

THE FRS NOMINATION OF SIR PRAFULLA C. RAY AND
THE CORRESPONDENCE OF N. R. DHAR

by

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Sir Prafulla Chandra Ray (1861–1944) was the first Indian chemist to achieve high international reputation. Originally trained at the University of Edinburgh, he worked for many years at Presidency College in Calcutta and then at Calcutta University. He built up a remarkable school of chemical research by attracting many outstanding students to work with him and published about 150 papers—many of them in leading British and German journals. Ray was highly respected by his British peers and was the first Indian of that era to be nominated for FRS, in 1913. At the time when his nomination was being considered by the Royal Society, Ray's favourite student, Nil Ratan Dhar (1892–1986), who was to become the second Indian chemist to achieve high international reputation, worked in London and Paris for a few years. Even when Dhar was merely a 24-year-old student, he lobbied with several leading British chemists for the election of Ray and kept Ray informed in a series of fascinating letters—giving us a rare glimpse of what election to the Royal Society meant for Indian scientists of that era. During this time, Ray received a knighthood for his contributions to chemistry, and *Nature* published a front-page article on Ray's 'life-work'. Many British chemists felt strongly that Ray should be elected FRS and were willing to discuss Ray's case with the young Dhar quite openly. But, rather mysteriously, Ray never got elected.

**Keywords: Royal Society; Fellowship election; chemical research in India;
P. C. Ray; N. R. Dhar**

INTRODUCTION

It was in the closing years of the nineteenth century that a few scientific papers written by ethnic Indians under British colonial rule started appearing in European scientific journals, and Fellowship of the Royal Society of London was one of the most coveted academic distinctions for the small number of Indian scientists who aspired to international recognition.¹ While a Nobel Prize may have been the ultimate goal, it was recognized

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that this accolade was for truly extraordinary achievements, and the limited number of awards (not more than three per subject per year) ensured that many discoveries would not be crowned with this prize—especially if the work was done in a colony such as India, far away from the active centres of science. On the other hand, an Indian whose work made a reasonably big impact in the world of science could expect to be elected FRS and a few Indian scientists of that era were indeed elected.

William Blaupied, in his study of ‘pioneer scientists’ in pre-independence India, identified six ‘tribal leaders’.² Of these six, five were elected FRS (H. J. Bhabha, J. C. Bose, S. N. Bose, C. V. Raman and M. N. Saha). The only tribal leader identified by Blaupied who was not elected FRS was P. C. Ray.

Prafulla Chandra Ray (1861–1944) was a prolific researcher who published a large number of scientific papers in reputable European chemistry journals, and he established a school of chemistry training numerous students.³ What is more, he was a multi-faceted personality in a colonial setup—historian of science, founder of a chemical industry, political activist—and there are many articles and biographies which deal with various aspects of his life.⁴ However, so far as we know, nothing has been written about his nomination for the Fellowship of the Royal Society. The present paper intends to fill that gap. As we shall see, Ray was highly regarded by his British peers and his non-election to FRS remains somewhat of a mystery.

Ray was nominated for FRS several times, the first nomination being in 1913. Although he was not elected, he was knighted during the time when his nomination was being considered. One of Ray’s favourite students, Nil Ratan Dhar (1892–1986), was in London during some of the years when Ray’s nominations were considered by the Royal Society. As a great admirer of Ray, Dhar unsuccessfully lobbied with several leading British chemists for Ray’s election to FRS and kept Ray informed in a series of fascinating letters written in Bengali. Unfortunately, Ray’s letters to Dhar are not available to us, so we do not know what Ray’s attitude was on this matter. But Dhar’s letters to Ray give us a rare glimpse of what the election to FRS meant for Indian scientists of that era who aspired to international recognition (figure 1).

A FEW FACTS ABOUT RAY

Ray has given an account of his life in his fascinating autobiography,⁵ which provides much of the information we give here. Since Ray’s life is well documented, we shall restrict ourselves only to stating some bare facts. We shall mainly comment on those aspects of Ray’s life and works which will be relevant for the subsequent discussions in the paper.

Ray was born on 2 August 1861 in the village of Raruli, which is now in Bangladesh. After completing his college education in Calcutta, he was selected for the highly competitive Gilchrist Scholarship, which enabled Indian students to study in Britain. Ray joined the University of Edinburgh in 1882, where he received training in chemical research under the guidance of Professor Alexander Crum Brown, eventually winning a DSc degree. He was even elected vice-president of the University Chemical Society, of which Crum Brown was the president, and established contacts with several leading British chemists.

After his return to India in 1888, Ray got a job at the Presidency College in Calcutta. The physicist J. C. Bose, who, around 1895, became the first man to produce microwaves in the laboratory and was a life-long friend of Ray, had taken up a job at Presidency College in



Figure 1. A photograph of P. C. Ray with N. R. Dhar, probably taken during a visit of Ray to Allahabad in the late 1920s. This is the only known photograph of Ray and Dhar together. (Courtesy of Professor Mahesh Chattopadhyay, Allahabad University.)

1885 after his education at Cambridge and London. At that time, the Education Service of India had two different grades. According to Patrick Geddes, the biographer of J. C. Bose:

[T]he Higher Education Service is accessible only by nomination; and these posts, with extraordinarily rare exceptions, had not been given to Indians, even of the highest European qualifications. In general, the Indian professors, though of the very same duties and responsibilities, formed the 'Provincial Service', with much lower pay.⁶

As is well known, Bose worked at Presidency College for three years without accepting his salary because he was not given the salary of the Higher Education Service. Eventually Bose was put on the Imperial, or the Higher Education Service, grade. However, Ray was not so lucky. In spite of his voluminous research output published in European journals, Ray always remained in the Provincial Service.⁷

Ray's scientific work will be described in the next section. What is worth mentioning here is that Ray was a rare professor who could easily mingle with students many years younger than him. As mentioned in Ray's autobiography, several students admitted to Presidency College towards the end of his tenure there turned out to be prominent scientists in later life. Apart from Nil Ratan Dhar, the other chemistry students in this group mentioned by Ray who later became important in Indian chemistry were Jnanendra Chandra Ghosh and Jnanendra Nath Mukherjee. Ray mentioned that this group also included Satyendra Nath Bose and Megh Nad Saha, who rose to fame in later life as physicists for their discoveries of the Bose–Einstein statistics and the Saha equation. Ray wrote that all these students were close to him and commented:

Although as yet scientists *in posse*, there was something indescribable in their character, which drew me to them. The bonds existing between them and me were as subtle as those

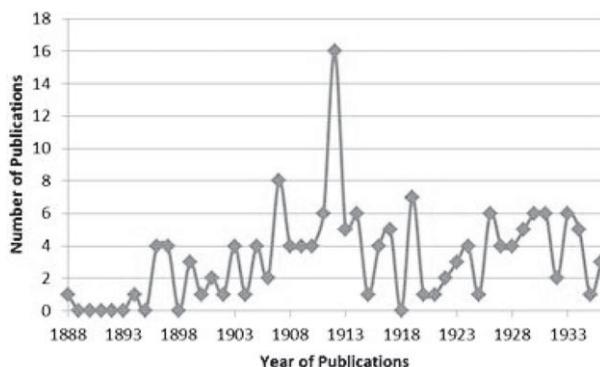


Figure 2. The number of papers by P. C. Ray published in different years.

of chemical affinity. I used to visit them often in their hostel rooms and they were my constant companions in my *maidan* walk in the evenings.⁸

After retiring from Presidency College in 1916, Ray joined the newly established chemistry department of Calcutta University as Palit Professor. Although he continued in that position till 1936, he stopped accepting his salary after 1921 when he turned 60.⁹ He asked the university to spend his salary on development of the chemistry department. A bachelor known for his ascetic lifestyle, he spent the last few years of his life in a laboratory room converted to a small apartment within the University College of Science at Calcutta University. This apartment now houses the P. C. Ray Museum. He passed away on 16 June 1944.

P. C. RAY'S SCIENTIFIC ACHIEVEMENTS AND RECEPTION BY THE SCIENTIFIC COMMUNITY

Figure 2 shows the number of papers published by Ray in different years. Altogether, he published more than 150 scientific papers.¹⁰ The *Journal of the Chemical Society* (London) appears to be Ray's favourite outlet for his research, in which he published about 65 papers. As a great admirer of German science, he also wrote several papers in German, of which more than 10 appeared in *Zeitschrift für anorganische Chemie*. About eight of Ray's papers appeared in *Nature*. As for publications in Indian journals, Ray published about a dozen papers in the *Journal of the Asiatic Society of Bengal* and, in later life, more than 35 papers in the *Journal of the Indian Chemical Society*. Ray himself was the driving force behind establishing the Indian Chemical Society in 1924 and initiated its journal as the Founder-President of the Society. Apart from regular scientific papers, Ray was the author of *A history of Hindu chemistry*, which was prominently mentioned in Ray's nomination for FRS.¹¹ While the mathematical and astronomical traditions of ancient India had been studied by a few Indologists, the tradition of experimental science in India received very little attention from scholars before Ray's time. Ray's vast two-volume opus was based on several manuscripts which he collected from different places in India.

For a detailed analysis of Ray's contributions to chemistry from a modern perspective, we refer to a couple of studies by professional chemists.¹² Animesh Chakravorty, a leading chemist of present-day India, provides a modern assessment of Ray's contributions to chemistry in the following words:

In those days, physical methods of study were few and little was known about the nature of chemical bonds. What was possible to do was to synthesize new and interesting families of compounds and to study their composition and certain physical properties. And in this, Prafulla Chandra's endeavours stood tall. True, his work did not have the dimension of the discovery of noble gases by Ramsay or of the coordination theory by Werner—events which took place at about the time Prafulla Chandra began his nitrite studies. But the nature of his mission was most difficult: to grow the first few blades where none was grown before.¹³

What is more important for our discussion of Ray's FRS nomination, however, is what contemporary chemists thought of his scientific contributions.

The synthesis of mercurous nitrite in 1895 was arguably Ray's most famous chemical work. Some of the chemists who would later nominate Ray for FRS realized the importance of this work immediately. Alexander Pedler stated in a lecture at the Asiatic Society of Bengal after this discovery: 'It was in December, 1895, that Dr. Ray rose to fame and became known to the scientific world by his celebrated discovery of mercurous nitrite. . . . Dr. P. C. Ray, by his discovery of the method of preparation of this compound, has filled up a blank in our knowledge of the mercury series.'¹⁴ Henry H. Armstrong said: 'The way in which you have gradually made yourself "master of nitrites" is very interesting and the fact that you have established that as a class they are far from being the unstable bodies, chemists had supposed, is an important addition to our knowledge.'¹⁵ International journals such as *Nature* and *The Chemist and Druggist* (London), also reported the discovery. For instance, the latter wrote: 'Dr. Ray's discovery has been well received in Chemical circles.'¹⁶

Ray's *History of Hindu chemistry*, of which a 15-page review by the eminent French chemist and historian of chemistry Berthelot appeared in *Journal des Savants*, was critically acclaimed in the British press as well.¹⁷ The Vice-Chancellor of the University of Durham, while conferring the honorary DSc degree on Ray in 1912, commented: 'A keen and successful investigator, he has long made his mark by contributions to scientific periodicals, both English and German, but his fame chiefly rests on his monumental *History of Hindu Chemistry* . . . of which, if of any book, we may pronounce that it is definitive.'¹⁸

There is no doubt that Ray's work was sufficiently well known among the British chemists when he was nominated for FRS. Sir Thomas Thorpe, a leading British chemist of that era, wrote a two-page review of a book by Ray as a front-page article in *Nature* entitled 'The life-work of a Hindu chemist'.¹⁹ The opening sentence of this review is:

Sir Prafulla Chandra Ray, professor of chemistry in the Presidency College, is well known to chemists in this country as the author, either alone or in collaboration with his pupils, of more than a hundred papers, chiefly on the inorganic and organic nitrites, published in the Transactions of the Chemical Society, in Continental journals, or in the Journal of the Asiatic Society of Bengal.

Thorpe noted that Ray was also known in his own country 'as the founder of a successful chemical industry', which 'proved of considerable service to the Government during the war, when the supply of Western chemicals and drugs was seriously interfered with'.

The laboratory of Frederick G. Donnan, a professor of chemistry at University College London, seemed to be particularly popular with Indian students. Two of Ray's students, Jnanendra Chandra Ghosh and Jnanendra Nath Mukherjee, worked in this laboratory. In a

letter to Ray dated 2 March 1921, Donnan wrote of the ‘very high opinion’ he had of these students and then commented:

[Y]ou have, by your constant devotion to teaching and research, created a school of chemistry in India which will be of the greatest importance for the prosperity of that land. I feel certain that you have done work in India of which any man might feel proud in any country.²⁰

NOMINATIONS FOR THE FELLOWSHIP OF THE ROYAL SOCIETY

In the twentieth century only 40 Indian scientists were elected FRS.²¹ Before the Statute of 1847 was adopted, the Royal Society was more like a ‘gentlemen’s club’ and, in that era, Ardaseer Cursetjee, a ship-builder from Bombay, was the first Indian to be elected FRS (in 1841).²² Only after 1847 did scientific achievement become the key criterion for election to the Society and the number of candidates to be elected per year was limited to fifteen²³—a limit that remained in place till the 1930s.²⁴ Throughout the second half of the nineteenth century and the first half of the twentieth century, many British scientists working in the Indian Empire were elected as FRS—quite often as a recognition for their organizational or administrative contributions, even when the scientific achievements were rather commonplace.²⁵ Only after 1910 were some scientists of ethnic Indian origin starting to be nominated. Ray was the first Indian scientist of this era to be nominated for FRS. Since there were no Indian Fellows to nominate him, he naturally had to be nominated by his British peers. As we shall see below, in addition to several eminent British chemists who were Ray’s peers, his nominators included a few British scientists who had worked in India.

Ray’s nomination took place after a meeting of the Congress of the Universities of the Empire at London in 1912. Ray and Deva Prasad Sarvadhikary were sent by the Syndicate of the Calcutta University as representatives. Ray recalled the reading of his paper at the Chemical Society, where V. H. Velely and E. Roscoe were present and appreciated his work. The latter stated: ‘Prof. P. C. Ray has added to his success in preparing ammonium nitrite in a tangible form, a further accomplishment in determining the vapour density of this very fugitive compound.’²⁶

To start with, it should be mentioned that, for the Fellowship of the Royal Society, it is not enough to make discoveries. The chances of election are minimal if there are no contacts with existing Fellows, because, according to the Statutes of the Society from the years 1847 and 1939: ‘Every candidate shall be proposed and recommended by a certificate in writing signed by six or more Fellows of whom three at least shall recommend from personal knowledge of the candidate’s contributions to the natural science.’ Thus, it is necessary to say a few words on Ray’s contacts.

Shortly after the London visit, Ray was nominated for the first time on 16 December 1912, by Henry E. Roscoe, Alexander Crum Brown, James Walker, William Henry Perkin, Herold Bailly Dixon, Thomas H. Holland, Herbert B. Baker, Martin O. Forster, Percy F. Frankland, William A. Tilden, Arthur W. Crossley, Alexander Pedler, William J. Pope, James E. Reynolds, Victor H. Velely, Alexander Scott and Hugo Müller. The number of nominators (a total of 17) was unusually large—many more than the minimum requirement. Since Ray was outside the British scientific establishment, the nominators probably wanted to make the point that Ray had support from a very large number of Fellows.

In one way or other Ray had contact with several of these persons, some of whom also had India connections. For instance, in Edinburgh, Crum Brown and Walker were Ray's teacher and friend, respectively. Alexander Pedler, who was a good friend of the first proposer Henry Roscoe, taught at Presidency College in Calcutta for many years and served as a principal of the college for some time.²⁷ He was also a vice-chancellor of Calcutta University from 1904 to 1906. He had seen Ray both as student and colleague. His teaching motivated Ray to choose chemistry for his career. Ray wrote of him: 'Pedler was an expert in gas-analysis and he was almost unrivalled as an experimenter. His manipulative skill was the envy of us all.'²⁸ Another of the signatories, Martin O. Forster, later served as the director of the Indian Institute of Science in Bangalore during 1922 to 1933, although he probably did not yet have any connection with India at the time of Ray's nomination. Not all of Ray's proposers were chemists. T. H. Holland worked in the Geological Survey of India and also served as a professor at Presidency College when the geology department was opened there in 1892 (during Ray's tenure in the chemistry department).²⁹ Unfortunately, Holland's elevation to the position of director of the Geological Survey of India in 1903 was mired in controversy. The Indian geologist Pramatha Nath Bose, who had discovered rich mineral deposits in various regions of central India as well as petroleum deposits in Assam, was working in the Geological Survey and expected to become the director. When he was superseded by the much more junior Holland, he perceived this as a case of racial discrimination and resigned in protest.³⁰ It may also be mentioned that the names of H. E. Roscoe and T. E. Thorpe were well known to chemistry students and teachers in Calcutta, since their chemistry textbooks were taught there, as mentioned in the syllabus of the University of Calcutta.³¹ Roscoe's elementary textbook on chemistry, which had gone through many editions, was studied by Ray himself as a student.³²

On his nomination certificate, Ray was said to have published 54 articles (alone or as co-author). Some mentioned on the nomination certificate are on: 'Mercurous Nitrite and its Derivatives... Isomorphism of Univalent Mercury with Silver... Decomposition of Hyponitrous Acid... Sublimation of Ammonium Nitrite in a Vacuum and Determination of the Vapour Density of the Ammonium Nitrite.' The nominators did not forget to mention Ray's landmark *History of Hindu chemistry*.

According to the Statute of 1925, not later than the month of February should the names of the nominated candidates, listed in alphabetic order, be sent to the Fellows. This list also contains the names of candidates who were not elected in the previous four years, provided their 'Proposers' do not withdraw the name of the candidate.³³ From the list of nominated names, the Council selects candidates by ballot. The candidate must have at least two-thirds of the votes. The Council then recommends to the Society a list of candidates with the strongest claims for election.

In 1913 Ray's certificate, along with the certificates of other candidates, was suspended (which means that the certificates were displayed in the building of the Royal Society). He was not elected. As we can see in figure 2, 1913 happened to be an extraordinarily productive year for Ray. For the next year's consideration, some of the nominators wanted to point out this fact in a 'Supplementary Certificate' dated 19 November 1913. In the supplementary certificate, from Roscoe, Crossley, Tilden, Perkin, Dixon, Frankland and Pope, it was stated that about 40 articles had been published by Ray and his students during the past 12 months. The three papers published in the *Journal of the Chemical Society* were listed.

Ray's nomination, along with this supplementary certificate, was suspended in 1914 as well as in the three following years 1915–17 because, according to the Statutes, a certificate remained valid for five years. Ray was not elected during these years. In 1915 Ray's main proposer, Roscoe, died.

After Ray's first nomination elapsed in 1917, he was nominated again in the same year. On 24 December 1917, Ray was nominated by Crum Brown, Walker, Dixon, Pope, Baker, Tilden, Crossley, Pedler, Reynolds, Veley, Scott and Perkin. After pointing out Ray's achievements as a 'distinguished' chemist and historian, the nomination ended with the statement: 'His influence in promoting scientific research in India would be difficult to overestimate.'

In the year 1917, in which Ray was nominated for the second time, another Indian was also nominated—the mathematician Srinivasa Ramanujan. He was elected in 1918 in the very first year of his nomination and became the first Indian to become FRS for his scientific contributions (leaving out Ardaseer Cursetjee). As expected, according to the Royal Society Statutes, Ray's second nomination remained valid during the period 1918–1922. However, he was not elected on the second attempt either. In the year 1922, in which Ray's second nomination elapsed, Crum Brown, his former doctoral supervisor in Edinburgh and his main proposer in the second nomination, also died.

After more than a decade, Ray was again nominated, by Gilbert Thomas Morgan, Henry E. Armstrong, William Pope, William P. Wynne, Richard A. Gregory, James C. Philip and William A. Bone. It is interesting to note that, apart from Pope, the others were nominating Ray for the first time. After mentioning the standard things mentioned in the earlier nominations, this nomination described him as 'a veteran leader of scientific education in India'. Again he was not elected, though his certificate was suspended from 1934 to 1938.

In the second and third nominations, the last sentences need special attention. They indicate that the proposers tried to convince the Royal Society that, in addition to being considered for Fellowship in the 'Mainstream group' (that is, for contribution to scientific knowledge), Ray could also be considered for either of the groups 'Applied Science Candidate' or 'General Candidate'. The first case would cover things such as the making of a new device, whereas the second case covered leadership, inspiration or help in the public understanding of science.³⁴

WHY RAY 'FAILED': SOME SUGGESTIONS

The official reason why Ray's nomination for FRS did not succeed is not known. In that era, the Royal Society did not keep records of the discussions within the Council for those nominations which did not succeed. So, we can only speculate about possible reasons.

Table 1 lists the Indians who were nominated for FRS between 1913, when Ray's nomination was considered for the first time, and 1939, when his final nomination elapsed.³⁵ Ray was the first Indian scientist to be considered for FRS in 1913. As the scientific community in India grew in size, more and more Indian candidates started to be nominated. Clearly, Ray had to compete with the other Indians. During 1913–1922 when Ray's first two nominations were valid, two Indians got elected: the mathematician Srinivasa Ramanujan and the physicist J. C. Bose, Ray's colleague at Presidency College. No Indian chemist got elected FRS during this era. Shanti Swarup Bhatnagar was the first Indian chemist elected FRS in 1943. It should be noted that, although Ray was highly active in research at the time of his first nomination in 1913 (see figure 2), he was already

Table 1. Indian scientists nominated for FRS between 1913 and 1939. For those who were elected, the year of election is indicated in bold.

Names	Nomination years	Subject of specialization
Prafulla Chandra Ray	1913–22, 1934–38	Chemistry
Jagadis Chandra Bose	1915– 1920	Physics
Srinivasa Ramanujan	1918	Mathematics
Devendra Nath Mallik	1919–1923	Mathematics
Chandrasekhar Venkata Raman	1922– 1924	Physics
Meghnad Saha	1925– 1927	Physics
Raghavendra Row	1926–1930	Medicine
Nil Ratan Dhar	1927–1936	Chemistry
Birbal Sahni	1932– 1936	Botany
Sudhansu Kumar Banerji	1933–1937	
L. K. Ananthakrishna Iyer	1935–1938	
K. S. Krishnan	1936– 1940	Physics
Shanti Swarup Bhatnagar	1937– 1943	Chemistry

past 50 and his most famous works were done a few years earlier. So, with the passage of time, his case did not become stronger and his subsequent nominations did not have any substantial new contributions to strengthen his case.

We mention one other possible factor that might have gone against Ray, although we do not have documents to support a definite conclusion. Ray was well known to be a critic of British imperialism and a strong supporter of Gandhi. In fact, Ray organized Gandhi's first political meeting at Calcutta in 1901 during Gandhi's maiden trip to the city as a relatively unknown 32-year-old.³⁶ Gandhi recorded in his autobiography how impressed he was by Ray.³⁷ Later, when Gandhi launched the non-cooperation movement and called for the boycott of British goods, Ray expressed his strong support for Gandhian philosophy and started wearing only dresses made out of khadi (coarse cotton clothes prepared by Indian weavers). Ray's nomination for the Royal Society was being considered at a time when Ray was deeply involved in political activities. We can only speculate that these activities might have come in the way of his being elected FRS.

While the Royal Society has not kept records of its deliberations on the nomination of Ray, the record of the deliberations on the FRS nomination of the physicist M. N. Saha, who was elected, have been preserved. These records of the Royal Society pertaining to Saha's FRS election have been explored in some detail and show that the Royal Society was quite likely to carry out a background check for those nominated Indian scientists who were known to be politically active.³⁸ Saha had befriended Indian revolutionaries in his youth. The geologist T. H. Holland, who was one of Ray's nominators in his first nomination, was the vice-president of the Royal Society when Saha was nominated in 1924. Holland wrote to A. P. Muddiman, Home Member of the Viceroy's Executive Council, enquiring 'whether Saha's political record is likely to be embarrassing afterwards to the Royal Society'.³⁹ On receiving a negative report from Muddiman, Saha's nominators, A. Fowler and G. T. Walker, were pressurized to withdraw the nomination. When they refused to do that, and a majority of the Council members gave their verdict in Saha's favour, he was elected as FRS in 1927. While the objections raised on political grounds were overruled by the Council of the Royal Society in Saha's case, the same might not have happened in all other cases and Ray was much more deeply active in politics than Saha.

NIL RATAN DHAR'S LETTERS: RAY'S NOMINATION AND THE ANGLO-INDO CHEMISTS' INTERACTION

Nil Ratan Dhar is one of the unsung heroes of Indian science and not much has been written about his life.⁴⁰ Dhar was one of Ray's favourite students at Presidency College, with whom Ray had bonds 'as subtle as those of chemical affinity' and who used to accompany Ray in his maidan walks in the evening. While still an MSc student, Dhar worked in Ray's laboratory and published about half a dozen papers in collaboration with Ray. In 1915, Dhar obtained a State Scholarship to study in London. He got the DSc degree from there in 1917, after spending barely two years in London, and then proceeded to Paris for further research. After obtaining a State Doctorate from the Sorbonne in 1919, Dhar joined Muir Central College in Allahabad, which served as the seed for Allahabad University and eventually became an integral part of the university.⁴¹ Dhar was lucky enough to be placed in the Imperial Service from the very beginning of his academic career in 1919. As we have discussed, Ray was never placed in this Service. One possible reason behind Dhar's success must be that his curriculum vitae in 1919 looked decidedly more impressive than Ray's in 1888 when Ray was looking for jobs in India. At that time, Ray had only one paper published in the *Proceedings of the Royal Society of Edinburgh*. Ray's reputation grew as he built up his laboratory at Presidency College and started attracting outstanding students. On the other hand, Dhar had the opportunity of working in Ray's laboratory even as an MSc student, leading to a few papers. With several more papers based on his work in London and Paris, Dhar's record surely would have appeared exceptionally strong in 1919 for somebody of age 27. So, Ray played an indirect role in Dhar being placed in the Imperial Service.

Dhar first built up his reputation by working on physical chemistry. However, from the middle phase of his career he started studying the influence of tropical sunlight on photosynthesis, which led him into research on soil chemistry. His international reputation among his peers can be gauged from the following two facts.

First, as can be seen in table 1, Dhar became the second Indian chemist to be nominated for FRS, although, like Ray, he was not elected. He was nominated in 1926 by F. G. Donnan, James Walker, James C. Philip, George Barger, W. C. McC. Lewis and J. N. Collie. According to his certificate, the candidate was a distinguished scientist in the field of physical chemistry and had published 140 articles on different topics such as 'theory of solutions, colloid chemistry and adsorption phenomena, catalyst, photochemistry, reaction velocity, ... bio-chemistry'. He was given credit for founding an active centre of chemistry in Allahabad. After his nomination elapsed in 1931, in the second nomination, made in the same year, his book *Chemical action of light* (published by Blackie) was also mentioned and he was said to be the editor of the 'Indian Chemical Society's Journal and President of the Chemical Section, Indian Science Congress, 1922'.

Second, it is well known that each year a few eminent scientists from around the world are invited to send nominations for the Nobel Prize. Dhar was invited to send nominations for the Nobel Prize for Chemistry repeatedly—in 1939, 1947 and 1952.⁴² He was one of only three chemists in pre-independence India who sent nominations for the Nobel Prize for Chemistry, the other two being Ray himself (in 1935) and P. C. Mitter. One chemist whom Dhar nominated in 1939 was G. Urbain, who was Dhar's mentor in Paris. Dhar's letter of nomination for Urbain is quite interesting to read.⁴³

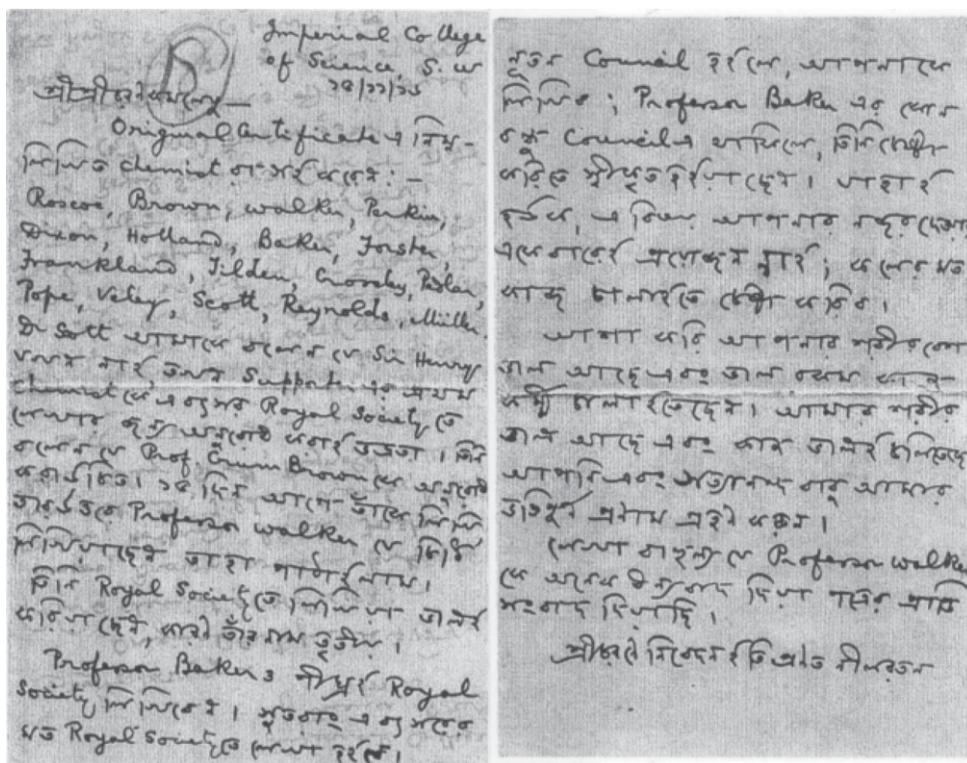


Figure 3. The letter from N. R. Dhar to P. C. Ray in Bengali dated 15 November 1916. (Courtesy of Professor Syamal Chakrabarti, Calcutta University, and the P. C. Ray Museum.)

Dhar was in London and Paris during 1915–1919 when Ray's nomination for FRS was being considered seriously. In 1919, towards the end of Dhar's stay abroad, Ray was knighted. Dhar's letters to Ray (in Bengali) from London and Paris describe his efforts to lobby for Ray's FRS election. These letters are preserved in the P. C. Ray Museum and have been printed in the authoritative study of Ray in Bengali by Syamal Chakrabarti.⁴⁴ This book has an extremely valuable collection of various source materials connected with Ray. To the best of our knowledge, Dhar's letters to Ray have not been translated into English before.

We quote from the first letter from Dhar in which Ray's FRS nomination is discussed, dated 15 November 1916 (see figure 3):

The following chemists signed the Original Certificate—Roscoe, Brown, Walker, Perkin, Dixon, Holland, Baker, Forster, Frankland, Tilden, Crossley, Pedler, Pope, Veley, Scott, Reynolds, Müller. Dr. Scott told me that, since Sir Henry [Roscoe] is no more, it would be appropriate to request the present first person among the supporters to write to the Royal Society. Accordingly, he felt that Prof. Crum Brown should be requested. I had written to him about 15 days ago. I am attaching the letter which I received from Professor Walker. It is good that he has written to the Royal Society, since his name is the third among the signatories. Professor Baker also plans to write to the Royal Society soon. So letters to the Royal Society have been arranged for this year.

I shall write to you when a new Council is formed. Professor Baker has promised to lobby for you in case any friend of his is elected to the Council. In any case, you need not bother about these things at all. I shall do like a machine whatever is necessary.

It should be pointed out that the nomination papers to the Royal Society remain confidential. Only Fellows of the Royal Society had access to the Original Certificate. It is remarkable that Dhar managed to get completely accurate information of who the signatories were. This shows that, although Dhar was a student barely 24 years old at that time, he already had sufficient contacts with leading English chemists of that era. Since Roscoe had died on 18 December 1915, there was a question as to which of the signatories should communicate with the Royal Society in 1916. The young Dhar wrote to Crum Brown and received a reply from Walker. Unfortunately, the letter from Walker which Dhar forwarded to Ray has not been found. In a letter dated 25 September 1917, Dhar wrote further about the deceased Henry Roscoe:

Sir Henry had a generous mind. His daughter Miss Dora Roscoe told me that her father had the earnest desire of seeing Professor Ray elected in the near future.

Roscoe must have felt sufficiently strongly about Ray's case to mention it to family members.

After the mathematician Ramanujan, working with Hardy in Cambridge, was elected FRS in that year, Dhar commented in a letter dated 20 April 1918 written from Paris:

Electing Ramanujan is not anything different from honouring Cambridge. I have grave doubts whether Ramanujan would have been elected if he did the same work from India . . . I have a firm belief that you will be elected next year, no matter what kind of Council is in place. This year's Council was dominated by men from Cambridge.

Then, in another letter dated 3 November 1918 from Paris, Dhar wrote:

I plan to return to London in December and shall meet some of the big bosses of the Royal Society. We shall see which chemists will be in the Committee this year. Whoever happens to be in the Committee, prospects seem good this year. This injustice cannot go on.

Although this letter hinted that it would be Dhar's last letter from Paris before he left for London, Dhar wrote another letter from Paris dated 8 January 1919 after he had learned that Ray had been knighted:

The Government has done a very wise thing by conferring knighthood on you. I was delighted to read about this in the 'Times'. Now the Royal Society will find it very difficult not to elect you this year.

The knighthood brought a congratulatory letter from the Chemical Society (London). It was dated 11 February 1919 and written by William J. Pope, president of the Society. He wrote:

The Council of the Chemical Society has noted with much pleasure that His Majesty has been pleased to confer the honour of knighthood on you and has requested me to offer you its hearty congratulations on this well-merited mark of distinction.⁴⁵

The election at the Royal Society was to take place within a few months of Ray being knighted. It appears that a concerted effort was made to lobby for Ray's election in that year. Soon after reaching London, Dhar wrote to Ray on 8 February 1919:

A few days ago Professor Baker and Sir William J. Pope told me that the Government has done well by making Professor Ray knighted.

A pioneer like him should have been knighted a long time ago. They further said, the Royal Society also should support the Government by electing you Fellow this year . . .

I have heard that you have a plan of coming here with the two Jnans around July. If your election goes through the Royal Society this year, then you need not come. I am hoping that I shall be able to send you a 'Cable' in March with the good news.

The 'two Jnans' referred to were Jnan Ghosh and Jnan Mukherjee. This letter is quite intriguing. Was Ray planning to come to England specifically to lobby for his election to the Royal Society? Since we do not have Ray's letters to Dhar, we cannot answer this question.

In another letter, dated 17 February 1919, written barely nine days after the previous letter, Dhar writes:

Professor Pope also has been knighted this year and will be in the Council. He is very sympathetic. You have done well by writing a letter to him. Dr. Forster is also in the Council this year. I had gone to see him. Without my bringing up the subject, he told me on his own that it is urgent to admit Sir Prafulla Chandra to the Royal Society. The Council should take special care . . .

All the leading chemists here are aware that you have done very good and solid work and that you are a pioneer who built up a School. Walker, Frankland, Thoran, Pope, Scott, Baker, Forster, Thorpe, Philip—all have told me these things. But their words do not get translated into actions. Perhaps they are not sufficiently influential and have their own candidates to push.

Dhar had to send a letter of disappointment on 12 March 1919. He wrote:

I had been to the meeting of the Royal Society on the 27th of the last month. The President read the names of the 15 newly elected Fellows. I was disgusted that your name was not in the list. People here just keep on giving oral assurances and then do not hesitate to commit the injustice of not acting on those assurances.

Dhar was to leave London in a few months, but still he made one last effort of campaigning for his guru, as he mentions in the same letter:

The first article in the 6 March issue of Nature is 'Life work of a Hindu Chemist' by Sir T. E. Thorpe. Although he has shown a little bit of a patronizing attitude on your 'Writings and Speeches', he is clearly very sympathetic. Had this article appeared even a month earlier, it might have had some effect on the decision-making process of the Royal Society. I have purchased 25 copies of Nature. I plan to send these copies to important people around November.

Presumably, November was the time when the Royal Society would again begin the election process.

CONCLUSION

Each of the other five ‘tribal leaders’ identified by Blanpied succeeded in making at least one extraordinary scientific discovery.⁴⁶ In contrast, Ray was a scientist who had a high plateau but no peaks. His effort in establishing the first important school of chemical research in India was internationally recognized. There is no doubt that several leading British chemists knew Ray’s work well and had a high respect for him. Ray also had a good network of contacts within the British chemistry community. So, Ray’s not being sufficiently well known in the British scientific community was definitely not the reason behind his not being elected. When a scientist working in a colony of the British Empire aspired for the same recognition as his British peers, he encountered a glass ceiling. Ray’s case is perhaps the clearest example of such a ceiling from the colonial period. He was never put in the Imperial Service and never elected FRS. We can imagine that any election of the Royal Society would involve tussles among different groups who would try to push their candidates. People not belonging to the British establishment surely required much stronger credentials compared to those who had many supporters within the establishment. Perhaps it was more difficult to ignore somebody who had even one spectacular discovery. It might have been easier to dismiss the claims of a scientist whose work did not have any peaks. However, C. V. Raman was elected FRS in 1924, before the discovery of the Raman effect in 1928, which brought him the Nobel Prize in 1930. Given that many British chemists strongly felt that Ray should be elected FRS, his non-election does appear a bit mystifying.

Dhar was one of the most respected Indian chemists in the generation after Ray. The correspondence between Dhar and Ray, in many ways, constitutes a unique document in the history of the development of chemical research in India. We unfortunately have only one-half of this correspondence—the letters of Ray to Dhar being unavailable. Any scholar studying the history of Indian science in that era knows that very little archival material has been properly preserved.⁴⁷ We should perhaps consider ourselves lucky that we have Dhar’s letters to Ray. Dhar received his first training in research from Ray and an exemplary ‘guru-shishya’ (master-and-disciple) relationship existed between them. Dhar’s letters clearly show the importance which Indian scientists of that era attached to the Fellowship of the Royal Society. While Dhar’s lobbying was not successful, his overtures were usually reciprocated with politeness and even enthusiasm. Since election to the Royal Society is a confidential process, British chemists could easily decline to discuss this subject with Dhar. But Dhar used his own growing stature to obtain a considerable amount of insider information from leading British chemists of the day through correspondence and discussion.

Not having Ray’s letters to Dhar, we do not know how keen Ray was on being elected FRS. Most probably Ray craved the FRS election which many contemporaries believed that he highly deserved. But a close reading of Ray’s autobiography gives us the impression that he was never a bitter or complaining man and was generally happy with what life gave him.

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NOTES

- 1 A striking example of the importance of being elected FRS to Indian scientists of that era is provided in the diary of K. S. Krishnan, who was involved in the discovery of the Raman effect as a student of C. V. Raman. On the evening of 9 February 1928, as soon as Raman and Krishnan were confident that they had made this discovery, the immediate discussion in their laboratory was when Krishnan would become an FRS (Raman had already been elected FRS in 1924). Krishnan was to be elected FRS in 1940: D. C. V. Mallik, 'The Raman effect and Krishnan's diary', *Notes Rec. R. Soc. Lond.* **54**, 67–83 (2000).
- 2 W. A. Blanpied, 'Pioneer scientists in pre-independence India', *Phys. Today* **39** (5), 3–44 (1986).
- 3 J. Lourdasamy, *Science and national consciousness in Bengal 1870–1930* (Orient Longman, Hyderabad, 2004), pp. 143–187; M. Mazumdar, 'The making of an Indian School of Chemistry, Calcutta, 1889–1924', in *Science and modern India: an institutional history, c. 1784–1947* (ed. Uma Das Gupta), pp. 801–847 (Centre for Studies in Civilizations, New Delhi, 2011).
- 4 P. Ray, 'Prafulla Chandra Ray', in *Biographical memoirs of Fellows of the National Institute of Sciences of India* (ed. P. Ray), pp. 1, 59–76 (1966); J. Sengupta, *P. C. Ray* (National Book Trust, New Delhi, 1972); N. R. Dhar, *Acharya P. C. Ray and his achievements* (Indian Chemical Society, Calcutta, 1972); S. Chakrabarti, *Oitihya, Uttarakar o Bijani Prafullachandra* (in Bengali) (Sahitya Sansad, Kolkata, 2009). P. C. Ray's work as historian of science has been analysed by D. Raina, 'The early years of P. C. Ray: the inauguration of the School of Chemistry and the social history of science', *Sci. Technol. Soc.* **2** (1), 1–40 (1997).
- 5 P. C. Ray, *Life and experiences of a Bengali chemist* (Chuckervertty, Chatterjee & Co., Calcutta, 1932).
- 6 P. Geddes, *The life and work of Sir Jagadis C. Bose* (Longmans, Green & Co., London, 1920), p. 34.
- 7 According to Ruchi Ram Sahni, there had been only three Indians in the superior service by 1918: 'It will be enough to mention here even at the time of my retirement from service in 1918, there were, so far as I knew, only three Indians in the whole of India who could flourish the coveted letters I.E.S. after their names. Even Ray remained in the Provincial Service all his life, and there were several others equally well qualified (Sir Jagdish Chandra Bose, FRS (Physics), Dr. D. N. Mullick (Mathematics) and an Indian Christian gentleman (English) in Madras.)' N. K. Sehgal and S. Mahanty (eds), *The memoirs of Ruchi Ram Sahni* (Vigyan Prasar, New Delhi, 1994), p. 44.
- 8 Ray, *op. cit.* (note 5), pp. 166–167.
- 9 'Editorial', *Science and Culture*, July 1944.
- 10 A complete list of P. C. Ray's scientific papers can be found in Chakrabarti, *op. cit.* (note 4), pp. 37–45, 99–106. See also A. Chakrabarti and B. Chakrabarti, 'Research papers of Acharya Prafulla Chandra Roy: a bibliometric study', *Qual. Quant. Meth. Libr. (QQML) Special Issue: Bibliometrics and Scientometrics*, 203–229 (2015).

- 11 P. C. Ray, *A history of Hindu chemistry* (Chuckerverty, Chatterjee & Co., Calcutta, 1902), vol. I; (Chuckerverty, Chatterjee & Co., Calcutta, 1909), vol. II.
- 12 S. Goswami and S. Bhattacharya, 'The chemical research of Sir Prafulla Chandra Ray', *Resonance* **6**, 42–49 (2001); A. Chakravorty, 'The chemical researches of Acharya Prafulla Chandra Ray', *Indian J. Hist. Sci.* **49**, 361–370 (2014).
- 13 A. Chakravorty, 'Prafulla Chandra Ray', *Resonance* **6**, 3–5 (2001).
- 14 P. C. Ray, *Essays and discourses* (G. A. Natesan & Co., Madras, 1919), p. ix.
- 15 Ray, *op. cit.* (note 5), p. 114.
- 16 Ray, *op. cit.* (note 14), p. x; Ray, *op. cit.* (note 5), p. 114.
- 17 Ray, *op. cit.* (note 5), p. 119.
- 18 *Ibid.*, pp. 120–121.
- 19 T. E. Thorpe, 'The life-work of a Hindu chemist', *Nature* **103**, 1–2 (1919).
- 20 Chakrabarti, *op. cit.* (note 4), p. 304.
- 21 *List of Fellows of the Royal Society 1660–1998* (Royal Society of London, London, 1999).
- 22 R. K. Kochhar, 'Ardaseer Cursetjee (1808–1877), the first Indian Fellow of the Royal Society of London', *Notes Rec. R. Soc. Lond.* **47**, 33–47 (1993).
- 23 E. N. da C. Andrade, *A brief history of the Royal Society* (Royal Society of London, London, 1960), pp. 12–13.
- 24 *Ibid.*
- 25 R. W. Home, 'The Royal Society and the Empire. The Colonial and Commonwealth Fellowship, part 2: after 1847', *Notes Rec. R. Soc. Lond.* **57**, 47–84 (2003). Appendix 1 of this paper, at pp. 69–71, lists all the persons with Indian connections (both ethnic Indians and British working in India) who were nominated for FRS during the period 1847–1948, with indications as to which nominations were successful.
- 26 Ray, *op. cit.* (note 5), p. 174.
- 27 *175th Anniversary commemoration volume* (Presidency College, Calcutta, 1992), pp. 25, 62, 139–140, 163.
- 28 Ray, *op. cit.* (note 5), p. 83.
- 29 *Op. cit.* (note 27), p. 83.
- 30 D. M. Bose, S. N. Sen and B. V. Subbarayappa, *A concise history of science in India* (Indian National Science Academy, New Delhi, 1971), p. 527. It is curious to note that Pramatha Nath Bose was later involved in a Hindu revivalist project of determining India's place among the world civilizations; see A. Sur, *Dispersed radiance* (Navayana, New Delhi, 2011), pp. 49–52.
- 31 University of Calcutta, *Calendar for the year 1890* (Thacker, Spink & Co., Calcutta, 1890), p. 50.
- 32 Ray, *op. cit.* (note 5), p. 47.
- 33 *Year book of the Royal Society of London* (Royal Society of London, London, 1925), p. 64.
- 34 *Year book of the Royal Society of London* (Royal Society of London, London, 2000), p. 15.
- 35 Table 1 is based on data extracted from Home, *op. cit.* (note 25).
- 36 Ray, *op. cit.* (note 5), pp. 126–128.
- 37 M. K. Gandhi, *An autobiography: or the story of my experiments with truth* (Penguin Books, London, 1982), at p. 218.
- 38 D. H. DeVorkin, 'Saha's influence in the West: a preliminary account', in *Meghnad Saha birth centenary commemoration volume* (ed. S. B. Karmohapatra), pp. 154–202 (Saha Institute of Nuclear Physics, Calcutta, 1993), at pp. 182–184. See also R. S. Anderson, 'Meghnad Saha's two international faces: politics in science and science in politics between the wars', in *The internationalist moment* (ed. A. Raza, F. Roy and B. Zachariah), pp. 229–262 (Sage, India, 2014); R. Singh, *Chemistry and physics Nobel Prize: India's contribution* (Shaker Publisher, Aachen, 2016), pp. 30–38.
- 39 Letter from T. H. Holland to A. P. Muddiman, 12 March 1925 (Royal Society of London Archive).

- 40 S. Kar, *Agraja Bijani* (in Bengali) (Ananda Publishers Pvt. Ltd., Calcutta, 1980), pp. 104–113; S. G. Misra, ‘Nil Ratan Dhar’, *Biographical memoirs of Fellows of the Indian National Science Academy* **14**, 89–101 (1990); P. K. Majumdar and M. Chanda, *Barenya Bangali Bijani* (in Bengali) (Srishti Prakashan, Calcutta, 2001), pp. 101–111; S. Mahanty, ‘Nil Ratan Dhar: pioneer in agricultural research in India’, *Dream 2047* **10**, 31–34 (2007).
- 41 N. S. Gour, *Three rivers and a tree: the story of Allahabad University* (Rupa, New Delhi, 2015).
- 42 R. Singh, *India’s Nobel Prize nominators and nominees* (Shaker Publisher, Aachen, 2016), p. 11.
- 43 R. Singh, ‘India’s physics and chemistry Nobel Prize nominators and nominees in colonial and international context’, *Notes Rec. R. Soc. Lond.* **61**, 333–345 (2007). Quotations from N. R. Dhar’s nomination letters are at pp. 338–339.
- 44 Chakrabarti, *op. cit.* (note 4). The letters from Dhar to Ray are fully reproduced in original Bengali at pp. 321–333. The excerpts from these letters given here are in our translation from Bengali.
- 45 *Ibid.*, p. 303.
- 46 J. C. Bose was the first to produce microwaves in the laboratory; C. V. Raman discovered the Raman effect and won the Nobel Prize for it in 1930; S. N. Bose formulated the Bose–Einstein statistics; M. N. Saha developed the Saha ionization equation; H. J. Bhabha is known for his theory of Bhabha scattering.
- 47 A. R. Choudhuri, ‘The golden age of Calcutta physics: difficulties in reconstructing the history’, in *CU physics 100* (ed. Gautam Gangopadhyay and Anirban Kundu), pp. 1–22 (University of Calcutta, Calcutta, 2016).