

## CHEMISTRY IN ENGLISH ACADEMIC GIRLS' SCHOOLS, 1880-1930

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### Introduction

Accounts of curricula in English girls' schools in the late nineteenth and early twentieth century rarely mention science, particularly chemistry. Science is not addressed in either of Kamm's books: *Hope Deferred: Girls' Education in English History* (1) and *Indicative Past: A Hundred Years of the Girls' Public Day School Trust* (2). In Turner's *Equality for Some: The Story of Girls' Education*, he remarks (3): "Even in schools where science was taught, it was unusual for a pupil to acquire an adequate grounding for advanced study." In Avery's *The Best Type of Girl: A History of Girls' Independent Schools* (4), the comment is made: "In the privately owned schools there was on the whole a marked absence of science before the 1950s," while subsequent discussion in the book supported that thesis. Thus there is a clear implication that science (including chemistry), was of marginal relevance to English girls' schools until the mid-twentieth century.

An exception to this viewpoint was given by Manthorpe in a chapter in Walford's *Private Schooling of Girls: Past and Present*. Her focus was on the socio-historical perspective, rather than on the science. However, in the concluding points, Manthorpe notes (5):

The North London Collegiate School for Girls acted as a model for many of those new schools. From the beginning, science education was included in the curriculum of these schools, and most often one or more branches of the physical sciences were taught as well as mathematics.

The widely-accepted view of a lack of grade-school science education for girls was also at variance with the backgrounds and life-stories of early-twentieth century British women chemists in our own research (6).

### Methodology of the Study

To confirm our contentions, we have extended our studies and report here on our research. The time period which we explored was approximately 1880 to 1930. Our starting point was the published histories of the individual academically-oriented schools. Though most schools made no more than a passing reference to science facilities, a few, such as the two histories of King Edward VI High School for Girls, Birmingham, and that of St. Swithun's School, made especial note of science teaching at the respective schools. A second source of information was the contemporary magazine, *Girl's Realm*, which published a series of articles titled "Famous Girl's Schools" and these, too, noted the science facilities at some of the schools (accessed at the British Library). A third source was that of contemporary education journals, in particular, *Journal of Education* and *School World* (accessed at the University of Cambridge Main Library).

The fourth, and most interesting, source was that of high school student magazines. These were typeset and often published from the school's inception. From our searches, these magazines are not generally available, the sole surviving set of issues often being held in the

specific school. Over the period of interest (1880-1930), such magazines tended to be very “academic” with club and society reports and students’ accounts of their lives, travels, and experiences. (In subsequent decades, such magazines became literary-oriented with fiction, poems, and so on.)

In our analysis of women who became an Associate or Fellow of the Royal Institute of Chemistry or a Fellow of the Chemical Society (6), a notable proportion came from certain high schools. Of the schools which produced the most women chemists to-be, we ascertained that six had archives containing a complete set of their student magazines for our period of study. These were: King Edward VI High School for Girls, Birmingham (*The Phoenix*); North London Collegiate (*Our Magazine: North London Collegiate School for Girls*); Cheltenham Ladies College (*Cheltenham Ladies’ College Magazine*); Manchester High School for Girls (*The Magazine of the Manchester High School*); Croydon High School for Girls (*Croydon High School Magazine*); and Mary Datchelor School, East London (*Datchelor School Magazine*). We are grateful to each of the first five schools for access to their archives and also to the Clothmakers Guild, for access to the archives of the long-closed Mary Datchelor School.

### The Science Education of Girls

It was in 1869 that the feminist educator, Lydia Becker, made the case for the education of middle-class girls in science (7):

... many [married middle-class] women might be saved from the evil of the life of intellectual vacuity, to which their present position renders them so peculiarly liable, if they had a thorough training in some branch of science, and the opportunity of carrying it on as a serious pursuit.

By the 1880s and 1890s, chemistry was being discussed as a specific component of a middle-class English girl’s liberal education. As an example, in an 1884 article on science teaching in girls’ schools published in the *Journal of Education*, the anonymous author stated (8):

With a small amount of material, and with no more space than is afforded by an ordinary school-room, much may be done to make Chemistry, as it should be, the basis of all Natural Science teaching.

Where a chemical laboratory, however small can be obtained, it becomes possible, as well as desirable, that Chemistry should be taught more thoroughly and practically.

Take, for instance, such a course of Chemistry as that prescribed for the London Matriculation Examination. The facts and phenomena should be taught first by the aid of experiments performed by the teacher. This should then be followed by practical lessons, in which the pupils themselves perform the experiments. The simple gases – Oxygen, Nitrogen, Hydrogen, &c. – can be prepared by a class of pupils without difficulty in a moderately sized laboratory, and students who have themselves actually performed such experiments acquire a knowledge of the laws of chemical reaction, and of the properties and constitution of matter which would be impossible without such means.

In a definitive study of education for girls published in 1898, there was a chapter on *The Teaching of Chemistry* by the woman chemist, Clare de Brereton Evans (9). In that chapter, Evans argued that junior, as well as senior, girls needed exposure to practical chemistry:

For success in examinations it is now necessary to have a certain amount of practical knowledge of chemistry and examination classes are therefore given some practical training, but this reform still remains to be extended universally to the junior classes, which need even more than the senior ones that the teaching should be objective: a child may learn and repeat correctly a dozen times that water is composed of oxygen and hydrogen, and the thirteenth time she will assure you that its constituents are oxygen and nitrogen; but let her make the gases herself, test them and get to know them as individuals, and mistakes of this kind will become impossible.

Queen’s College, Harley Street, founded in 1847 (10), seems to have played a pivotal role, directly and indirectly, in the wider acceptance of science as part of a girl’s education. Though the initial focus was on the secondary education of governesses, the aims grew rapidly broader as the nineteenth century progressed. In particular, the Queen’s College curricula from 1848 to 1868 (11) contained a course on Natural Philosophy which included a chemistry section covering the facts and classifications of chemistry, illustrated by experiments performed by a University chemistry lecturer.

One of the many Queen’s College graduates to attain fame was the educator Frances Buss (12). It was arguably her experience at Queen’s College that led her to include a very strong science program when she subsequently founded the North London Collegiate School. Buss included chemistry in the curriculum, as was noted by Watson, the school’s biographer (13):

Robert Buss [Frances Buss’s father] made a memorable science teacher as Annie Martinelli, an early

pupil later remembered: 'His talents were simply wonderful. His Chemistry series was marvellous, especially for smells and explosions.'

The turning point for the wider population was the Report of the Schools Inquiry Commission (the Taunton Commission) of 1868 (14) which provided, in general, a damning indictment of girls' education in England. In the Report, Professor T. H. Green, Assistant Commissioner for Birmingham, recommended that a girls' school was needed on the outskirts of every considerable town which would give girls an education similar to that provided in the best boys' grammar schools. Responding to this proposal, the Shirreff sisters (15) organized the "National Union for the Improvement of the Education of Women of All Classes" which led to the organization of the Girls' Public Day Schools Company (GPDSC). Under the auspices of the GPDSC, girls' schools were founded across England during the 1870-1890 period, with the majority being in the greater-London area. These schools were modeled on the North London Collegiate School and hence incorporated science as part of the curriculum. Other independent girls' schools also introduced strong science programs (16), including Manchester High School for Girls and King Edward VI High School for Girls, Birmingham.

### Chemistry Teachers

We contend that it was a generation of powerful Headmistresses (17) who promoted science at their schools and, in the process, hired some highly qualified women chemistry teachers. For example, Buss hired Grace Heath (18) as the science teacher at North London Collegiate School in 1888. Heath had been the first woman chemistry student with the famous British chemist, Henry Armstrong, at the Central Technical College (later part of Imperial College, University of London). Sadly, Heath died in 1895 before she was 30 years old. Buss's successor as Headmistress, Sophia (Sophie) Willcock (Mrs. Bryant), was determined to maintain the School's science reputation. Willcock hired Rose Stern (19). Stern had been educated at King Edward VI School and, while there, had been elected as the first woman Student Member of the Institute of Chemistry.

At King Edward VI School, the first Head was Edith Elizabeth Maria Creak. The School biographer, Winifred Vardy, noted (20): "To Miss Creak belongs the honour of being a pioneer in the teaching of science to girls. Though her own training [at Newnham College, Cambridge University] had been mathematical and clas-

sical, she seems to have foreseen the value of scientific knowledge for women." Creak hired two dedicated and enthusiastic science staff, Lizzie Davison and Alice Celia Slater, upon the School's opening in 1883. Like Creak, they were both Newnham graduates. Another School biographer, Rachel Waterhouse, commented (21):

Miss Davidson and Miss Slater took charge of science, each stayed for thirty-one years at the School, and to them belongs almost all the credit for the great scientific successes achieved by Edwardians during the whole of that period.

While Vardy quoted a former student (20):

Miss Davison also used to take the XIIth Class, little girls of 8 to 10, in the principal gases. "She did all the demonstrations, which according to modern ideas was bad," writes a pupil, "but she made it so interesting that I used to be impelled to tell my small brother all about it each week, and what she taught us *sticks*."

Buss's long-time friend, Dorothea Beale (22), also a graduate of Queen's College, became the second Principal of Cheltenham Ladies' College. Beale made an equally inspired choice of hiring Millicent Taylor (23). Taylor had been a student at Cheltenham Ladies' College, returning as chemistry teacher upon completing her B.Sc. in chemistry at University College, Bristol (later the University of Bristol). Croydon High School likewise hired one of its own outstanding former students, Kathleen Mary Leeds (24). Leeds had been one of the first women chemistry graduates from the prestigious Royal College of Science (also later part of Imperial College, University of London) but, like Heath, Leeds died young, in 1921 at age 26.

It was the second Principal of Manchester High School, Sara Burstall, who emphasised science at that school. Burstall commented that by the 1920s (25): "We had ... four specialist teachers on the staff, all first class honours graduates in chemistry, physics, botany and zoology, and many Old Girls were students in universities or science graduates".

At Leeds Girls' High School, the first Head Mistress, Catherine Kennedy, was so keen for her girls to take chemistry that she arranged in 1876 to take them to the Yorkshire College of Science (later the University of Leeds) where they were taught by Professor Edward Thorpe (26). One of the six girls that year won a prize, and others were equally successful in subsequent years. The arrangement continued until science laboratories were added to the school in 1883.

A significant number of girls were studying chemistry at these science-active schools. For example, at Mary Datchelor School in East London, an issue of the *Datchelor School Magazine* of 1901 proudly reproduced the Report of the chemistry section of the high school examination administered by Cambridge University (27): “In the Upper VI. [class] the section on Physical Chemistry studied had been thoroughly mastered, and a large number of girls scored over 90 per cent of the marks.” Some of these students proceeded to university to study chemistry. For example, in 1908, two students from Mary Datchelor School entered the (women’s) Royal Holloway College of the University of London, to study chemistry (28): “... She [Edith Hancock] is entering for an Honours Degree in Science, taking Chemistry as her special subject. Phœbe [Routh] is also reading for Honours in Chemistry ...”

### School Chemistry and Science Clubs

We found that some of the science-active schools had student chemistry clubs or science clubs with chemistry sections. North London Collegiate School (NLCS) had a Chemistry Club from the early part of the twentieth century. The School had a hand-written magazine, illustrated with glued-in photographs. Called *The Searchlight: NLCS Student Magazine for Science*, it gave a record of Chemistry Club activities. The social events were also reported in the (printed) school magazine, *Our Magazine: North London Collegiate School for Girls*, such as (29): “On Thursday, July 11<sup>th</sup> [1912], Miss Stern, Miss Drummond [junior chemistry teacher] and the Science Sixth gave a party in the Old Laboratory. We drank tea out of beakers, and stirred it with long glass wands. ...”

We know more about the Science Club at King Edward VI School, which was not formed until 1923 and survived through the remainder of the 1920s. It had a strong chemistry focus, with the first meeting involving the reading of papers on the famous early chemists, Priestley, Scheele, Cavendish, and Lavoisier (30). At a meeting in 1928, students gave presentations on the topics of “Chemistry in the Service of Man,” “Industrial Chemistry,” “Flame and Fuel,” and “Synthetic Chemistry” (31). While in 1929, two students gave “Chemical Magic” demonstrations. The student magazine, *The Phoenix*, reported (32):

They succeeded, among other things, in ‘Turning water into wine,’ producing a miniature snow-storm, and charming a beautiful serpent out of an ordinary crucible. Judging by the inquiries afterwards as to

how they did it, this last feat seems to have been their greatest triumph.

### School Chemistry Laboratories

The construction of a chemistry laboratory was a mark that the girls’ school was serious about the subject. Several of the articles on famous girls’ schools in *Girls’ Realm* highlighted the chemistry laboratory, often with a photograph, and usually showing sophisticated glass distillation apparatus and earnest-looking girls performing chemical analysis. For example, in a report on Mary Datchelor School, Whyte, a regular contributor to *Girls’ Realm*, wrote in 1901 (33): “Upstairs two well-equipped laboratories for chemistry and physics are included amongst the class-rooms.”

Other contemporary reviewers of prominent girls’ schools were equally sure to mention the chemistry laboratories. In an article in *Girls’ Realm* in 1900 on North London Collegiate School, Hill reported (34): “Beyond is a chemical laboratory well fitted up and large enough for twenty-four girls to work together at one time.” The construction of science laboratories at Cheltenham Ladies’ College was one of Beale’s priorities. This was accomplished as noted in a description of the school in an 1899 issue of *Girl’s Realm* (35): “in the Science Department there is a laboratory for physics and two for chemistry ...” while a new Science wing was added in 1904. A report in *School World* (36) on the new laboratories described in detail the dedicated chemistry lecture room with a fully-equipped demonstration bench, an elementary chemistry laboratory, an advanced chemistry laboratory, a chemical preparation room, two storerooms for chemicals and equipment, and a chemistry study room (though it should be noted these extensive facilities were also used for an external B.Sc.(London) in chemistry offered at the College).

St. Swithun’s School acquired a chemistry laboratory in 1895, following a tour by the Administrative Committee during which students deliberately left an open flask releasing chlorine gas in a classroom to highlight their lack of facilities. The hazards of practical chemistry seem to have been taken as an integral part of the work. At St. Swithun’s, one of the students taking the chemistry practical examination in 1897 reminisced (37):

In those days a ‘don’ was in charge in cap and gown. An enterprising examiner had given red phosphorus as the unknown substance. About ten minutes after we had commenced a nervous candidate dropped a glowing match on the ‘unknown’—result, a wild

flare and we all 'knew'. Hardly had the invigilator extinguished this when it was discovered that a pile of dusters was on fire; this in turn was extinguished. Then suddenly the bottom came out of a medicine bottle improvised to contain sodium hydrate, devastating a varnished table and all the candidates' papers. Wearily our friend came for a third time to the rescue, remarking, 'My life is insured—I only hope yours are!'

While in her report for *Girl's Realm* in 1901 on Bedford High School, Whyte implied that the inherent dangers of practical chemistry were a valuable part of the educational experience (38):

Practical chemistry is among the best modern educational improvements. It teaches things which go much deeper into our consciousness than mere words could ever go. It teaches consequences—the stern, certain consequences of doing quite the right or the wrong thing. It never makes a mistake, or slurs over a little bit of carelessness, or pretends everything is right when everything is quite the reverse. And for girls who have to go through with life, it is not a bad thing to learn when young to expect the natural consequences of an action, even to the correct or incorrect testing of a compound or simple liquid.

Some of the school chemistry laboratories seem to have been of high quality. A group of students at the Manchester School for Girls visited Cambridge University in 1901 and pronounced (39):

The Newnham Chemistry Laboratory was inspected on Monday morning, but was agreed to compare very unfavourably with the Chemical Laboratory of the Manchester High School, whatever the standard of work might be.

### The End of an Era

The first two decades of the twentieth century was marked by a debate whether "real" science or domestic science was more appropriate for a girls education (40). The academically-oriented independent girls' schools, such as the GPDSC schools, seemed to have been immune to the issue. This rise of domestic science seems to have been more of an influence on state schools, particularly those teaching girls from the "lower classes." Nevertheless, the fervor for science education for girls seems to have abated by the 1930s.

As early as 1912, the Headmistress of Sacred Heart School, Hammersmith, described how the educational reforms of the later decades of the nineteenth century had emphasized the teaching of natural science. Nevertheless, in her view, the enthusiasm for laboratory science for girls was coming to an end. She added (41):

So laboratories were fitted up at great expense, and teachers with university degrees were sought after. The height of the tide seemed to be reached in 1904 and 1905... Then disillusion seems to have set in and the tide began to ebb. It appeared that the results were small and poor in proportion to expectation and to the outlay on laboratories. ... The links between this teaching and after life did not seem to be satisfactorily established.

Yet this explanation has to be considered in context. By the 1930s, attitudes to women in science had changed (42). Those charismatic pioneer Headmistresses, fired with the fervor of the need to match or exceed boys' schools and to provide a springboard to university, had retired or died (43). As Hunt has commented (44):

In the 1920s and 1930s it was fashionable to accuse girls' secondary schools of neglecting the 'feminine' side of their pupils' development. The Victorian pioneers (and Miss Buss and Miss Beale were frequently cited on these occasions) were supposed to have adopted a model of 'liberal education' and in doing so had 'assimilated' the 'boys' curriculum' and ignored the needs of femininity in their schools. The result, said the accusers, was that girls' education was a 'slavish imitation' of boys' (and by definition, therefore, inappropriate for girls).

To the new pragmatic generation of Headmistresses, chemistry and its associated laboratory work was no longer the high-priority item that it had once been. It is therefore no wonder that we found that the late 1920s-early 1930s period also coincided with the demise of most of the science and chemistry clubs at girls' schools.

### Commentary

We have endeavored to provide evidence that chemistry was a significant component of the curriculum at some academically high-achieving English girls' schools in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries. In our view, the impetus came from forceful Headmistresses who saw science, and chemistry in particular, as being crucial to their goal of the schools' recognition for academic excellence. To this end, they hired some of the earliest—and most outstanding—women chemistry graduates. Some of the schools possessed modern chemistry laboratories and at several schools, enthusiastic students founded chemistry clubs or science clubs with chemistry sections to pursue their interests. As described above, the enthusiasm declined by the late 1920s and chemistry at girls' schools appears to have waned.

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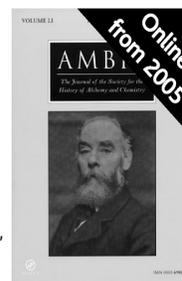
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