Michael Faraday and the Royal Institution

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It is always inspiring to read about the life of a great scientist. This is all the more true when the person you are reading about is one of the founding fathers of modern science, Michael Faraday. Faraday's story is perhaps the most romantic story in the annals of science and it continues to inspire in countless ways. He rose from humble origins as an errand boy to become one of the greatest scientists of all time. Even though he was self-educated and knew practically no mathematics, he introduced one of the most fundamental concepts in modern mathematical physics, the concept of the *'field'*. Today, every schoolchild reads about the magnetic *field*, the electric *field*, or the gravitational *field*, and these concepts are woven very early on into the mathematical foundation of physics. Can you imagine that this was introduced by someone who knew no mathematics!

The book brings alive the story of Faraday's life, his work, and his contributions both to science and to the Royal Institution. It is filled with numerous photographs, drawings, cartoons and figures, all of which present a fascinating picture that offers something for the young student and the practising scientist alike. Reading the book shows you how science is actually done with a behind-the-scenes look at the hard work and long hours involved, and shows that the history of discovery in science is not always a straight and narrow road as finally presented in textbooks. Instead, it is filled with false trails, and hard work and perseverance are necessary to overcome these difficulties.

The book is conveniently divided into sections, each of which provides an insight into a different aspect of Faraday's life. After setting the historical context for his early life, there are separate chapters that cover his rise from an errand boy to becoming Sir Davy's assistant at the Royal Institution, his scientific contributions, his writings, his personal life, and finally his impact on both the Royal Institution and the popularization of science. This last aspect of his life, the fact that he was such a good presenter of the latest discoveries in science and technology to the lay person, is a thread that runs throughout the latter part of the book. He initiated the Christmas Lectures for Children and the Friday Evening Discourses at the Royal Institution for the express purpose of increasing public understanding of science. His remarkable insight and clarity of thought is evident in his writings and that is what made him so successful at presenting science in clear and simple terms. A typical example is his analysis of the

supposed forms of lightning, written in a letter to the Editor of the *Philosophical Magazine*. Not only does this letter elucidate a simple phenomenon and the misinterpretations that are possible, it also demonstrates the elegance of Faraday's writing and his genius in finding good science hidden in everyday phenomena.

The photographs of original apparatuses used by Faraday and some of his illustrations give us a feel for the state of the art during his time. It gives an idea of his genius that he was able to achieve so much with that kind of equipment. His tireless efforts at understanding and explaining a wide range of topics are covered throughout the book. As an example, consider the following anecdote. Sir George Porter was giving a lecture to school students on the chemical bond. In order to demonstrate standing wave patterns, similar to those formed by electrons in atoms, he decided to use the well-known Chladni plate, on which sand accumulates at the nodes when the plate is set into vibration. While doing the demonstration, he noticed something unusual. If he used talcum powder instead of sand, it behaved in an opposite manner and accumulated at the antinodes! He excitedly showed this to a colleague, who calmly said that a full account and explanation of the effect had been published more than a century ago, by none other than Faraday. Note the thoroughness of Faraday's study. In his paper in the *Philosophical Transactions of the Royal Society* (1831), he had described 129 experiments covering all aspects of these vibrating plates. And, in true Faraday style, he had done controlled experiments to *prove* that his explanation was correct. In other words, he hypothesized that the effect was caused by something, but to prove this conclusively he showed that if the cause was removed, the effect also disappeared. What a perfect example of the scientific method of inquiry. I have deliberately withheld the simple but clever explanation, but I hope I have whetted your appetite enough to want to find out more.

What I gained most from reading this book was an insight into the character of Faraday as a person. Often, biographies tend to humanize their subjects and show that great people are subject to the same human foibles as us lesser mortals, given to the same pettiness that seems to occupy most of our lives. But in the case of Faraday, reading about his personal life makes him appear even greater. We should be grateful that he lived at a time when the only mode of long-distance communication was through letters. He left behind a large collection, a sampling of which is presented in the book. What comes through is his tenderness and his rare insight into human nature. Faraday has indeed been acknowledged as one of the greatest thinkers of his time. Einstein repeatedly claimed to be inspired by his thinking on the theoretical basis of physics. And his wisdom is evident in the following statement:

"A philosopher should be a man willing to listen to every suggestion but determined to judge for

himself. He should not be biased by appearances, have no favourite hypothesis, be of no school and in doctrine have no master. He should not be a respecter of persons, but of things. Truth should be his primary object. If to these qualities be added industry, he may indeed hope to walk within the veil of the temple of nature."

Profound words for all of us to live by.

The book is a must-read for all lovers of science, from students to scientists. For students, it is the inspiring story of a great scientist with several easy-to-understand illustrations of great scientific experiments. For practising scientists, it has several useful tips on what it takes to do good science and what kind of effort goes into it. For teachers of science, his general comments on *the lecturer's art* are absolutely essential reading. If more of us could follow this lecturing technique, and particularly implement his use of demonstrations and experiments in a lecture, science would become the most popular subject in schools and colleges! But most importantly, the book teaches the importance of popularizing science to the wider public, and shows how a great practitioner was able to explain the latest developments in science to a wide audience. Indeed, this is also the primary motivation of the journal you are reading. The Christmas Lectures were particularly targeted at a young audience of schoolchildren. Today, 175 years after Faraday initiated them, inspiring young minds to have a scientific temper is ever more important. The words of H G Wells, spoken while giving a discourse at the Royal Institution and quoted in the book, could be said equally well today:

"... If we care to look, we can foresee growing knowledge, growing order, and presently a deliberate improvement of the blood and character of the race. And what we can see and imagine gives us a measure and gives us faith for what surpasses the imagination. It is possible to believe that all the past is but the beginning of a beginning, and that all that is and has been is but the twilight of the dawn. It is possible to believe that all that the human mind has ever accomplished is but the dream before the awakening."

Awaken into this new world, my dear young readers!

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"Keep me away from the wisdom which does not cry, the philosophy which does not laugh, and the greatness which does not bow before children"

Kahlil Gibran
Poet (1883-1931)