Pioneers of Science Education: #3

Jane Marcet (née Haldimand): (1 January 1769 – 28 June 1858) 'Populariser of chemistry'

In this series I will look at some of the pioneers of science education (PoSE), either in terms of pedagogy, curriculum development or science education research. Some of them have an Irish connection, but all have had an influence on the teaching and learning of science in Ireland. In PoSE #1 we looked at Maria Edgeworth, who was a friend of Jane Marcet, and in PoSE #2 at Richard Dawes, a pioneer of child-centred science in context. In PoSE #3 we look at the life of Mrs Jane Marcet, one of the earliest popularisers of science, especially for women.

Introduction:

If Jane Marcet was known for nothing but her influence on the young Michael Faraday, then she would be rightly famous. She was the successful author of popular science books, particularly her *Conversations in Chemistry*, first published in 1805. Faraday read it when he was an apprentice bookbinder, and he credited it as one of the influences that drew him to natural philosophy. Her long life overlapped those of Maria Edgeworth (PoSE #1) and Richard Dawes (PoSE #2). However, her contribution was not in formal school education but in writing what we might today call self-help or popular science books. She was born in London on New Year's Day 1769 to Anthony Francis Haldimand (1740-1817) and his wife Jane (d. 1785), who were Swiss. Her father was a successful businessman in London. Jane was one of 12 children and was well educated at home in Latin and in chemistry, biology, history and other subjects. Following the Swiss tradition, girls and boys were educated in the same way. She took over running the house when her mother died in 1785, acting as hostess to gatherings of scientific and literary people. She studied art with Joshua Reynolds and Thomas Lawrence and later this helped her was to illustrate her own books. In 1799 she married the Swiss Huguenot exile John Gaspard Marcet (1770-1822), a physician, and after their marriage the Marcet's lived in London. They had four children. Her husband was interested in chemistry, as many doctors were, and had been taught by Joseph Black, and he lectured on chemistry at Guy's Hospital, London and was elected a Fellow of the Royal Society. When Jane became interested in chemistry after attending Humphry Davy's lectures at the Royal Institution, husband and wife collaborated, working in a home laboratory. Jane's father lived with them and when he died in 1817, his legacy enabled her husband to give up medicine and devote himself fully to chemistry. The Marcets had four children, one of whom (François Marcet (1803–1883) became a famous physicist. Sadly John Marcet died in 1822 and Jane spent the rest of her long life as a widow. The Marcet's were part of a wide literary and scientific circle, which included Maria Edgeworth (PoSE #1). In one of her letters Maria gave a description of the Marcet family:

"We came here last Friday, and have spent our time most happily with our excellent friend Mrs. Marcet. His children are all so fond of Dr. Marcet, we see that he is their companion and friend. They have all been happily busy in making a paper fire-balloon, sixteen feet in diameter, and thirty feet high. A large company were invited to see it mount." (Edgeworth, 1895, p.354)

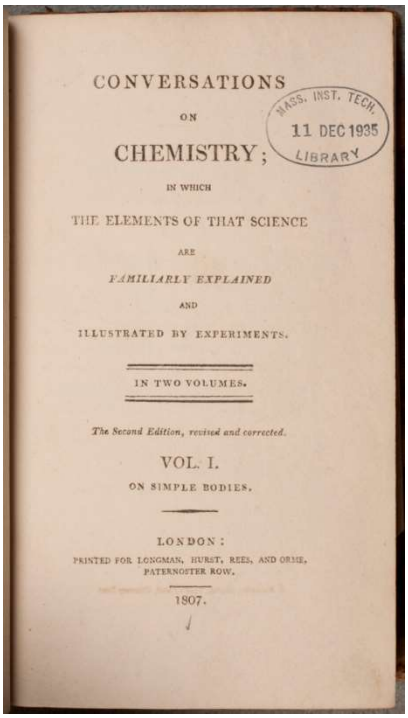
Table 1 shows the main dates in her long life and Figure 1 shows her in old age.

Table 1 Main dates in Jane Marcet's life

1769	Born 1st. January in London
1785	Her mother died
1799	Married John Gaspard Marcet
1806	First edition of Conversations in Chemistry
1817	Her father died
1822	Her husband died
1858	Died 28th June in London

Figure 1: Jane Marcet in old age

Conversations in Chemistry



CONVERSATIONS

ON

CHEMISTRY;

IN WHICH

THE ELEMENTS OF THAT SCIENCE

ARE

FAMILIARLY EXPLAINED

AND

ILLUSTRATED BY EXPERIMENTS.

IN TWO VOLUMES.

The Second Edition, revised and corrected.

VOL. I.

ON SIMPLE BODIES.

LONDON:

PRINTED FOR LONGMAN, HURST, REES, AND ORME, PATERNOSTER ROW.

1807.

Figure 2: Frontispiece of Conversations in Chemistry (1807)

Mrs Marcet is best known for her popular science book, *Conversations in Chemistry*, first published anonymously in 1806 (Figure 2). The book sold like hot cakes and went through 16 editions in England and at least 23 pirated editions were published in America, where it became a popular school text book, especially in girls' schools. It was also translated into Italian, French and German. It was a large book, published in two volumes, and it gave an up-to-date view of the state of chemistry at that time. It was published anonymously at first, as women authors ere uncommon and she may have been trying to protect her husband's reputation. There was much debate about its authorship and some people claimed it as their own work! It was not until the 12th edition in 1837 that Mrs Marcet was revealed as the author.

In the preface to the book Mrs Marcet explains her reasons for writing the book, after she had attended Humphry Davy's lectures at the Royal Institution in London.

"In venturing to offer to the public, and more particularly to the female sex, an Introduction to Chemistry, the author, herself a woman, conceives that some explanation may be required; and she feels it the more necessary to apologise for the present undertaking, as her knowledge of the subject is but recent, and as she can have no real claims to the title of chemist.

On attending for the first time experimental lectures, the author found it almost impossible to derive any clear or satisfactory information from the rapid demonstrations which are usually, and perhaps necessarily, crowded into popular courses of this kind. But frequent opportunities having afterwards occurred of conversing with a friend on the subject of chemistry, and of repeating a variety of experiments, she became better acquainted with the principles of that science, and began to feel highly interested in its pursuit. It was then that she perceived, in attending the excellent lectures delivered at the Royal Institution, by the present Professor of Chemistry, the great advantage which her previous knowledge of the subject, slight as it was, gave her over others who had not enjoyed the same means of private instruction. Every fact or experiment attracted her attention, and served to explain some theory to which she was not a total stranger; and she had the gratification to find that the numerous and elegant illustrations, for which that school is so much distinguished, seldom failed to produce on her mind the effect for which they were intended.

Hence it was natural to infer, that familiar conversation was, in studies of this kind, a most useful auxiliary source of information; and more especially to the female sex, whose education is seldom calculated to prepare their minds for abstract ideas, or scientific language.

As, however, there are but few women who have access to this mode of instruction; and as the author was not acquainted with any book that could prove a substitute for it, she thought that it might be useful for beginners, as well as satisfactory to herself, to trace the steps by which she had acquired her little stock of chemical knowledge, and to record, in the form of dialogue, those ideas which she had first derived from conversation."

(Marcet, 1817, Preface i-ii)

She wrote it specifically for women and girls and it was presented in the form of a conversation between Mrs. Bryant (B) and her teenage pupils Emily and Caroline. This was a common style for educational books in the 19th century. *"The conversational format had been a typical format for introductory works since the late eighteenth century. It particularly appealed to female writers, who found in its imitation of private domestic conversations a forum in which they could participate in subjects otherwise dominated by men."* (Fyfe, 2004) Conversations were supposed to be good for learning because breaking up information into small chunks of dialogue, and interspersing it with interplay between the fictional characters, made it more palatable. In the opening conversation Caroline says she is uninterested in chemistry (quoted in Lindee, 2001, p. 11).

Caroline. To confess the truth, Mrs. B., I am not disposed to form a very favourable idea of chemistry, nor do I expect to derive much entertainment from it. I prefer the sciences which exhibit nature on a grand scale, to those that are confined to the minutiae of petty details.
Mrs. B. I rather imagine, my dear Caroline, that your want of taste for chemistry proceeds from the very limited idea you entertain of its object.... [Nature's laboratory] is the Universe, and there she is incessantly employed in chemical operations.
You are surprised, Caroline; but I assure you that the most wonderful and the most interesting phenomena of nature are almost all of them produced by chemical powers.

Table 2 shows a typical extract from the book, showing its conversational format between Mrs B. And the two girls.

Table 2: An extract from *Conversations in Chemistry* (Marcet, 1817, 7-8)

MRS. B.
If every individual substance were formed of different materials, the study of chemistry would, indeed, be endless; but you must observe that the
various bodies in nature are composed of certain elementary principles, which are not very numerous.
CAROLINE.
Yes; I know that all bodies are composed of fire, air, earth, and water; I learnt that many years ago.
MRS. B.
But you must now endeavour to forget it I have already informed you what a great change chemistry has undergone since it has become a regular science. Within these thirty years especially, it has experienced an entire revolution, and it is now proved, that neither fire, air, earth, nor water, can be called elementary bodies. For an elementary body is one that has never been decomposed, that is to say, separated into other substances; and fire, air, earth, and water, are all of them susceptible of decomposition.
EMILY.
I thought that decomposing a body was dividing it into its minutest parts. And if so, I do not understand why an elementary substance is not capable of being decomposed, as well as any other.
MRS. B.
You have misconceived the idea of decomposition; it is very different from mere division. The latter simply reduces a body into parts, but the former separates it into the various ingredients, or materials, of which it is composed. If we were to take a loaf of bread, and separate the several ingredients of which it is made, the flour, the yeast, the salt, and the water, it would be very different from cutting or crumbling the loaf into pieces.
EMILY.
I understand you now very well. To decompose a body is to separate from each other the various elementary substances of which it consists.

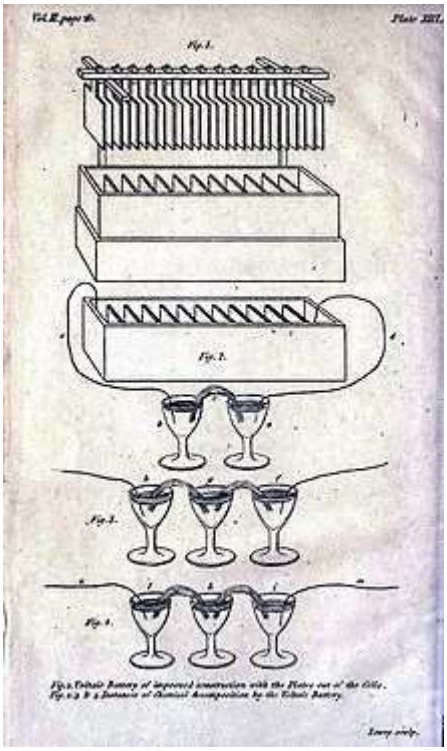


Figure 3: A drawing from *Conversations in Chemistry*

As noted above, Mrs Marcet had received instruction in drawing and so she was able to illustrate the book herself. Figure 3 shows an example of one of her drawings. She continued to update and revise the book in successive editions, right until the end of her life, writing to leading scientists to confirm the latest discoveries. Mrs Marcet and Michael Faraday kept up correspondence throughout her life, and she would contact him for information on the most recent developments in order to update her *Conversations*. For example, when Faraday's discovery of the link between light and magnetism was announced in the press, Mrs. Marcet wrote to ask Faraday for more information (letter dated November 24, 1845):
Dear Mr. Faraday, — I have this morning read in the "Athenaeum," some account of a discovery you announce to the public respecting the identity of the imponderable agents, heat, light and electricity; and as I am at this moment correcting the sheets of my "Conversations on Chemistry" for a new edition, might I take the liberty of begging you would inform me where I could obtain a correct account of this discovery. It is, I fear, of too abstruse a nature to be adapted to my young pupils; yet I cannot make up my mind to publish a new edition without making mention of it; I have, therefore, kept back the proof sheets of the 'Conversation on Electricity,' which I was this morning revising, until I receive your answer, in hopes of being able to introduce it in that sheet.
https://skullsinthestars.com/2014/10/14/jane-marcet-educates-michael-faraday/

Other writings

Although she is best known for *Conversations in Chemistry*, Mrs Marcet was a prolific writer on many topics. She wrote many other books: for example, *Conversations in Political Economy* (1816); *Conversations on Natural Philosophy* (1820); *Conversations on Vegetable Physiology* (1829); and *Mary's Grammar* (1835). We must remember that Jane Marcet was writing at a time when formal education was limited to a few, mostly boys, when girl's education was almost non-existent and when science did not have a well-defined role in the school curriculum. Her books were intended for girls and young women of the middle and upper classes, who might not have had formal education, certainly not in science, and was

intended to provide them with the background to understand popular scientific lectures and make intelligent conversation at social gatherings. This was how *Conversations in Chemistry* was used in Great Britain but in America it was widely used as an elementary science textbook, particularly in female academies. Boston Girls' High School is credited as being the first girls' school in America to teach science with laboratory instruction in 1865, and they used *Conversations in Chemistry* as their textbook. In America, where the book was extensively pirated, the 'authors' started to add study questions, glossaries, guides to the experiments and critical commentaries, thus foreshadowing the general chemistry learning packages of today.

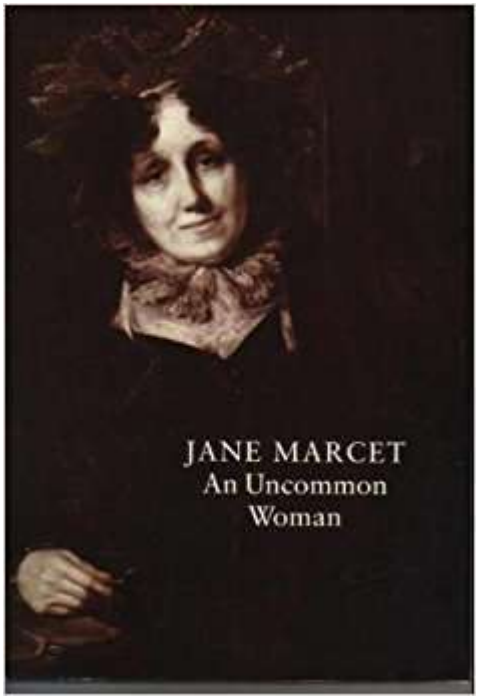


Figure 4: Jane Marcet in middle age on the cover of *Jane Marcet: An Uncommon Woman*, B. Polkinghorne (1993)

Mrs Marcet's influence

The popularity of *Conversations in Chemistry* is one indication of its impact: 16 editions in England and 23 (pirated) editions in the USA, which together sold 160,000 copies.
We have mentioned already the impact on Michael Faraday. When Jane Marcet died in 1858, M. De la Rive, a friend of Faraday was asked to write a biography of her. De la Rive had heard about Marcet's influence on Faraday's and asked to him to confirm the story. This is what Faraday replied:
"Your subject interested me deeply every way, for Mrs. Marcet was a good friend to me, as she must have been to many of the human race. I entered the shop of a bookseller and bookbinder at the age of 13, in the year 1804, remained there eight years, and during the chief part of the time bound books. Now it was in those books, in the hours after work, that I found the beginning of my philosophy. There were two that especially helped me, the "Encyclopædia Britannica," from which I gained my first notions of electricity, and Mrs. Marcet's "Conversations on Chemistry," which gave me my foundation in that science. Do not suppose that I was a very deep thinker, or was marked as a precocious person. I was a very lively, imaginative person, and could believe in the "Arabian Nights" as easily as in the "Encyclopædia;" but facts were important to me, and saved me. I could trust a fact, and always cross-examined an assertion. So when I questioned Mrs. Marcet's book by such little

experiments as I could find means to perform, and found it true to the facts as I could understand them, I felt that I had got hold of an anchor in chemical knowledge, and clung fast to it. Thence my deep veneration for Mrs. Marcet: first, as one who had conferred great personal good and pleasure on me, and then as one able to convey the truth and principle of those boundless fields of knowledge which concern natural things, to the young, untaught, and inquiring mind.
You may imagine my delight when I came to know Mrs. Marcet personally; how often I cast my thoughts backwards, delighting to connect the past and the present; how often, when sending a paper to her as a thank-offering, I thought of my first instructress, and such like thoughts will remain with me."
https://skullsinthestars.com/2014/10/14/jane-marcet-educates-michael-faraday/

Mrs Marcet's legacy

Jane Marcet did not teach formally or open a school, unlike Maria Edgeworth or Richard Dawes, but her writings had an enormous impact on the public understanding of science and on science education. She wrote in the age when science was not yet part of the formal school curriculum at any level, despite the pioneer activities of people like Maria Edgeworth (PoSE #1) and Richard Dawes (PoSE #2). Science was only just starting to penetrate the secondary schools (public and grammar schools) and the elementary schools when she died. Many people, especially women, received their science education through her books. Her main impact was in making science a respectable subject for girls and women to study, before it became part of the school curriculum and before education for girls was widely available. She also advocated teaching chemistry to beginners using simple laboratory experiments and she integrated experiments into her books. This approach to teaching chemistry was very influential in America where her books were used as textbooks, especially in girls' schools. Lindee (2001, p. 23) comments on her influence:
"Despite competition from dozens of other texts, Jane Marcet's Conversations on Chemistry dominated elementary chemical instruction in these academies. Administrators could have chosen texts that emphasized useful applications or spiritual lessons. They chose instead a presentation novel for both its attention to chemical theory and its advocacy of hands-on laboratory instruction for beginners. It was not simply a matter of teaching the principles of baking or soap making. Academy chemistry, at least in those schools that used Marcet's text, was serious chemistry for beginners: an up-to-date review of European chemical theory, illustrated by experiment, requiring an understanding of chemical terminology and facility in the manipulation of laboratory equipment and chemicals."

As noted above, Alexander and Jane Marcet worked closely together until his early death, although only Alexander had formal chemical training. (Rosenfeld, 2001; Dreifuss and Sigrist, 2012).
"More decisive than either partner's single contribution, the complementarity between his chemical knowledge and her popular-science writing, energized within a supportive scientific and literary circle of friends, culminated in the making of a bestseller." (Dreifuss and Sigrist, 2012, p.27)
Although Alexander was an FRS and a respected scientist in his own right, his achievements have been eclipsed by the fame of his wife Jane. The pen is indeed mightier than the pipette!

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