Science and Faith In the Life of Michael Faraday

Colin Russell

Summary

Michael Faraday (1791-1867) is one of the best known of all British scientists whose discoveries have transformed our world and who pioneered the public understanding of science in his Royal Institution lectures. He was also a person of deep religious faith, whose science was practised within a Christian world-view that shaped his attitudes and practices, a world-view which in some cases impinged more directly upon his scientific theories. This paper suggests that a 'convergent' rather than 'divergent' model best describes science and faith in the life of Michael Faraday.

Introduction

Michael Faraday (1791-1867) was a founder of electromagnetism, architect of classical field theory, discoverer of two laws of electrolysis and of numerous chemical compounds, such as benzene and fully chlorinated hydrocarbons. In all he published nearly 400 scientific publications. He has been much studied, and by 1971 had been the subject of more biographies than most scientists attract.[1] His theology has recently been carefully examined, especially by G. Cantor,[2] though an earlier article by R. E. D. Clark appeared in 1967.[3] This paper will focus on the interactions between Faraday's theology and his science.

The roots of Faraday's beliefs

When, in later years, Michael Faraday was asked about his religion he replied 'I am of a very small and despised sect of Christians known, if known at all, as Sandemanians, and our hope is founded on the faith that is in Christ.'[4] This was the faith of his parents that had flourished in a remote corner of Cumbria, and it was to have profound effects in every department of his life. Founded in Scotland by a Presbyterian minister John Glas in 1724, it was a search for the primitive Christianity disclosed in the New Testament and was promoted by the weighty theological writings of Glas's son-in-law Robert Sandeman.

As with many at that time the Faraday family had a long tradition of religious 'dissent' (i.e. not conforming to the Church of England). In the early eighteenth century a Robert Faraday managed a small estate in NW Yorkshire and in due course joined the Sandemanian Chapel at Wenning Bank, Clapham, Yorkshire. It was in the simple devotions of their church, with its appeal to biblical authority and its high ethical demands, that the children of Robert Faraday were reared. Clearly evangelical, their faith was also strongly Calvinist, while the customs of the church were taken seriously.

Robert's son, James, became a blacksmith in Mallerstang, on the old drovers' road from Scotland to London. Then, in 1791 James and his wife Margaret moved to London. Shortly afterwards, in the September of that year, their third child was born. He was named Michael, after Margaret's father.

We pass over Faraday's early years of penury, limited schooling, apprenticeship with a bookbinder and attempts at self-education, picking up the narrative when Faraday was in residence at London's Royal Institution. He had owed his introduction there to the chemist Humphry Davy, whose lectures he had attended and in 1813 Faraday was hired as Sir Humphry Davy's assistant at the Royal Institution, where he spent the next fifty-four years, becoming director of his own laboratory in 1825. From 1816 Faraday also lived there, high up in the building and free from unwelcome intrusions, continuing his childhood habit of attending the Sandemanian chapel in Paul's Alley, in the City of London. Week by week he would listen to the reading and exposition of Scripture and add his own melodious contribution to the singing of hymns.

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1. Three recent volumes are Agassi, J. *Faraday as a Natural Philosopher*, Chicago and London: University of Chicago Press (1971), p.1x.; Williams, L.P. *Michael Faraday*, London: Chapman & Hall (1965); Thomas, J.M. *Michael Faraday and the Royal Institution*, Bristol: Hilger (1991). There have been several attempts to publish Faraday's letters, the latest (and most successful) being by James, F. *The Correspondence of Michael Faraday*, London: Institution of Electrical Engineers (from 1991).
2. Cantor, G. *Michael Faraday: Sandemanian and scientist. A study of science and religion in the nineteenth century*, Basingstoke: Macmillan (1991).
3. Clark, R.E.D. *Hibbert Journal* (1967), 144-147.
4. Bence Jones, H. *The life and letters of Faraday*, London: Longmans (1870), vol. ii, pp.195-196.

Gradually, perhaps imperceptibly, he adopted their values as his own and identified in a deeper way with their community.

The private world of Faraday's home merged inextricably with that of his church. Among the young members of the Sandemanian congregation was Sarah Barnard, daughter of Edward Barnard, elder of the chapel and member of an old Sandemanian family. Realising that he was in love with her, Faraday pursued her with an energy usually reserved for scientific enquiries. He was entirely successful and, on 12 June 1821, they married at the Anglican church of St Faith's in the City of London, where their marriage was registered though there was no religious service.

Within days of the wedding Faraday sought membership of the Sandemanian church, which his wife had joined two years previously. Their marriage may possibly have precipitated his action, though when Sarah asked him why they had not talked about his joining he gave the memorable reply 'That is between me and my God.' Joining the church was, in one sense, the natural conclusion of a process that had begun in childhood, and it meant a very great deal to Faraday. Having been deemed 'to understand and believe the TRUTH, and express a readiness to do whatever Christ has commanded' he received the laying-on of hands, a holy kiss and a hearty welcome into that small fellowship of believers in London.

At home in his private sanctum in the Royal Institution Faraday could relax in perfect contentment and welcome the extended family of the Sandemanian faith. Most Sundays were spent at their church, where the communion service was sandwiched between two other services for teaching and prayer, each often lasting three hours. After such a spiritual marathon there would be time for family reunions, and a further gathering would take place on Wednesday evenings. During the week Michael Faraday would visit other Sandemanians, especially those in need. This became more of a duty after his admission as deacon (1832) and elder (1840), and he gradually became involved in preaching in Sandemanian meetings in London and much further afield. The physicist John Tyndall, no friend of institutional religion but a sympathetic contemporary biographer of Faraday, attributed Faraday's week-day strength to 'his Sunday exercises', adding that 'he drinks from a fount on Sunday which refreshes his soul for the week'.

We must now enquire how this faith reacted with Faraday's science. Two possible models emerge.

A divergent model

This is a conventional view, that between science and faith a great gulf is fixed. They are two different worlds, divergent entities.

In Faraday's own words

> There is no philosophy [science] in my religion . . . Though the natural works of God can never by any possibility come in contradiction with the higher things that belong to our future existence, and must with everything concerning Him ever glorify Him, still I do not think it at all necessary to tie the study of natural science and religion together, and in my intercourse with fellow-creatures, that which is religious, and that which is philosophical, have ever been two distinct things.

Sir John Meurig Thomas writes:

> Serene in the security of his religious conviction, he was untroubled by the apparent conflict between science and religious beliefs. He could excoriate the spiritualists for their naivety of the faith while at the same time accept, as did his fellow Sandemanians, the literal truth of the Bible. Resolute in his pursuit of excellence as a lecturer and dedicated to the attainment of the highest standards of the Royal Institution at Albemarle St, he accepted with equanimity the primitive theological pronouncements of his fellow worshippers in the Paul's Alley Meeting House off Aldersgate St.[5]

In other words scientific practice is kept separate from religious convictions. The picture is that of *separation*.

Geoffrey Cantor has expressed it in a different way. As Faraday descends from the private world of his home to the public world of his lectures 'a mask slips over his face'. For here he is not 'at home' and has to encounter values alien to those of the Sandemanianism that ruled supreme in his private rooms. In so far as many people have a distinction between their private and public lives this is not particularly remarkable. Nor is it surprising that a lecture in the artificial – even stifling – world of the Royal Institution Theatre should be something of a performance, where a 'mask' is necessary and expected.

However there is another element in Cantor's analysis, and that is one of *selectivity*. He goes on to argue that 'in the public domain at the Royal Institution Faraday *avoided* those aspects of the mundane world which were inimical to Sandemanianism'. It is certainly the case that what might be construed as matters of contention like the age of the earth, the universality of the Flood, and the continuity of species are studiously avoided by Faraday. Yet these were all so remote from his immediate projects that they could never have been serious candidates for debate.

So, in separation or in selectivity, Faraday's religion can be seen as divergent from his science. But why should this be? The answer seems to lie in two contemporary movements against which Michael Faraday reacted.

Romantic idealism

This was a movement that owed much to German *Naturphilosophie*. Its stress on 'unity' was reflected in work by the Romantic poets such as Wordsworth and Coleridge, and there is evidence that the Romantic emphasis on the connectedness of the whole of creation was useful to Faraday in the development of some of his scientific ideas (see below). But where unity was applied to God and man, or to God and the universe, Faraday's Sandemanian faith rose up in disbelief. Moreover the Romantic emphasis on intuition as a route to truth, in religion or in science, was totally incompatible with his understanding of revelation through the Bible or through experiment. So the idea of unity and connection between science and religion was anathema to Michael Faraday.

Natural theology

This was a specially British phenomenon, as popularised in the writings of Paley and in the Bridgewater Treatises, summarised in the pithy phrase: 'from Nature up to nature's God'. Yet amongst evangelicals it often back-fired, for it seemed to place reason above revelation, nature above Scripture. So when Faraday famously announced 'there is no "philosophy" in my religion' he was denying that scientific knowledge ('philosophy') could illumine religion or lead men to God.

Yet when all this is recognised, problems remain. Strong evidence suggests that Faraday cannot have meant that there was no connection at all between scientific and religious truth. As his biographer Pearce Williams put it, 'his deepest intuitions about the physical world sprang from this religious faith in the Divine origin of nature'.We can now go even further than that and see how that same faith gave meaning, purpose and shape to his whole life, scientific and otherwise. Even his agnostic friend John Tyndall recognised that 'his religious feeling and his philosophy could not be kept apart'[6]. An alternative model seems better to fit the facts.

A convergent model

Here science and the Sandemanian faith are seen to interact in a variety of ways.

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5. Thomas, J. M. *op. cit.*, (1), pp. 116-117.
6. Tyndall, J. *Faraday as a discoverer*, London: Longmans (1868), p.178.

(a) Vocation to science

As a young apprentice Faraday was deeply dissatisfied. The acquisition of book-binding skills, though worthy in itself, was never going to fulfil a need of which he was rapidly becoming aware. Working in an environment with books all around him he began to long for knowledge, for an encounter with truth about nature, just as his Sandemanian faith assured him of access to truth about God. Though he did not put it quite like that, it was as though Sandemanianism and science could be twin partners in an enterprise that had been recommended long ago by Francis Bacon who wrote of the two 'books' of Scripture and nature. Many years later Faraday himself spoke of 'the book of nature' that was 'written by the finger of God'.[7] There is a striking isomorphism between Faraday's science and his faith that only a convergent model can accommodate.

One aspect of Faraday's vocation to science was his exercise of superb experimental skills.[8] Tyndall remarked that he was 'the greatest experimental philosopher that the world has ever seen'. These skills may have derived from the manipulative abilities of his blacksmith father, skills to which Faraday was keen to pay tribute. In a more general sense, Sandemanianism encouraged the manual arts, perseverance *and* a spirit of intellectual enquiry.

(b) Concepts of science

It is always notoriously difficult to prove a connection between metaphysical beliefs and the cognitive parts of science. Yet there are two examples from the science of Michael Faraday where such links are highly probable.

Field theories

For many years Faraday had been pursuing his inquiries into current electricity and into magnetism. He had been dogged by questions as to how the influences, electric or magnetic, were actually transmitted. There were two fairly common kinds of explanation that he rejected. One was that of material atoms like those proposed by the chemist John Dalton. The other was the old doctrine of action-at-a-distance: bodies are attracted to one another without any intermediate bodies to pass on the effects down a chain, as it were. Eventually Faraday came to his theory of 'fields', which were some kind of mechanical agencies to transport energy across a distance.

Possibly he was also indebted to some similar ideas proposed by the eighteenth century Italian mathematician R. J. Boscovich. But in addition to that 'secular' input there may have one from theology also. Some years ago a document was discovered in the Library of the Institution of Electrical Engineers, a private memorandum by Faraday, never intended for publication, written in order to clarify his ideas on atoms and fields. Unlike his published papers it contains several references to God, one of which wondered whether God could not as easily put 'power' round *point centres* as he could about material *nuclei*. His theology of an all-powerful God led him to the idea of point centres and thus of fields around them. Professor Trevor Levere of Toronto, who discovered this document, remarked that these new ideas 'fitted in with the world picture imposed by his religion'[9]. Thereafter, as another commentator put it, 'Faraday was, quite literally, at play in the fields of the Lord.'[10]

Paramagnetism of gases

Faraday also addressed the theory that *all* substances not actually paramagnetic (i.e. not readily aligning themselves when placed within a magnetic field) should show diamagnetic behaviour instead (i.e. the tendency to lie at right angles to the magnetic axis). So what applied to solids and liquids should also apply to gases. Early results were disappointing but Faraday seems to have been stimulated by a discovery by the Italian scientist Michele Bancalari in 1847 of diamagnetism in flames (which are, after all, burning gases). After repeating much of Bancalari's findings, he showed that many common gases were diamagnetic, but that oxygen was considerably paramagnetic. This surprise result was used to formulate a theory of the earth's magnetism that used the fact of oxygen's paramagnetism. Though mistaken, this theory seemed to confirm once again the great inter-connectedness of the whole universe scanned by science. Partly this may have been a Romantic legacy, but Pearce Williams was probably right when he wrote: 'His strongly held belief in the unity of the forces of matter . . . revealed his faith in the harmony of creation brought about by the beneficence of the Creator' who made the whole universe to work together in harmony.[11]

(c) Communication of science

Faraday was one of the great science communicators of all time, in the early days taking lessons in elocution. By avoiding conventional mannerisms of rhetoric or convoluted logic he was in fact reproducing the style of the best preachers in his Sandemanian church (who showed none of the flourishes of even the greatest preachers like Wesley). He wrote full notes and prepared in great detail. Those scientists today who regret their own inability to communicate effectively would do well to take note of the technique of Michael Faraday. Above all they should read his *Chemical history of a candle* (1860-1).

Let just one regular member of his audience speak for all:

> No attentive listener ever came away from one of Faraday's lectures without having the limits of his spiritual vision enlarged, and without feeling that his imagination has been stimulated to something beyond the expression of physical facts.

(d) Application of science

Chemistry

In the early nineteenth century chemistry was seen as a great benefactor of mankind, and Faraday was to find that highly congenial to his Sandemanian faith. He spoke of the 'gifts of God' bestowed for human benefit, of nature operating 'for our good' and of the application of scientific laws to add to human welfare. The greatest English chemist of his day, he undertook many small-scale analyses for industry, and was much in demand for his chemical services outside the Royal Institution.

Trinity House

In 1836 Faraday was appointed scientific adviser to Trinity House (the authority that managed Britain's lighthouses). He was consulted on ventilation; electric lights; heating oils, etc. His energy was inexhaustible. Even in 1860, when he was sixty-nine years old he reported:

> On Friday I again went to Dover. . . hoping to find the roads clear of snow; they were still blocked up towards the lighthouse, but by climbing over hedges, walls and fields, I succeeded in getting there and making the necessary enquiries and observations.

Science had to be applied for the benefit of society, in this case upon the high seas. He was acutely aware of human frailty as well as of the grandeur of nature, both strong emphases in the book of

7. Cantor, G. *op. cit.*, (6), p.200.
8. One remarkable case was his isolation of benzene by distillation of whale oil. Recent work has established that the mixture contains over 300 chemical compounds, many of which Faraday was able to separate: Kaiser, R. *Angew. Chem.Int. Edn.* (1968), **7,** 345.
9. Levere, T.H. *British Journal for the History of Science* (1968) 4, 95-107.
10. Berman, M. *Social change and scientific organization*, London: Heinemann (1978), p.162.
11. Williams L.P. *op. cit.*, (1), p. 396.

Job which in his Bible is the most heavily marked book in the Old Testament.

(e) Lifestyle in science

In his personal relationships within science Faraday showed what his opponents might have caricatured as pietism but what was, in reality, a simple manifestation of his Sandemanian faith. Though he could be angry he was never vindictive and, though scurrilously treated by Davy during the early stage of his career when he worked as Davy's assistant, would never hear criticism of his former mentor but would turn on his heel and walk away. And the earthly honours that a brilliant scientist might have expected were spurned, including Presidency of the Royal Society and even a knighthood.

The question has been raised as to how far someone as 'unworldly' as Faraday could have been happy to receive a quite generous income for the time (up to £1000 per annum). As a Sandemanian, however, he was committed to a biblical view of wealth which included injunctions like 'Ye cannot serve God and mammon [worldly values]' (Matt. 6:24) and 'Seek ye first the kingdom of God' (Matt. 6:33). Interesting evidence relevant to Faraday's inner faith comes from his Bibles (the old Authorised Version, of course) which have been examined by H. T. Pratt.[12] They are well marked and the markings suggest certain values that Faraday held very dearly. Thus there are conspicuous vertical lines pencilled against the long passage containing this last verse, and many others including:

> The love of money is the root of all evil (I Tim. 6:10);
>
> and
>
> Lay not up for yourselves treasures upon earth, where moth and rust doth corrupt, and where thieves break through and steal: but lay up for yourselves treasures in heaven, where neither moth nor rust doth corrupt, and where thieves do not break through nor steal (Matt.6:19-20).

The physicist John Tyndall, a colleague at the Royal Institution, asserted that by the 1830s Faraday's external income rapidly dwindled to nothing and we know that in later years his salary of an extra £200 for services to Trinity House was often not taken. It has been said that he could have earned £5000 p.a. after 1832 had he so wished.[13] And Faraday never patented any of his inventions. All this adds up to a consistent picture of a man who sat lightly with regard to worldly wealth. There is much in the Faraday manuscripts that confirms this view. It is not surprising that another verse prominently marked in his Bible was Galatians 6:9: 'And let us not be weary in well doing: for in due season we shall reap, if we faint not.'

The Final Years

By the 1860s it was clear that Faraday, now into his seventies, would have to face retirement with all the losses that inevitably meant. In 1864 he resigned from his eldership at the Sandemanian church and in 1865 stepped down from the position of Superintendent of the House at the Royal Institution and severed his long connection with Trinity House. For the remaining two years of his life he was largely confined to his chair at home, and those who came to see him were impressed as much by his serenity as his withdrawal from the world of science he had served so long.

One short letter he wrote in 1861 to de la Rive discloses something of the inner strength he drew from his Christian faith as the world he had known so long was beginning to collapse all around him.

> Such peace is alone in the gift of God, and as it is He who gives it why should we be afraid? His unspeakable gift in His beloved Son is the ground of no doubtful hope.[14]

As the end approached visitors and carers alike testified to his quiet confidence. In his times of lucidity he spoke of his comfort in Christ, and dwelt on such passages as the 23rd and 46th Psalms. Then, on 25 August 1867, while sitting quietly in his study chair, he died.

Four days later his funeral took place at Highgate cemetery in north London. Only close family and a few personal friends were present. There was, at his request, no ceremony or pomp. As was Sandemanian custom his body was laid to rest in soil not 'consecrated' by ecclesiastical ceremony, without a religious service (for none was enjoined in Scripture), and in perfect silence. At the head of the grave a simple stone carries the words:

> MICHAEL FARADAY
>
> Born 21 September 1791
> Died 25 August 1867

The epitaph from his agnostic friend Tyndall was: 'Just and faithful knight of God'.

Michael Faraday was in a class of his own where science was concerned – a giant among pygmies. In his synthesis of science and Christianity, in his strong confidence in the authority of Scripture, and in his simple faith in Christ, Faraday was typical of a great many gifted scientists, both before and since. For them, and for him, the task of scientific exploration was not only exciting and satisfying. In a very real sense it was a Christian vocation.

12. Pratt, H.T. *Bulletin for the History of Chemistry* (1991) 11, 40-47; reprinted in *Science & Christian Belief* (1993) 5, 103-115.
13. Thompson, S.P. *Michael Faraday: his life and work*, London: Cassell (1901), p. 63.
14. Letter to A. de la Rive, 19 September 1861.

The Faraday Papers

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