the idea of going to college (Welsh, 1914, p. 9). However she did put her heart and soul into her work in science. Here she achieved a first division in both the first and the second part of the Natural Sciences Tripos in 1885/1886. It was a remarkable achievement considering that she was working in a second language and that at the time it was difficult for women to get advanced instruction in practical chemistry. Physics was her second subject for part of the Natural Sciences Tripos and she did this almost as brilliantly as her beloved chemistry.

3. CAREER

In 1886, she became a lecturer in Cambridge Training College. In 1887, she was appointed Demonstrator in chemistry at Newnham College. However, in 1890, she underwent an operation which left her lame for life (Welsh, 1914, p. 10) and she temporarily left Cambridge to support her uncle in London. There are three slightly different versions of the cause of her lameness. An informant with access to the University Library at Cambridge states that amongst the William Bateson Correspondence (Cambridge University Library) in a letter from Bateson to Anna Bateson, of 16 Jan 1890, Bateson wrote: 'Poor Miss Freund has had a leg amputated for disease of some sort. I believe, Trumpington Street is laid with straw for her.' On the other hand, Benfey (1968) states that 'she lost a leg in a carriage accident'. Wilson (1905) says 'In her youth she had a cycling accident and lost a leg; she had an artificial one...' and this latter version of events is confirmed by Mary Creese (Creese, 1991, p. 287).

Freund stayed in London until 1893 and when her health improved, she returned to Cambridge with her uncle whose health was failing. She resumed work at Newnham and she looked after her uncle until 1899, when he passed away.

Her chief interest was her work at Newnham College, particularly practical chemistry. In 1903 she won the Gamble prize (Anon, 1948, pp. 21-22) for her essay on *The history prior to 1800 of theories concerning the ultimate constitution of matter*. This is unavailable but it would seem likely that much of it is contained in her first book, which was entitled *The study of chemical composition* and was published in 1904. It is a massive piece of work of about 650 pages in length of which M. M. Pattison Muir says '... is to be classed among the really great works of chemical literature...' (quoted Gardiner, 1914, p. 36)

Considerable information is available about her teaching responsibilities and schedule:

The Cambridge University Reporter shows that she taught practical chemistry at the lab in Newnham for two hours, three mornings a week, from Easter Term 1887 until Lent Term 1898 inclusive. After this date, the timetable for chemistry seemed to alter considerably. For example, in Easter Term 1898 she lectured on Chemical Theory (treated historically) at the Balfour laboratory for 1 hour, three times a week; lectured on physical chemistry in a room at Newnham 8pm on Thursday evenings; practical chemistry classes as before. (P. A. Gould, 1997b)

4. MISS FREUND'S CHEMICAL WRITING

As stated earlier Miss Freund wrote two major books, namely *The study of chemical composition* and *The experimental basis of chemistry* and a few articles on chemistry.

Contemporary reviews of these seem uniformly favourable, for example a review of *The study of chemical composition* states:

The author quotes very freely from original sources, the experiments of the writers being described and their reasoning given in their own words wherever possible, and this gives to the book a peculiar freshness which will be appreciated by every reader... (Stokes, 1906, p. 282)

Kahlenberg (1905, p. 567), himself an experienced chemistry textbook writer, provides a very favourable review of *The study of chemical composition* for students and others who need an accurate summary of existing views of chemical composition.

This viewpoint is confirmed by the number of scholars citing Freund's book *The study of chemical composition*. Freund is often cited by historians of science, such as Thomas Kuhn (Kuhn, 1952, p. 12, footnote 2: for her evaluation of atomism in chemistry), Richard Sharvy (Sharvy, 1983, p. 439, footnote 1: concerning Aristotle's ideas on mixtures), Guerlac (Guerlac, 1961, p. 535, footnote 6: for her opinions on Dalton), Aaron Idhe (Idhe, p. 96, footnote 4: for her table of data on Richter's analytical results) and Benfey's (Benfey, 1974, p. 353, footnote: brief biography of Julius Lothar Meyer). There is no doubt that Freund acts as a greatly appreciated secondary source for the views of earlier chemists on the chemical composition of matter, a source which later historical scholars have built upon.

The book, *The experimental basis of chemistry*, was originally planned by Ida Freund to have been 20 chapters in length; she continued writing until a few days before her death, completing ten chapters. Her friends (Mr Hutchinson and Ms Beatrice Thomas) edited these ten chapters, remarking how little editing was necessary (Hutchinson and Thomas, 1920,

p. viii); the book was published in 1920, six years after her death. Brock (2000, p. 418) regards this book as influential in reinforcing 'the significance of illustrative experiments in teaching the fundamental laws of chemistry'. Freund in her writing considered that 'the use of terms such as research, discovery and proof in connection with experimental work' of students was inappropriate (Brock, 2000, p. 418).

Apart from her two books it is difficult to trace Freund's other publications in full. She did research on the neutralisation of a number of salts and published her results in a lengthy article (58 pages) in *Zeitschrift für physikalische chemie* (Freund, 1909). The article was written by Freund in English as Effect of temperature on the volume change accompanying neutralization in the case of a number of salts at different concentrations (Benfey, 1968, p. xi) and translated into German by W. Neumann. The paper was also communicated to an English audience, being read to the Royal Society (Freund 1908). Producing quality research in the limited laboratory conditions available at Newnham College and combined with her physical handicap was an amazing achievement. Richmond (1977, footnote 13) quoting from Freund and from a student of the period, points out the inadequacies of the Cambridge women's college laboratories in terms of size 'no one could tell whether it was the post-office box, a safe, or a draught-cupboard' and in terms of heating in the winter 'I still quiver with cold as I remember those raw days in the laboratory...'.¹

These would have been the conditions in which Ida Freund produced her research. Berry and Moelwyn-Hughes (1963, pp. 357-392) tell the story of the revival in 1901 of the old Cambridge Chemical Club which included all those who lectured in chemistry at the university and at the colleges (1963, p. 357). Ida Freund would have been a member of the club as she was in charge of the Newnham College laboratory (1963, p. 358). Many prominent chemists including H. E. Armstrong presented papers to the club, which had an average attendance of thirty for its meetings. These meetings would have provided Ida Freund with an opportunity to hear the latest research and to present her own research. 'A valuable paper entitled "Double Salts" was given by Miss Ida Freund (Lecturer at Newnham College)'. No detail of this paper appears available but the main points are described by Berry and Moelwyn-Hughes (1963, p. 361) and a number of these headings can be found in *The study of chemical composition*, so some idea of the paper may be obtained.

Freund also had a piece of laboratory apparatus (Fowles, 1957, p. 371) named after her as her invention, though the apparatus is no longer in common use. The apparatus was a variation on Ostwald's gas measuring tube, see

Fowles (1957, p. 324). This does indicate that Ida Freund was a skilled laboratory chemist and practical researcher as well as a chemical writer.

5. STUDENTS' VIEWS OF MISS FREUND'S LIFE

Some comments by friends and students give an indication of the esteem in which Ida Freund was held:

Miss Freund was a terror to the first-year student with her sharp rebukes for thoughtless mistakes. One grew to love her as time went on, though we laughed at her emphatic and odd use of English. Yet how brave she was trundling her crippled and, I am sure often painful body about in her invalid chair smiling, urging, scolding us along to 'zat goal to which we are all travelling which is ze Tripos'. (Ball, 1905, p. 76)

In my day Miss Freund reigned supreme in the Chemistry Lab. in the garden. She was a great character. (Wilson, 1905, p. 72)

Everyone who worked with Miss Freund knows that her high standard and stringent requirements gave you a new idea of the demands of science; you were not allowed to think that you understood, when you did not understand, or to be satisfied with a result which was not the most accurate that you could obtain. (Gardiner, 1914, p. 35)

Gardiner (1914, p. 35) also refers to a student who speaks of Miss Freund's power of encouraging the timid, showing them what they could achieve. All these comments indicate the regard in which Ida Freund was held by her students.

6. PEDAGOGY

Ida Freund's pedagogy is perhaps one of the most interesting facets of her life, yet it is not clear that she had any great influence on the direction that science education was taking at a time when debate in this area was fierce. As previously indicated she certainly seems to have crossed swords with Henry Edward Armstrong on the issues of *heurism* in science teaching describing it as 'nothing better than make-believe, fraught with grave intellectual danger (Freund, quoted Fowles, 1957, p. 513). From a distance of a hundred years, the differences on *heurism* do not seem that great. Freund appears to have been against discovery learning, which she considered fraudulent.

Miss Freund had a dread of thoughtless experimenting and slipshod thinking. She felt strongly that much that passes for training in science has little relation to scientific method and is of small educational value.

(Hutchinson and Beatrice Thomas, 1920, p. vi)

Surely, therefore, the more honest, intellectually bracing and eventually more fruitful course is to sweep away all delusions as to what pupils can discover for themselves... (Freund, 1920, p.8)

But as things are, the attitude of many teachers of elementary chemistry who are considered most progressive and most truly scientific has much in common with the Alchemists of an earlier age... (Freund, 1920, p. 9)

These statements may have been written specifically to annoy Armstrong and no doubt would have done so, but by the time the Freund's book was published he was already a spent force due to the practical difficulties of implementing heurism on a large scale. Ironically one doubts that the sort of critical understanding of chemistry that Freund desired for teachers and their students was brought any nearer by the gradual diminishing of Armstrong's influence. In fact, the outcome was of a cheaper, learn-by-rote science that would not have satisfied the ideals of either Armstrong or Freund.

Ida Freund strongly opposed the replacement of science in the curricula of girl's schools by domestic science:

But powerful opposing forces, including other women such as Ida Freund, who was herself a science graduate and a fellow of Girton College, Cambridge, ridiculed the idea that cooking could ever attain the status of science in her attacks on the King's College course during 1911-12. (Bird, 1998)

During her teaching career Ida Freund was responsible for helping undergraduates pass Part 1 of the Natural Sciences Tripos in chemistry, where frequently they had not studied chemistry before, so she is one of the earliest science teacher educators. In 1897, Ida Freund held a vacation course for physics teachers at Newnham College, because several of her former students who were now teaching 'complained of the scarcity and inferiority of the apparatus at their disposal'. They learned 'how to construct the simpler kinds of instruments for themselves.' (Gardner, 1921, pp. 121-122). Thereafter she organised regular courses for science teachers, fulfilling the teacher educator's role of assisting the teaching profession, whenever possible. Ida Freund's influence was limited because she mainly worked at an individual level, concentrating her energies on a few students rather than getting involved in serving on committees and writing articles publicising her views.

Ida Freund (Freund, 1905) wrote briefly about her chocolate periodic table, which serves as an exemplar of her pedagogy. She had made a periodic table from Edinburgh Rock and chocolate when 'the elements were iced cakes each showing its name and atomic weight in icing... We divided it up between us' (Wilson, 1905, p. 72).

Freund modestly describing the same event said:

Whether it [Freund's chocolate periodic table] is of a kind that would lend itself to extended use as an adjunct to the study of chemistry must be

considered doubtful. (Freund, 1905)

The chocolate periodic table was made with care and skill, combining a knowledge of chemistry with ability as a cook and craftsman; it was a labour of love and evidently each year she prepared a different treat for her students. This example is certainly a precursor to much current work in making lessons interesting (often through food), so her pedagogy is excellent. It is Freund's excellent example as a teacher with her own distinctive pedagogy as well as her intellect and her sincere concern for her students that makes her a model for teacher educators.

Freund appears to have reservations about the accuracy of the periodic table from a theoretical perspective – perhaps not surprising as the table as then known was constructed on different principles from those used today (atomic weight rather than atomic number). However, her reservations can be seen more clearly in one chapter of *The study of chemical composition* where she points out some of the periodic table's deficiencies (see Freund, 1904, pp. 504-5, Wyruboff's criticisms). Nonetheless the criticism of the periodic table may surprise those present day educationalists who see the periodic table as central to the study of school chemistry.

Ida Freund retired due to ill health in 1912 and died in 1914 (Anon, 1914a: 1914b), but up to the day before her death was still working on the manuscript for her book *The experimental basis of chemistry*. The Ida Freund Memorial fund was subscribed by friends after her death and the proceeds were given to Newnham College to raise the standard of physical science teaching in schools by giving teachers opportunities for further study. This was in accordance with Freund's life-work.

7. FREUND'S OTHER WRITING AND HER POLITICAL VIEWS

It is said (Gould, 1997a) that Austria, where Freund had received her early education had been supportive of the educational and social progress of women, whereas English social conventions of the time gave women's education only limited support and virtually no political influence. She was active on many social issues; she was a member of the women's suffrage movements (Hill and Dronsfield, 2004); she financially supported the Southwark Settlement for the mentally handicapped and knitted clothing for the soldiers in the Boer War. She was well-travelled as, whilst her uncle was alive, they used to go on trips around Britain and Europe together. After his death she went on cycling holidays to Europe (she used a tricycle, powered by her arms) and went as far afield as Scotland, Switzerland, Germany, Austria and Italy.

Her views on education for girls, particularly in science, were strongly and sincerely felt, but her desire also for scientific accuracy, individual effort and examination success would not

necessarily endear her to women's movements today. It should be remembered that tempering her surface hardness, there was a deep compassion for people.

As a committed feminist, Freund wrote in a number of different journals and gave evidence to a Parliamentary committee. Two examples follow: in 1911, Freund who was seriously concerned about academic standards in girls' schools, wrote a lengthy contribution for *The Englishwoman* (Freund, 1911) pointing out the dangers of trying to teach science in an applied, 'domestic form' (Dyhouse, 1977, p. 29); Vickery (1999, p. 155) states that when the question of whether domestic science should replace science as a discipline in women's colleges such as Newnham College was raised, Ida Freund responded angrily arguing that domestic science could in no way prepare a student to think and analyse in the proper scientific method.

8. CONCLUSION

There is something particularly remarkable about Ida Freund's life and many people find Freund's life inspirational. For example Susan Gasser, Director of the Friedrich Miescher Institute for Biomedical Research in Basel, writes:

My other heroes include a set of women scientists, Ida Freund, Marie Curie, Barbara McClintock and Dorothy Hodgkin. They pursued the research that they loved and tolerated whatever they had to bear to do it, ignoring that science was not 'something appropriate' for women. I admire their force of character. (Gasser, 2007)

Her interest in the teaching of chemistry, her concern for accurate practical work and her interest in chemical composition naturally lead to her work on physical and chemical change, which is a particular interest of the author of this study (Palmer, 2003).

Although she wrote just two books and some articles, a contemporary Cambridge chemist Matthew M. Pattison Muir said that her work 'is to be classed among the really great works of chemical literature' (quoted by M. I. Gardiner, 1914). Her obituary in *Nature* (A correspondent, 1914, p. 327) remarked that 'science has lost a devoted follower, chemistry an enthusiastic and original teacher, investigator and writer, and her friends a wise, warm-hearted and gentle woman'.

It is worth noting that she is one of only fifteen British women chemists mentioned in *The Oxford Dictionary of National Biography*, which contains biographies of 514 British male chemists (Kauffman, 2004) amongst the total of 50,000 biographies. This distinction places Ida Freund in context as achieving great distinction in her chemistry in an era where it was not easy for a woman to excel in the sciences and she accomplished this in spite of severe physical difficulties. She also found time and energy to be

active politically to ensure women a place in the science of the future.

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