

# FARADAY:CHEMIST, PHYSICIST, NATURAL PHILOSOPHER

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*This report of the famous scientist Michael Faraday is composed principally of the transcriptions of two interviews with Faraday, hitherto unpublished. The contents of the interviews indicate they were both with Faraday while he was the Director of the Laboratory at the Royal Institute, in London.*

*Unfortunately, neither interview has any additional documentation attached. Both interviews were found loose leaf with no coversheet or introductory notes. Perhaps they are fragments of a greater work, still to be uncovered. Faraday, an individual well liked by the populace for the Cinderella quality to his life story; the greatest experimental physicist of his time; often not seriously accepted as a thinker or theorist by the scientific community of his day; is more wrote of than even Newton or Einstein. Hopefully these interviews will provide yet another view. The author has included both interviews as found, back to back, so the readers may more completely form, for themselves, the image and character of Michael Faraday - Chemist, Physicist, Natural Philosopher.*

## Interview 1: The Dialogue

Interviews by a certain Mr. H. Marryat, a journalist for The Times, London, were recently found among the papers of the late Professor Miles Pickering. After Professor's Pickering's untimely death in 1991, his personal notebooks and papers were given to a colleague, also a 1992 member of the WWNFF. Among Pickering's papers were a rather complete and intact set of interviews

of Faraday which apparently were given to Professor MacLean, the first chemistry Professor at The College of New Jersey, the present day Princeton. Mr. Marryat apparently came to Princeton to start a newspaper and did not publish his interviews in The Times before he departed. Arriving in America he may well have sought the advice of one of the few chemists in the area. These interviews of Faraday were handed down from MacLean until the papers apparently ended up in Pickering's hands. Pickering was well known for his expertise in chemical education. This fact may well account for the rather strange circumstance of the presence of these valuable papers in Princeton. It is quite evident, that the structure and phrasing of Faraday's replies are in the hand of the journalist, and yet the journalist has captured the modest and non-assuming personality of Faraday which is so evident in his letters. The following are selected excerpts of the interview following his famous Christmas Lectures for a Juvenile Auditory and several Friday night discourses.

**HM:** Sir, May I ask you some questions?

**MF:** Well, I need to clean up the table. You do know that is how I started here at the Institute. Come along; you can help me.

**HM:** Then please tell me how you started here. It is said by some that you are Sir Humphry's greatest discovery.

**MF:** It is true I am in Davy's debt. I was an apprentice to Mr. Riebau and did not enjoy the business. I did enjoy reading the books that were set out for me to bind, but the business on the whole is completely, in my opinion, selfish and vicious. However, by a rare chance, passes to Davy's lectures came into the hands of Mr. Riebau and he in turn presented them to me. I must confess, on many occasions I did perform experiments on the mantle at the bindery. For this I am equally in debt to Mr. Riebau.

**HM:** Sir, I am told you come from a poor family. You have nine brothers and sisters. How is it that you came to desire an education?

**MF:** As you probably know, I was born in Newington Butts. My father was a blacksmith, and there is much chemistry in smithing; I would dare say

a great deal of science. My father did not know the natural reasons for many of his habits. Also near my house, were the Butts, and I always was interested in the methods of archery. The bowman did not tell me much about their craft. They seemed to have a rather common understanding of the principles but, it did seem to me, even as a child there was something beyond folklore and superstition, that could account for the consistent accuracy of certain bowman. This fascination with nature has compelled me to read and to observe. Indeed, the purpose of my lectures, simple and plain as they are, is to show my audience how wonderful it is to observe. Indeed, the best members of my audience are children. They just watch, and very little escapes their awareness. I hope in the future to present Christmas lectures for the juvenile audience. Maybe you could come to observe their wonderful uninhibited behavior.

**HM:** That is very interesting. I dare say many young man of modest means are observant and curious. Is there something else that can account for your tremendous successes?

Faraday, paused for a long time, I was in fear that I had provoked him and he might end the interview. He sensed my uneasiness and assure me that I had asked a very difficult question.

**MF:** Well, I do not feel that I possess anything extraordinary. If I do have the pleasure of a special talent it must certainly be perseverance. If I do say so, the present obligation to work on optical glass is one that requires great perseverance on my part. Maybe in the future I can use some of the results of this experimentation in my own studies. Working with Young and Herschel is most challenging and enlightening, but it is not the work that I would choose to do. I have had an early interest in electricity. Seven years ago, I believe, I came in contact with Orsted's little manuscript concerning the deviation of a compass needle by electric current. I have many ideas about electricity and I have several lectures planned for special occasions, limited just to electromagnetic science. Now you must help me remove some of the apparatus to my basement laboratory, the old frog room. Be careful with the residues, as you saw tonight, they have a caustic effect and a great affinity for body tissues.....

The following interview may be after the last of the "electricity" Juvenile lectures given in December, 1829 and January 1830.

**HM:** Hello Sir! May I help you and continue our conversation from last week?

**MF:** Yes of course; it seems that I have been looking forward to spending some time with you. The lectures are really quite enjoyable. It seems the children are most interested and unassuming. They do not know anything about the science and therefore have very open minds. They seem to grasp the purpose more quickly than many learned adults.

**HM:** May I say, you seem very excited about electromagnetic science. It seems to be well known that you suffered greatly over the "rotation." How is it that you still take such enjoyment from electromagnetic science?

**MF:** I would prefer not to spend time on that subject. It not only grieved me, but many accounts of the affair did an injustice to Sir Humphry and to our colleague Wollaston. To be sure, that affair took place a decade ago and many, many new ideas have been realized concerning the magnetic induction and the rotation. I feel I have made some advances recently and I hope to have a way to capture, or convert the magnetism to electricity. I have many other urgent projects I must finish, but the electricity is a joy to demonstrate. Would you not agree, the children enjoyed the demonstrations tonight?

**HM:** Certainly! Without question!. Yes, I will not again digress to the last decade. You seemed concerned tonight that the audience would not understand the "action at a distance" as you put it. I must admit, both the magnetic effects and the effects of electricity do appear to have actions without contact. Am I not correct that Coulomb and Cavendish have proposed a law which provides a mathematical relationship for this action at a distance?

**MF:** Yes, yes! It is true, but I still do not care for this concept of action at a distance. It is also apparent that the space between the object, such as a magnet, and the iron filings does not play a role in the forces operating there. This appears to have been shown conclusively, but I still do not care for the idea.

This interview would seem to be after one of the Friday night Discourses, either on March 7 or April 11. The questions and answers relate to electrochemistry.

**HM:** Good evening Sir. Can I assist you in returning the crucibles to the frog room. I am very aware they are still quite warm.

**MF:** Yes. Yes, by all means. Good to see you again. You have not missed many of the recent Discourses. You should have quite an education by now. I do hope you have taken my advice and used the tickets to the other lectures. While I do not subscribe to some of their theories, it is advisable to know what they are advancing. I take my greatest joy in presenting the ideas of chemical decomposition by electricity to the audiences. To be sure, the results of the amounts of decomposition and electricity passed through is quite easy to measure and very repeatable. I have always enjoy working with electricity and magnets. Recently I have tried again to show that a magnet can alter light. This experiment has been a source of both joy and frustration. I am not entirely sure if my negative results are the result of experimental error. I think I am right about this and the deviation is less than the instruments can produce.

The next interview appears to be after another set of Christmas Lectures, possibly his fifth set in 1837 / 8.

**HM:** Sir! Several years ago we talked just as now about "action at a distance" and the role the "space" between objects plays in the transmission of charge or lack thereof in the effect of "insulators," to paraphrase your words. In several recent discourses you seem to have trouble with your contemporaries' ideas about the "medium."

**MF:** Yes, you are referring to my recent paper, On Induction. Yes, again I am still trying to reconcile the differences between my understanding and my colleagues'. Recently I have performed several experiments to show that the division of charge, when two spheres are brought together, is not equal when a substance is placed in the air gap. I feel very strongly this experiment has a very profound effect on this idea. You must understand, I have listened to, read and reread all of Dalton. He is a very careful experimenter and his arguments seem to be consistent. However, atoms and combined groups of atoms are not consistent with my results. My work can stand alone without Dalton's. My experiments do not show that a relationship exists between the type of crystal and the insulating ability. These last several years have been very difficult, as you see now I have a very severe headache.

Here! Make yourself useful, take these condensers down to the frog room..... I do not remember, did I tell you about a recent experiment that has shown a difference?..... The holiday I took two years ago allowed me to have more faith in my memory and it was certainly good for the family. There were times when I could not trust my day to day memory. And I still seem to have short periods of not clearly remembering events..... Ah, Yes put them over there.

## Interview 2: Faraday the Man

*The second interview, titled only "Faraday the Man" is quite different in style and scope from the first interview. It is an interview probably done in 1862-63, where Faraday obliges the interviewer by reflecting and reminiscing on his life. (Michael Faraday died August 25, 1867). Although these papers were found among the other Faraday papers, they are not necessarily the same interviewer. In the first interview series the interviewer chooses to be involved in a conversational dialogue with Faraday about his research and work at the Royal Institute.. The second interviewer, denoted only by his initials (N.P.M.), has chosen to let Faraday's reminiscences tell the story of the Man.*

**NPM:** Mr Faraday, we have discussed your research, lectures and work at the Royal Institute. Now , if it meets with your pleasure, I would like to turn to questions of a more intimate nature. It is not sufficient to say that Michael Faraday was born September 22, 1791 of Margaret Hastwell, a farmer's daughter, and James Faraday, a blacksmith of Yorkshire, England. With your permission I shall ask questions to acquaint the readers with Faraday the Man.

To begin, Describe please your childhood.

**MF:** First, to be accurate, I am not from the English Countryside. Shortly before I was born my parents and older brother, Robert, moved from the country to South London. I was actually born in Newington, Surrey. When I was five years of age, the family moved to Jacob's Well Mews, Charles Street, near Manchester Square in London. I remember the streets made a maze, filthy with foul garbage. Although my father was of the artisan class, we were very poor taking lodging in rooms over a coachhouse. For a time

my mother could give me little more than a loaf of bread a week. Still I have pleasant memories of family and playing juvenile games, particularly marbles with fellow boys of Manchester Square.

**NPM:** Excuse the comment sir. The background you describe does not sound like that of your position<sup>2039</sup>the profession of gentleman scholar of science.

**MF:** First to your comment sir, no pardon is required; for it is true. I am not, as are most men of science, of gentleman class or independent wealth. True, M. de la Roche, for whom I was a journeymen bookbinder, offered me his shop and goods, not having a child of his own; but, that was not my path. It is with humility that I may claim the profession of natural philosopher.

**NPM:** What then of your formal eduction as scientist or excuse me as you prefer, Natural Philosopher?

**MF:** Thank you. I do consider myself a philosopher of natural phenomena. But to your question: many would say I am selftaught, being without benefit of formal schooling. As a boy I was schooled in the rudiments of reading, writing, and mathematics. Being too small to follow in my father's trade, my parents obtained for me at age 13 an apprenticeship with Mr. Riebau as a bookbinder. In that capacity I made the acquaintance of M. Masquerier, a french painter lodging with Mr. George Riebau. He loaned me books to read and taught me sketching. Also, I would read the books left in my care for binding. Fortunately many books of a scientific nature came to me. I remember that when first I evidenced a predilection for the sciences and, more particularly, for that one denominated electricity, Mr. Riebau kindly interested himself in the progress I made in the knowledge of facts relating to the different theories in existence, readily permitting me to examine those books in his possession that were in any way related to the subjects then occupying my attention. (Williams, p.10)

From these I compiled interesting extracts and sketches into notebooks for the purpose of study. Here is the title page of my first such notebook:

## THE PHILOSOPHICAL

## MISCELLANY

being

A collection of Notices, Occurrences, Events, relating to the Arts Sciences; collected from the Public Papers, Reviews, Magazines and other miscellaneous works. Intended to promote both Amusement sand Instruction and also to corroborate or invalidate those theories which are continually starting into the world of science.(Randell, p.26)

My progress in the sciences was little and I was anxious to know more. October 8, 1812, I became journeyman bookbinder to M. de la Roche. Soon I despaired, seeing no chance ever in my that position, of having the needed time to pursue my science. I was of very low spirits.

*"The desire to be engaged in scientific occupation, even though of the lowest kind, induced me to write 2039 in my ignorance of the world and simplicity of my mind to Sir Joseph Banks, then President of the Royal Society (begging for a position of the lowest level. ) Naturally enough, no answer was the answer left with the porter." (Life and Letters 1:54)*

At first I felt "I must resign philosophy entirely to those who are more fortunate in the possession of time and means, but fortune was on my side. Late in October, of the same year, Sir Humphry Davy injured his eye from the explosion of the chloride of nitrogen on which he was working and could not read or write. Because of my penmanship I was recommended to Sir Davy to serve as his amanuensis for a few days. That December, inspired by Dr. Watt's writings on self improvement and the unity of moral philosophy and the scientific method, I took "the bold and simple step" of sending a bound volume of Sir Humphrey's notes along with a letter expressing:



*"my desire to escape from trade, which I thought vicious and selfish, and to enter into the service of Science, which I imagined made its pursuers amiable and liberal, expressing my wishes, and hope that, he would favour my views. At the same time that he gratified my desires as to scientific employment, he still advised me to remain a bookbinder, telling me that Science was a harsh mistress, and in a pecuniary point of view but poorly rewarding those who devoted themselves to her service. He smiled at my notion of the superior moral feelings of the philosophic men, and said he would leave me to the experience of a few years to set me right on that matter." (Life and Letters 1:54)*

But fortune again smiled. That very night William Payne who served as 'fag and scrub' was involved in a brawl and dismissed from his duties at the Royal Institute. Sir Davy sent for me and asked if I was still eager to accept any position in science. I assured him so and began working at the Royal Institute, where I was at liberty in my own time to make use of the apparatus.

**NPM:** And so you began a second apprenticeship, this with Sir Humphry Davy at the Royal Institute. How would you describe your relationship with this brilliant scientist?

**MF:** It would be true to say I started at the very bottom, washing bottles, with the very best, Sir Humphry Davy; who made chemistry as much a British as a French science through his sheer brilliance. To apprentice in the pursuit of research without the benefit of schooling was unusual and unheard of with such an individual as Davy I am ever grateful to have had such an opportunity. I greatly enjoyed working in the laboratory of the Royal Institute, not even minding the onerous, menial tasks, such as washing bottles required in doing chemical analysis. But my first true adventure into scientific apprenticeship was anguished enough to give me cause for review of my chosen pursuit of science. The tour of the Continent (1813 to 1815) allowed me the opportunity to learn French and a bit of Italian. Also, I witnessed research into modern problems and had the opportunity to converse with the great philosophers Ampere in Paris and Gaspard de la Rive of Geneva. But

it also gave to me great feelings of disappointment. The moral philosophy I sought in scientific research was tarnished by viewing from the inside the social intrigue and lust for fame. Alas, being rendered in the position of not less than of a servant, I thought:

*"Alas! how foolish perhaps Was I to leave home, to leave those whom I loved, and who loved me - And what are the boasted advantages to be gained? Knowledge of the world, of men,. of manners, of books, and of languages2039things in themselves valuable above all praise, but which every day shows me prostituted to the basest purposes. Alas! how degrading it is to be learned when it places us on a level with rogues and scoundrels! How disgusting, when it serves but to show us the artifices and deceits of all around! Knowledge of the world opens the eyes to the deceit and corruption of mankind."*(Life and Letters, 1:170)

Upon returning to London in April, 1815 I resolved never to leave again but to strengthen my efforts to gain the discipline of the superior moral philosopher, that which was an ideal for some was a goal for me. I worked hard not fearing the explosive quality of the experiments or the exactitude required of the lab. Having both my lodgings above and the lab in the basement of the Royal Institute meant I could work at any small moment I might find, and I could work through the night at no inconvenience to other parties. I did not complain; for the more I did the more I learned. It is best to say that:

*"I could not imagine much progress by reading only, without experimental facts and trials which could be suggested by the reading . I was never able to make a fact my own without seeing it. However what we call accident has in my life had much to do with the matter, for I had to work and prepare for others before I had earned the privilege of working for myself, and I have no doubt that was my great instruction and introduction into physical science."*(Life and Letters, 2:440)

Oh! would you like to see my first scientific paper? It was first published in 1816, it was a great inspiration to me. In 1859 I reprinted it in my *Experimental Researches in Chemistry and Physics*. It is a modest work entitled, "analysis of Native Caustic Lime of Tuscany".

*"It was the beginning of my communications to the public and in its results very important to me. Sir Humphry Davy gave me the analysis to make as a first attempt in chemistry at a time when my fear was greater than my confidence, and both far greater than my knowledge; at a time also when I had no thought of ever writing an original paper on science. The addition of his own comments and the publication of the paper encouraged me to go on making, from time to time, other slight communications—their transference from the 'Quarterly' into other journals increased my boldness."* (Williams p.44)

For the next three years I produced papers from the work I did with Sir Humphry Davy on the invention of the safety lamp, and analyses of various substances entrusted to me, for the patrons of the Royal Institute. Sir Davy commented favorably on my skill as an analysts This recognition of my analytical skill encouraged me to feel the chemist. I became known for my terse, impersonal reports that put forth only the details, but when necessary I willingly included the personal with frankness in acknowledging mistakes. I remember one fateful occasion I was to do some analysis of phosphorus for Sir Davy, determinations to be used in his debate with Jans Berzelius, and I overlooked important information. Accepting of Dr. Watt's teachings on the importance of accurate determination of facts, I henceforth repeated time and time again, with meticulousness, my analysis until there could be no doubt of error. Never again would I want to hear the charge of factual inaccuracy.

**NPM:** Would you share your philosophy of science and its pursuit?

**MF:** Many would say I was Baconian in my views for I believe that facts are the great importance and therefore should be sought The less one theorizes the less one involves prejudices and controversies. and yet hypotheses

give explanation giving direction to discovery of new facts, and so on, thus supporting the superstructure of theories. There is an undercurrent of speculation connecting all. It is the theoretical problem that gives interest and that we venture to solve. Our prejudices are what we must, at all times take notice and strive to avoid their entanglements. The man who wishes to advance in understanding of nature should never fix such obstacles in his way.

I am more concerned that my ideas will be ignored than that they be examined, discussed, tested and found wanting of truth. For in such discussion and consideration of interpretation will come the speculation allowing the process to move forward in pursuit of nature's secrets.

**NPM:** As I see you are fatiguing, may I ask this final question. Mr. Faraday what legacy do you hope to leave to the future study of natural philosophy?

**MF:** My lectures, especially the Juvenile Lectures and Christmas Lectures from which I derived so much pleasure, are a legacy to the popularizing of science for future curious minds and those who shall guide them.

For myself, I would hope to be remembered with respect for the ideas I have put forth not just for my ability as analyst; but to be viewed properly as a theoretician of chemical and physical phenomena of matter.

My theory of electrolysis; my ideas on electromagnetism and fields of force I shall leave to others to ponder and refine. I give forth the bold idea of antimaterialism; breaking the unanimous hold of millennia on matter that says its consideration must be either material or spiritual; giving freedom to thought.

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## Bibliography

**Note:** Michael Faraday was an interesting individual as well as a great scientist. To learn more about his life and particularly his scientific work the reader is encouraged to investigate in depth any of the books listed below. Each while similar, gives a different view of the person, Michael Faraday.

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