Acharya Prafulla Chandra Ray: Created Chemistry of Science, Rationalism, and Humanism

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Abstract

This essay provides a brief intellectual biography of Acharya Prafulla Chandra Ray (P. C. Ray in short) covering his science, thoughts on rationalism, and various socio-religious issues. Positioned against the coverage of P. C. Ray in the literature since 2002, the essay provides significantly more detailed treatment of some of the major strands of his thoughts. The essay also critically examines certain shortcomings in a 72-page article on P. C. Ray published in 2013–14, which is the longest of the articles that have appeared on him in the last two-and-half decades.

Keywords: Acharya Prafulla Chandra Ray, chemistry, science, rationalism, nationalism, criticism of casteism.

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1 Introduction

Acharya Prafulla Chandra Ray (2 August 1861 – 16 June 1944, usually referred to as P. C. Ray) is a unique figure in modern Indian history. He was simultaneously an eminent scientist, – one of the founders of modern Indian science, – a pioneering entrepreneur, a great nationalist, an original social thinker, and a prolific writer.

It is natural that there will be an enduring interest in such a personality. In the last two-and-half decades, various articles have appeared on his life and works. While some of the articles focus on particular aspects of his works, a few longer ones are more of a general biographical sketch.

In the present article, we attempt to construct an intellectual biography of P. C. Ray. We bring together various strands of thoughts and opinions of P. C. Ray and present them in a unified manner. Since P. C. Ray's writings in English and Bengali extend over multiple volumes, our treatment cannot cover everything in the space of a few pages. Nonetheless, we do cover aspects of his ideas which have not been adequately treated in the literature about him which has appeared in the last two-and-half decades. Specifically, in comparison to such previous works, we cover in greater depth P. C. Ray's emphasis on rationalism and his socio-religious views. We provide extensive quotations from the writings of P. C. Ray, so that the reader gets an idea of the actual words that he wrote.

Studying the life of P. C. Ray is instructive to general readers even in the present age. His achievements evoke deep respect and remain a model of inspiration for youth of any age. At the same time, his progressive and rationalistic outlook is worthy of adoption in the present age.

We hope that our sketch of his intellectual breadth will expose to a wide general audience P. C. Ray's achievements in the laboratory and beyond.

P. C. Ray dedicated his autobiography to the Youth of India with the following message [36]:

> **[R1]** This volume is affectionately inscribed in the hope that its perusal may in some measure stimulate them to activities.

An electromagnetic signal loses intensity as it travels over distances, and consequently such a signal needs boosting by relay stations at regular intervals. In a similar manner, historical messages also fade over time and require boosting at regular intervals. The present essay may be considered a contemporary boosting of the message of P. C. Ray's life which created a unique 'chemistry' of science, rationalism, and humanism.

We start by providing an overview of his life and works in Section 2, including his science and nationalism. Arguably, the *magnum opus* of P. C. Ray was his two-volume work entitled *A History of Hindu Chemistry*. In Section 3 we provide a very brief account of this work. In many of his writings on society and problems of the country in the present day and in ancient times, P. C. Ray expressed bold and novel ideas. An account of his socio-religious outlook is described in Section 4. The coverage of P. C. Ray in contemporary narrative is carefully examined in Section 5 to highlight that the present essay covers certain important aspects of P. C. Ray's thoughts in greater detail than has been previously done. The long article by Dutta [18] in 2013–14 and its short follow-up [20] in 2021 provide a narrative about P. C. Ray which arguably has some shortcomings in faithfully representing who P. C. Ray actually was. Section 6 performs a detailed analysis of certain aspects of Dutta's article. Finally, we conclude in Section 7 with P. C. Ray's idea of progress and the vision for India that he expressed in 1910.

2 Overview of Life and Work

We start by providing an overview of the life and career of P. C. Ray. The details of his life are available from various sources including his two-volume autobiography [36, 37], and later biographical sketches such as [1, 25, 4, 26, 29, 13, 14]. In particular, a chronology of events of P. C. Ray's life is available as an annexure to [26]. We have primarily relied on these sources for the basic facts of the overview. On certain aspects of P. C. Ray's life, our discussion goes beyond what is available in contemporary biographies.

2.1 Education

P. C. Ray was born on 2 August 1861 in undivided India in the village of Raruli, which is in Khulna, and earlier it was in Jessore. Presently, his place of birth is in Bangladesh. His father was Harischandra Roychowdhury and mother was Bhuvanmohini Devi. He received early education at his village school till nine years of age. In 1870, he was admitted to the Hare School in Calcutta. While in the fourth class, in August 1874, he got a bad attack of dysentry, which was difficult to cure and his attendance at the school had to be discontinued. The acute stage of dysentry lasted seven months, and subsequently it became chronic which affected his overall

constitution, and digestive problems along with associated insomnia plagued him throughout his life. Due to dysentery, he missed school for a couple of years. Subsequently, he got admitted to the Albert School in Calcutta and completed his Matriculation Examination in 1878–79.

The next stage of his education was at the Metropolitan Institution. Along with language studies, he attended lectures in chemistry (which was compulsory in the First Arts Course), and lectures on both chemistry and physics at the Bachelor of Arts Course at the Presidency College as an external student. P. C. Ray passed the First Arts Examination in 1881. Due to his interest in chemistry, for B.A., he chose the "B" course. During his college days, he prepared for, and in 1882 he won, the presitigious Gilchrist scholarship, which was awarded annually to two students on the basis of a highly competitive all-India examination. For this scholarship, knowledge of Latin, Greek or Sanskrit, French, or German, was essential. P. C. Ray knew Sanskrit, and had studied Latin and French on his own.

As a result of winning the Gilchrist scholarship, in 1882, P. C. Ray travelled to Great Britain and enrolled at the University of Edinburgh in 1883 to study chemistry. He obtained his B.Sc. degree in 1885, and subsequently was awarded the D.Sc. degree in 1887 in recognition of his work on *Conjugated (gepaarte) Sulphates of the Copper-Magnesium Group: A Study of Isomorphous Mixtures and Molecular Combinations*.

Subsequent to obtaining his D.Sc. he decided to stay on to pursue his interest in researches in chemistry. He won the Hope Prize Scholarship, and the Gilchrist Endowment made a grant of £50 on the termination of his scholarship, which enabled him to pursue his work at Edinburgh. The biographies [26, 13] mention that P. C. Ray was awarded the Faraday Gold Medal, though this is not mentioned in the other biographical memoir [29]. He was elected a Vice-President of the University Chemical Society at Edinburgh. In 1888, he returned to India.

2.2 Academic Career

From 1889 to 1916, P. C. Ray was a faculty member at the Presidency College, initially as a temporary Assistant Professor of Chemistry and as the Professor and Head of the Department of Chemistry at the time of his retirement. He retired from his position at Presidency College one year prior to his official retirement.

In those days, there were two kinds of educational positions in British India, namely the Imperial Service and the Provincial Service. The salary for Provincial Service was significantly lower than that of Imperial Service, and also importantly, people in the Provincial Service ranked lower than those in the Imperial Service. Indians, even though they were accomplished and acclaimed, were placed in the Provincial Service, while Europeans almost fresh out of college could be placed in Imperial Service. Unfortunately, P. C. Ray had to spend his entire career at the Presidency College in the Provincial Service. At one point in his career he was offered the post of principal of the Rajshahi College, but he declined primarily due to his "aversion to executive work," as also for the reason that his research would suffer, preferring instead to continue in the Provincial Service as a junior professor at Presidency University [36, p. 158].

In the year that he retired from Presidency University, i.e. 1916, P. C. Ray took up the position of Palit Professor of Chemistry at the University College of Science of the Calcutta University. He held the Palit professorship up to 1936, and thereafter he was a Professor

Emeritus at the University of Calcutta.

As a teacher and mentor, P. C. Ray was well known for his warm and helpful attitude towards his students. He did not believe in teaching only the material in the textbooks. His lectures were made interesting both because they were supported by many experiments, and also for the various inspiring anecdotes about great scientists that he used to tell in his classes.

It is primarily through his efforts that high quality chemistry research started in India. P. C. Ray mentored several well known researchers in chemistry, such as Jnanendra Chandra Ghosh, Jnanendranath Mukherjee, Rasik Lal Datta, Nilratan Dhar, and Jitendra Nath Rakshit. Apart from chemists, the famous physicist Meghand Saha also considered P. C. Ray to be his mentor.

The residence at 110, College Street used to be known as 'Doctor-babu's mess, and several students of Presidency College stayed there. On many evenings, he used to go out on long walks to the Maidan, and many of his students also accompanied him.

2.3 Scientific Research

P. C. Ray worked in various areas of chemistry. There are two bibliographies of his research work. The bibliography in [29] lists 118 papers, while the bibliography in [12, Appendix A] lists 158 papers. The second list contains all but one of the papers in the first list; further, the second list contains 22 papers which are not in the first list. There are also other small differences in the two lists.

In the following we consider the bibliography in [12, Appendix A]. The first paper by P. C. Ray appeared in 1888 in the Proceedings of Royal Society of Edinburgh. This paper was based on his D.Sc. research. The last paper by P. C. Ray appeared in 1936 in the Journal of Indian Chemical Society.

We have attempted to classify his research into a few broad categories. The categories we considered are Synthetic Chemistry, further sub-divided into Inorganic and Organic Chemistry; Analytical Chemistry; and Physical Chemistry. Based on the titles of the papers, we used automated software tools to classify the papers into these categories. The journal wise listing of the number of papers in each of these categories is shown in Table 1. This classification confirms that P. C. Ray was primarily a Synthetic Chemist. His favourite publication venue was the Journal of Chemical Society, where he published more than one-third of all his papers.

Among all of his chemical research, the primary claim to P. C. Ray's fame rests on his research on nitrites. In 1896, he made a breakthrough synthesis of the compound mercurous nitrite. The paper was published in the *Journal of the Asiatic Society of Bengal*. An 1896 note in *Nature* made the following comment [36, p. 114]:

> The Journal of the Asiatic Society of Bengal can scarcely be said to have a place in our chemical libraries; the current number, however, contains a paper by Dr. P. C. Ray, of the Presidency College, Calcutta, on mercurous nitrite, that is worthy of note. During a preparation of mercurous nitrate by the action of dilute nitric acid in the cold on mercury, yellow crystals were deposited which upon examination, proved to be mercurous nitirite.

P. C. Ray notes [36, pp. 113]: "The discovery of mercurous nitrite opened a new chapter in

Table 1: Publications of P. C. Ray (1888–1936) by journal and subject area.

	Synthetic chemistry		Analytical chemistry	Physical	
Journal	Inorganic	Organic	(organic)	chemistry	Total
Proc. Roy. Soc. Edinburgh	1	0	0	0	1
J. Asiat. Soc. Beng.	5	4	1	2	12
Proc. Chem. Soc.	8	7	0	5	20
Z. anorg. (allg.) Chem.	10	0	0	1	11
J. Chem. Soc.	24	22	1	20	67
Justus Liebigs Ann. Chem.	1	0	0	0	1
Chem. News	0	1	0	1	2
J. Indian Chem. Soc.	23	9	0	4	36
Nature	0	5	0	3	8
Total	72	48	2	36	158

my life." Subsequently [36, p. 114], he conducted "investigations on mercurous nitrite and its numerous derivatives as also on the nitrites in general," and such research "form the subject-matter of some one hundred and more communications to chemical journals. As one new compound followed in the wake of another, I took up their examination with unabated zeal." In 1914–15, Prof. Armstrong writing in the *Presidency College Magazine* referred to P. C. Ray as the '*Master of Nitrites*.'

In Table 2 we tabulate the numbers of papers published by P. C. Ray in various journals in different decades. Prior to 1900, he did not publish much, and became much more active in his later years. So it is only in his forties that his research activity became really significant. His most productive decade was in the 1910s, when he was in his fifties. Note that in the period 1930–36 (1930s in Table 2), when P. C. Ray was in his seventies, he published 29 papers indicating that he remained productive for a long time. His discovery of mercurous nitrite in 1896 gave a major boost to his research which is also indicated by the growth of the number of publications in the 1900s and the 1910s.

In 1896 when P. C. Ray synthesised mercurous nitrite, and subsequently in the 1890s and the 1900s when his research output on modern chemistry was picking up, he was simultaneously carrying out extensive research on history of chemistry in ancient India, and was also engaged in setting up the Bengal Chemical and Pharmaceutical Works, apart from his regular teaching duties at Presidency College. The ability to simultaneously carry out innovative and demanding high quality work in different fields was a hallmark of P. C. Ray's intellectual capacity.

In the 1910s and subsequently, P. C. Ray was publishing at a great pace, while at the same time he was engaged in nationalistic activties. Particularly, in the 1920s, he toured the country exttensively in connection with the Swadeshi movement. Also, starting from 1909–10 onwards, P. C. Ray wrote extensively on various social issues and delivered many talks at various national venues. At the same time, his company was growing which required him to devote time to its affairs. Also, in the 1920s and subsequently, P. C. Ray was involved in various flood relief activities. The unique ability of P. C. Ray to successfully balance various demanding work schedules is a lesson and a role model for all generations.

Other than his first paper, almost all of his subsequent research, including his breakthrough paper on mercurous nitrite as also his substantial research on nitrites in general, was done in India. It is in this sense that he initiated chemistry research in modern India.

Table 2: Publications of P. C. Ray (1888–1936) by journal and decade.

Journal	1880s	1890s	1900s	1910s	1920s	1930s	Total
Proc. Roy. Soc. Edinburgh	1	0	0	0	0	0	1
J. Asiat. Soc. Beng.	0	2	6	4	0	0	12
Proc. Chem. Soc.	0	5	5	10	0	0	20
Z. anorg. (allg.) Chem.	0	1	2	0	1	7	11
J. Chem. Soc.	0	4	17	38	8	0	67
Justus Liebigs Ann. Chem.	0	0	1	0	0	0	1
Chem. News	0	0	0	2	0	0	2
J. Indian Chem. Soc.	0	0	0	0	20	16	36
Nature	0	0	0	0	2	6	8
Total	1	12	31	54	31	29	158

A word of caution. The counts of the number of papers in various categories were obtained using an automated software tool based on the titles of the papers. So some of the papers might have been misclassified. Nonetheless, by and large the above tables provide a good overview of the range and quality of P. C. Ray's researches in chemistry.

Major recognition. We have previously mentioned the Gichrist scholarship, and the Hope Prize and Faraday Gold Medal of the University of Edinburgh, which he won during his student days. Due to his extensive research on chemistry, over his lifetime and also posthumously, he received several accolades which are listed below.

- Fellow of the Chemical Society (1902).
- Honorary Ph.D. of the Univesity of Calcutta (1908).
- Honorary D.Sc. of the University of Durham (1912), Banaras Hindu University (1920), Dhaka University (1936), Allahabad University (1937).
- Companion of the Indian Empire (CIE), 1912.
- Member of the Deutsche Akademie, Munich, 1919.
- Knighted, 1919.
- President of the Indian Science Congress, 1920.
- Honorary Fellow of the London Chemical Society, 1934.
- Foundation Fellow of the National Institutes of Sciences of India, 1935.
- Nominated for the Fellow of the Royal Society in 1912 (considered in 1913–1917), 1917 (considered in 1918–21), and 1933 (considered in 1934–38), though all the nominations were unsuccessful [16].
- Fellow of the Indian Association for the Cultivation of Science, 1943.
- Posthumous recognition: In 2011, the Royal Society of Chemistry honoured P. C. Ray with the Chemical Landmark Plaque, which was the first such plaque awarded to a person outside Europe.

To commemorate the birth centenary of P. C. Ray, the Indian Science Congress Association instituted the P. C. Ray Memorial Award to be given every alternate year. There are several academic institutions which are named after him.

Father of Modern Indian Chemistry. Due to his research in chemistry, mentoring of a generation of first rate chemists, as well as his contributions to institution building in the area of chemistry (as we describe below), P. C. Ray is aptly called the 'Father of Modern Indian Chemistry.'

2.4 Institution Building

Two of P. C. Ray's former students, J. N. Mukherjee and J. C. Ghosh, along with S. S. Bhatnagar, while studying in London conceived the idea of forming a Chemical Society in India similar to the Chemical Society of London. Their idea was realised in 1924, when the Indian Chemical Society (ICS) was formed. P. C. Ray was the first president of the ICS. Initially the ICS did not have office space of their own. P. C. Ray made a donation of Rs. 10000 which resulted in the construction in 1933 of the office space for ICS.

In 1924 itself, P. C. Ray became the President of the National Council of Education (NCE) and continued in this position till his death. Jadavpur University evovled from the Bengal Technical Institute which started under the auspices of the Society for the Promotion of Technical Education (SPTE) in 1906. The SPTE merged with the NCE in 1910, and it is this merged body of which P. C. Ray became the President in 1924; see [41] for a description of how Jadavpur University came about.

Along with Meghnad Saha, P. C. Ray was one of the founders of Indian Science News Association (ISNA) in 1935. Though at that time he was 74 years old, P. C. Ray became the first President of ISNA.

In 1918, P. C. Ray was invited by the Madras University to deliver lectures. He returned the honourarium that was offered to him with the suggestion that the money be used for the purpose of starting the William Wedderburn Prize to recognise research in chemistry. He made a similar gift to the Punjab University under similar circumstances. From 1921 onwards, P. C. Ray donated his entire salary of Rs. 1000 for the rest of his service as the Palit Professor of Chemistry to the development of the Chemistry Department of the University of Calcutta. In 1922, he donated Rs. 10000 to institute the Nagarjuna Prize to the University of Calcutta for the best scientific work in chemistry. (See [28, pp. 68–70]). Again in 1936, he further donated Rs. 10000 to institute the Ashutosh Mukhopadhyay Memorial Prize to recognise research in Zoology and Botany.

2.5 Entrepreneurship

P. C. Ray showed entrepreneurial acumen even during his college days. Due to financial problems, his father had to go back to their village home and P. C. Ray moved into his own small quarters. He relates [36, p. 535] how he supplemented the money his father could send by selling copies of H. H. Wilson's *Sanskrit English Dictionary* which his father had published but

had not been able to sell. He writes about this episode [36, p. 535]: "My business instinct now stood me in good stead."

Later in his life, he built upon this business instinct to start a very successful company. In the early 1890s, P. C. Ray embarked on the task of manufacturing chemical and pharmaceutical products from locally available raw material. One such raw material consisted of bones, which was burnt down to obtain phosphate of calcium (see [36, pp. 97–99] for an interesting account of this episode). In search of suitable opportunities, P. C. Ray scouted around (i.e. essentially conducted a market survey) to determine which products could be manufactured and sold at a profit.

His early manufacturing efforts were mainly pharmaceutical products. While he was a chemist, he did not have any pharmaceutical experiences. By consulting pharmacopias and journals on pharmacology, he uncovered certain products that could be made from locally available raw material. Additionally, on the suggestion and advice of Amulyacharan Bose, Radha Gobinda Kar, who were medical practitioners, P. C. Ray ventured into manufacturing indigenous medical products. While he managed to start production, there were significant difficulties in selling the products. These were of two kinds – namely doctors would need to prescribe the products, and secondly medicine shops were reluctant to store the products since customers preferred foreign to local products. On the first difficulty, Amulyacharan Bose canvassed among medical practitioners, while alleviating the second difficulty and gaining acceptance took time and built slowly.

P. C. Ray called his manufacturing business the Bengal Chemical and Pharmaceutical Works (BCPW). He started the business with a capital of only a few hundred rupees. Slowly it grew, and in 1901, it was registered as a limited company. Subsequently, the company flourished and became successful. During the first World War, the British government placed major orders on the company. In his 1932 autobiography, P. C. Ray noted [36, p. 111]: "The Firm at present employs 2000 hands and its net assets come upto half-a-crore of rupees."

An account of various industries including potteries, enamel, maritime travel, and ship building was given by P. C. Ray in Chapter XX of his autobiography [36]. In particular, he provides a detailed account of how the British government slowly but surely killed off the local maritime travel and ship building to facilitate the business of English firms. Other than BCPW, P. C. Ray was connected to other industries. He notes [37, p. 455]: "it has been my lot to be connected with several industrial enterprises, either as founder or active co-operator."

2.6 Social Service and Philanthropy

In Section 2.4, we described the financial donations made by P. C. Ray to various causes of science. Apart from science, P. C. Ray also made lifelong contributions, both financial and organisational, to various causes of humanity. Out of his salary, he kept only a small portion and donated the rest. In his autobiography, Gandhi recalls that in 1901 Gokhale introduced him to P. C. Ray with the following words [22, p. 538]:

> This is Prof. Roy, who having a monthly salary of Rs. 800, keeps just Rs. 40 for himself and devotes the balance to public purposes. He is not, and does not want to get, married.

P. C. Ray's philanthropy was well known. We quote the following passage from the reminiscences of N. R. Dhar included in the centenary volume in honour of P. C. Ray [1, p. 160]:

> For many years Acharya Ray contributed Rs. 400/- per month for helping the needy students of the Calcutta colleges and paid liberally to the Sadharan Bramho Samaj and to Bramho Girls' School which was under the supervision of his friend Lady Abala Bose. Whenever any good cause lacked money, people approached Lady Bose and she secured substantial help from Acharya Ray. Moreover, at his initiative and expense the Bengal Chemical and Pharmaceutical Works used to supply equipment and fittings to many of the colleges introducing science teaching. I gratefully acknowledge his help of £40/- (Rs. 500/-) when I proceeded to Europe for research work as a State Scholar in 1915. H. K. Sen, afterwards Professor of Applied Chemistry, Calcutta University, used to receive Rs. 40/- per month from the Acharya for a few years during his student days.

P. C. Ray helped several institutions and made numerous other donations. A book about him published in 1924 by an anonymous 'Admiring Pupil' notes [28, pp. 68–71] that P. C. Ray helped the City College of Calcutta, the H. E. School at his village, and the Bagerhat College; established an Education Council and donated Rs. 10000 for the spread of primary education in his village; along with other "private and regular charities." The book further states that P. C. Ray donated his entire savings and his shares in BCPW and other companies with total worth about Rs. 56,000 to a Trust for the organisation and propagation of Khaddar industry in Bengal.

Apart from his regular donations to various causes, he organised relief during disaster. In particular, P. C. Ray organised relief during the Khulna famine of 1921. In 1922, there was a major flood in North Bengal (see [36, pp. 238–249] and [28, pp. 60–61]) which caused extensive damage to crops, livestock, and dwelling houses. P. C. Ray headed the Bengal Relief Committee to provide aid to the people suffering from the devastation. At his call, people from all over Bengal made donations which amounted to several lakhs of rupees, and hundreds of volunteers joined in the operation. His efforts in systematically organising the major relief operation was praised by the *Manchester Guardian*. Floods were a recurrent problem in Bengal mainly due to the improperly planned construction of railway lines which blocked the natural flow of water. In 1929, and also in 1931, there were two other floods, and on both occasions P. C. Ray undertook major relief operations. Due to the extensive flood relief operations carried out by P. C. Ray, Meghnad Saha reports that Mahatma Gandhi reportedly referred to P. C. Ray as 'Doctor of Floods' [37, p. 166].

P. C. Ray's sense of empathy towards fellow human beings was an integral part of his nationalism. This is nicely reflected in the following sentence from his essay *Bengali Brain and Its Misuse* [34, p. 15]:

> **[R2]** When a man ceases to feel for brother man, he ceases to feel for his country.

2.7 Nationalism and Politics

P. C. Ray was a nationalist at heart. During his student days at the University of Edinburgh, in 1885, P. C. Ray made a submission to an essay competition on 'India Before and After the Mutiny' [36, p. 61]. While his submission did not win the prize, along with another essay, it was labelled as *proxime accesserunt*. The essay was extremely critical of the role of the British.

In the early twentieth century, P. C. Ray reportedly supported the revolutionaries. Chapter 6 of [8] entitled 'Revolutionary Activities' provides an account of the involvement of P. C. Ray with the revolutionaries of Bengal. Apparently, bomb making was carried out by the revolutionaries in P. C. Ray's laboratory in his absence, though with his deniable concurrence. There are reports that the famous revolutionary *Bagha Jatin* used to visit Doctor Babu's Mess. Various reports by former revolutionaries given in [8, Ch. 6] suggest that P. C. Ray was sympathetic to the cause of the revolutionaries, provided them with untraceable financial support, sheltered them at his residence, helped find them safe passage, and turned a blind eye to the use of his laboratory facilities and chemicals for bomb making experiments. He was under police watch for several decades. An account of such police records has been compiled [8], where it was noted that in police records, P. C. Ray was reportedly referred to as "A Revolutionary in the Garb of a Scientist." This is mentioned at several places in Chapter 6 of [8], see for example p. 176; for an earlier reference see Nimai Das Ray-Chaudhuri's reminiscence [1, p. 272].

Before proceeding, we pause for a moment to point out that extensive details unearthed by Anil Bhattacharya and published in 2015 dispel some of the misconception that nothing much is known about P. C. Ray's involvement with the Bengal revolutionaries. In 2013–14, quoting Hemendra Prasad Ghosh, Dutta [18, part V, p. 315] writes that the true history of P. C. Ray's involvement in the revolutionary movement in Bengal "must remain necessarily a mystery hidden and lost." This statement was repeated in 2022 by Chakrabarty [13, Part III, p. 227]. However, the 2015 publication by Anil Bhattacharya [8] unearthed numerous police records to reveal a great deal of the story. In particular Chapter 6 of Bhattacharya's work deals with P. C. Ray's involvement with the revolutionaries. While whether the records unearthed by Bhattacharya tell the complete story cannot be determined with certainty, nevertheless the material is sufficient to indicate a high level of active, but deniable, involvement of P. C. Ray in the revolutionary activities of Bengal.

In 1919, P. C. Ray attended a meeting called by C. R. Das against the Rowlatt Act. Due to being a well recognised personality, he was called upon to address the gathering. However, he was greeted with ovation after ovation and was unable to complete his sentence that there were occasions when even a scientist was required to get involved in protests [36, pp. 231–232].

P. C. Ray was actively involved in the Gandhian national movement of the 1920s. Despite being a scientist, his reason for such involvement was noted in 1924 [28, p. 59]:

> **[R3]** It is true that I am essentially a chemist but if I keep myself entirely aloof to-day on that plea from this national movement then the future generation will not hesitate to call me selfish and take me to task.

He travelled extensively throughout the country for the nationalistic purposes as he summarises [36, p. 228]:

> **[R4]** I made frequent tours (1921–26) throughout the length and breadth of our land preaching the need of supporting the National Schools which had sprung up and also the *khaddar* and of removing that great curse of Hinduism – untouchability.

The extent of his travels within the country can be understood from the following passage in his 1932 autobiography [36, p. 208]:

> **[R5]** A rough calculation shows that I have travelled throughout the length and breadth of this vast continent several times over and have covered at least 200,000 miles during the last ten years.

For P. C. Ray, a major motivation for setting up domestic manufacturing was to prevent import. The following passage [1, p. 96] shows what he understood by being Swadeshi.

> **[R6]** "Swadeshism" is based upon pure love of one's country-made products. "I am Swadeshi," he said, "and Swadeshi is my religion and it has been my life-long end to manufacture those articles which I have to import from foreign lands. Political consideration does not sway one."

During the height of the non-cooperation movement, he declared [36, p. 228]: "Science can afford to wait but Swaraj cannot."

While he supported Gandhian movement for independence, he did not support all of Gandhi's policies; for example, the following passage from his Convocation Address at the Jamia Millia Islamia, shows that though P. C. Ray was aware of the Asian political issues, he was not in favour of linking the issue of Indian independence to external issues [1, p. 96].

> **[R7]** I am certainly not impervious to the grandeur of the Pan-Islamic movement as one of the most promising portents of the awakening of Asia, nor to the sublimity of the spiritual call of the Khalifa upon the rank and file of the faithful in all parts of the world, but these demands must be all viewed in their proper perspective and must not be allowed to drown the clarion call of Mother India herself to her sons for achieving an independent, sovereign, national life. We must not allow our loyalty to the mother country to be swamped by the wave of extra-territorial patriotism. India must not be a spoke in the Khilafat wheel gyrated from Istanbul. The Swaraj of India must be our one all compelling goal, and everything else must be kept in its place.

The following passage attributed to P. C. Ray by Ranjit Singh Satyasray [1, p. 224] clearly shows P. C. Ray's down-to-earth attitude towards democracy and independence.

> **[R8]** If you want to establish government of the people, by the people and for the people, you shall have to come down to the level of the ordinary man. Whatever ideal you worship and practise in your private life or in public life, you shall have to identify yourself with the aspirations of the common man. His concern, first and foremost, is earning a square meal. Give up lazy dreams. Instil into the masses the ideas of independence. It is not a labour of love, it is the struggle for which labour is an absolute necessity. Lead them step by step, bit by bit. There is no hope for Swaraj by chance.

P. C. Ray was critical of the British rule throughtout his life, starting from his student days when he wrote the essay on the Mutiny to his later life when he advocated independence. However, P. C. Ray's view of English rule was more complex than a straightforward and simple rejection. The following extract from his speech at the Calcutta Town Hall on 4 March 1918 to mourn the passing away of Willam Wedderburn provides a more nuanced point of view [35, p. 300].

> **[R9]** The ultimate moral justification of England's rule over India is not *Pax Britannica*, not even the economic prosperity of the country, but the preparation of the Indian people for self-government.

P. C. Ray became more directly involved in politics towards the end of his life. To explain his involvement, it is required to delve a little into history of electoral politics in pre-independence India. The Indian Councils Act of 1909 provided for elections to legislative councils; muslims were made a separate electorate, in the sense that the muslim community elected their representatives. The Muslim League (ML) welcomed the separation of electorates, while the Indian National Congress (INC) opposed the idea. However, in the Lucknow Pact of 1916 between the INC and ML, the INC in principle accepted the idea of separate electorates. The Government of India Act of 1919 extended the separation of electorates to other minorities. The INC rejected the entire 1919 Act. The Communal Award of 1932 extended the separation of electorates to the depressed classes. This separation led to a strong difference of opinion between Gandhi and Ambedkar, which is a separate story. The Congress Working Committee found the Communal Award to be "absolutely unsatisfactory," but since the Congress represented all sections of the society, in view of division of opinion about the award prevalent in the society, it took the stance of neither accepting, nor rejecting the Communal Award [43, p. 373].

In 1934, Madan Mohan Malaviya formed the Congress Nationalist Party, which was a party within the INC, to oppose the Communal Award. Around this time, P. C. Ray became directly involved in politics. He also opposed the Communal Award, and became the President of the Bengal branch of the Congress Nationalist Party [5, pp. 223-224]. However, P. C. Ray does not appear to have had major involvement in the subsequent activities of the Congress Nationalist Party.

The Communal Award was modified based on the Poona Pact (between Gandhi and Ambedkar, and was related to the issue of representation of the depressed classes) and became institutionalised by the Government of India Act in 1935. Due to religion-based separation of electorates there was a feeling of insecurity about political representation among the Hindu community in Bengal. In 1936, a memorial was submitted to Lord Zetland which was signed by the leading Hindu personalities of that time, including Rabindranath Tagore, P. C. Ray, and others. The Hindu community being a minority in Bengal, the petition asked for "same protection that is guaranteed to Minorities of the other Provinces." (See [15, p. 25].)

In effect, the post-1930 phase of P. C. Ray's involvement in politics was significantly more complicated than his previous nationalism.

Even towards the end of his life, P. C. Ray remained actively sensitive about world affairs. In 1941, over 70 leading Bengalis led by P. C. Ray issued a manifesto which expressed sympathy with Soviet Russia in the face of onslaught of the Nazi invasion [44, p. 128].

2.8 Literature

Apart from his scientific research, P. C. Ray wrote textbooks on Chemistry and Zoology. He also wrote on Indian Colours (1929) and on Khadya Bigyan (in Bengali, meaning Food Science, 1936).

P. C. Ray wrote extensively on science education, and various social issues. He was a prolific author and wrote in both Bengali and English. His collected works are spread across multiple volumes. His first major Bengali piece was the essay *Bangalir Mastishka O Tahar Apyababohar* (1909). The English translation was published in 1910 with the title *Bengali Brain and Its Misuse*. P. C. Ray regularly contributed articles to various newspapers and magazines including *Monthly Basumati*, *Bharatbarsha*, *Ananda Bazar Patrika*, *Prabasi*, etcetera. Some of the most important of P. C. Ray's ideas can be found in the presidential addresses that he delivered at various national level conferences, and in his convocation addresses. P. C. Ray published his English autobiography in two volumes in 1932 and 1935 with the title *Life and Experiences of a Bengali Chemist*. The Bengali autobiography *Atmacharit* was published in 1937.

3 A History of Hindu Chemistry

The authoritative work by P. C. Ray entitled *A History of Hindu Chemistry from the Earliest Times to the Middle of the Sixteenth Century A.D.* was published in two volumes in 1902 and 1909. This work was a result of many years of research.

The following narrative of how P. C. Ray came about to undertake the writing of the book is mentioned in the Preface to the first edition dated May 1902 of the first volume of the work [30, Preface to the first edition]:

> **[R10]** The progress of chemical knowledge among the ancient nations has always had a fascination for me. The classical works of Thomson, Hoefer and Kopp have been my favourite companions for the last twelve years and more. In the course of my studies in this field I was naturally led to an inquiry into the exact position which India occupies therein, and with this view I undertook a systematic examination, from the chemical standpoint, of the Charaka, the Susruta and the various standard works of the Ayurvedic and Iatro-chemical Periods, which have escaped the ravages of time.

The actual trigger to undertake the huge and systematic exploration of the subject came from a correspondence with the well known French chemist Marcellin Berthelot as noted in his preface to the first edition.

> **[R11]** It was at this stage that I was brought into communication with M. Berthelot some five years ago—a circumstance which has proved to be a turning-point, if I may so say, in my career as a student of the history of chemistry.

In response to Berthelot's letter P. C. Ray wrote a paper based on *Rasendrasara Samgraha* and communicated the paper to Berthelot. This paper was praised by Berthelot in an article in *Journal des Savants*, which P. C. Ray noticed while attending a meeting at the Asiatic Society.

The high praise of Berthelot for P. C. Ray's paper motivated P. C. Ray to undertake the grand programme of deeply delving into various scriptures to extract the history of ancient Indian chemistry.

The publication of the first volume was well appreciated and received positive reviews in *Knowledge*, *Nature*, *American Chemical Journal*, and also a review by Berthelot in *Journal des Savants* [36, p. 119]. After the publication of the first volume in 1902, P. C. Ray took a break for a few years to bring himself up to the latest research on modern chemistry, before getting back to the work on the second volume. After a few more years of research, he published the second volume in 1909. Subsequent scholarship continued to appreciate and praise P. C. Ray in high terms for this work.

The first volume has a long introduction which is accessible to a non-specialist. Chemistry in ancient India was part of medicinal preparations, as well as industrial applications. Some aspects of chemistry developed in association with mystic rituals. P. C. Ray divides the history of chemistry in ancient India into five periods.

Vedic period. P. C. Ray's description of this period covers the alchemical ideas in the Vedas. The book mentions that the *Rigveda* recognised the medicinal value of some plants, and also the effect of the Soma plant, but it was the *Atharvaveda* which contained most of the early ideas [30, p. iv]:

> **[R12]** It is in the "Atharva-veda" however, that plants and vegetable products in general are fully recognised as helpful agents in the treatment of diseases, though their use is invariably associated with the employment of charms, spells, and incantations.

Ayurvedic period. Extends from the pre-Buddhistic era to circa 80 CE. P. C. Ray's description of this period starts with a description of matter as understood in those times. The book covers chemistry in the Charaka and the Susruta, chemistry in the Bower manuscript (a collection of seven Sanskrit treatises written on birch bark in early Gupta script, dating back to the late 5th or early 6th century CE), and chemistry in the works of Vagbhata. The chemistry in this period developed primarily to fulfill medicinal properties. Among other things, use of alkalis find prominent mention, as also the preparation of gold, silver, copper, iron, and lead and the use of mercury.

Transitional period. Extends from 800 CE to circa 1100 CE. P. C. Ray's decription of this period covers chemistry in the Siddha Yoga of Vrinda (circa 900 CE) and in the works of Chakrapani (circa 1060 CE) of Bengal. The discussion of the works of Vrinda mentions preparations in which sulphide of copper figure, while the discussion of the works of Chakrapani mentions black sulphide of mercury, and preparations of caustic alkali. In this period, the use of metallic preparations, minerals, and mineral-based compounds began to be used in medical practices.

Tantric period. Extends from 1100 CE to circa 1300 CE. P. C. Ray's description of this period covers chemistry in *Rasarnava* which is an extensive treatise on mercury and metallic

preparations written in the form of a dialogue between Shiva and Parvati. The development of chemistry, particularly that of mercury, in this period was motivated by mysticism – as a means to achieve spiritual liberation, physical immortality, and a divine body while still alive.

Iatro-Chemical period. Extends from 1300 CE to circa 1550 CE. P. C. Ray's description of this period covers chemistry in *Rasaratnasamuchchaya* which is an extensive treatise on various metals including metallurgical procedures and detailed discussion on mercury. There was a shift from the impossible goals of the Tantric phase (such as seeking magical elixirs) towards more practical and achievable applications in medicine.

While chemistry developed in ancient India to fulfill the needs of medicine, there was also simultaneous development of chemistry for practical industrial and technical applications, specifically in metallurgy, technical arts, and goldsmithy, as well as the manufacturing of colours and dyes. An example of the development of chemistry in India may be understood from the following passage [30, pp. xcvii-xcviii]:

> The knowledge in practical chemistry, prevalent in India in the 12th and 13th centuries A. D., and perhaps earlier, such as we are able to glean from Rasarnava and similar works is distinctly in advance of that of the same period in Europe.
>
> ...
>
> The colour of flames as a diagnostic test of metals was well understood.
>
> The metallurgical processes, leave little to improve upon ... and, indeed, they may be transferred bodily to any treatise on modern chemistry.

The book devotes a chapter to the transmission of knowledge of chemistry from India to the Arab world and from there to Europe.

About his work on the history of Indian chemistry, P. C. Ray writes in his essay *Bengali Brain and Its Misuse*, published in 1909 [34, p. 26]:

> **[R13]** I am as proud of the glories of the Hindus of old as anybody and I have spent the best years of my life in rescuing from oblivion and bringing before the world the contributions of the Hindus to the great branch of the science which I have the honour to profess.

The statement shows two things. Firstly, P. C. Ray mentions that he spent the "best years" of his life on the research that was required to unearth the history. This clearly shows that he worked on this compendium for many years. Given that the two volumes were published in 1902 and 1909, and that the work on the first volume itself was a multi-year effort, one may infer that the entire work took him almost two decades to complete – when he was in his thirties and forties, indeed the best years in the life of a scientist. Secondly, P. C. Ray mentions his sense of pride in discovering the work that was done in ancient India.

However, this sense of pride was also accompanied by a sense of despondency that research in chemistry subsequently died out in India. In the chapter entitled "Knowledge of Technical Arts and Decline of Scientific Spirit" P. C. Ray points to two consequences of the strictures of

Manu being followed rigidly. One of the criticisms pertains to the restrictions on touching a corpse [30, p. 193]:

> **[R14]** Manu now laid down that the very touch of a corpse would defile the sacred person of a Brahmin and thus we find that shortly after the time of Vagbhat the handling of a lancet was discouraged and anatomy and surgery fell into disuse and became to all intents and purposes lost sciences to the Hindus.

The other criticism is broader and describes how the rigid implementation of the caste system led to the dying out of science in India [30, p. 193–196]:

> **[R15]** It was considered equally undignified to sweat away at the forge like a Cyclops. Hence the cultivation of the *Kalas* by the more refined classes of the Society ... has survived only in traditions for a very long time past.
>
> The arts being thus relegated to the low castes and the professions made hereditary, a certain degree of fineness, delicacy and deftness in manipulation was no doubt secured, but this was done at a terrible cost. The intellectual portion of the community being thus withdrawn from active participation in the arts, the *how* and *why* of phenomena – the co-ordination of cause and effect – were lost sight of – the spirit of inquiry gradually died out among a nation naturally prone to speculation and metaphysical subtleties and India for once bade adieu to experimental and inductive sciences. Her soil was rendered morally unfit for the birth of a Boyle, a Des Cartes or a Newton and her very name was all but expunged from the map of the scientific world.

In the above passage, Boyle refers to Robert Boyle (1627–1691) who is considered to be the first modern chemist. Footnotes to the passage clarify two points. The first footnote states [30, p. 195]:

> **[R16]** The Vedanta philosophy, as modified and expanded by Sankara, which teaches the unreality of the material world, is also to a large extent responsible for bringing the study of physical science into disrepute. Sankara is unsparing in his strictures on Kanada and his system.

The second footnote identifies the following effect of the paralysing effect of casteism and strict implementation of the *Shastras* [30, p. 196]:

> **[R17]** Among a people ridden by caste and hide-bound by the authorities and injunctions of the *Vedas*, *Puranas*, and *Smiritis* and having their intellect thus cramped and paralysed, no Boyle could arise ...

The passages (R16) and (R17) are from the first volume of *A History of Hindu Chemistry*, published in 1902. Similar ideas were stated by P. C. Ray in his Presidential Address to the Seventh Indian Science Congress in 1920. A passage similar to (R16) can be found in this address [7, p. 717]:

[R18] To the Hindu, nursed in the principles of Vedanta, the material world has no real existence; and Sankara, as an exponent of the Vedanta philosophy, is unsparing in his criticism and denunciation of the atomic theory as propounded in the Vaiseshika philosophy.

Further, another passage similar to (R17) appears in the address a few paragraphs after (R18):

[R19] .. with the decay of ancient Hindu and Buddhistic culture, an intellectual torpor took possession of the Indian mind and the spirit of enquiry after truth rapidly declined. Authority of the Shashtras took the place of reason and clouded human intellect. A state of mind was thus fostered which was inimical to the study of Science, which accepts things not on trust, but by verification.

Both (R16) and (R18) show P. C. Ray's view that the *Vedanta* philosophy as expounded by Shankaracharya was not conducive to the growth of science. As to the explicit reason for the decline of science, P. C. Ray's view can be clearly found in (R15), (R17) and (R19).

3.1 Buddhist Contributions to Medicine and Chemistry

The title of P. C. Ray's work mentions "*A History of Hindu Chemistry*." This may seem to suggest that the book covers the history of chemistry as practised by the followers of the Hindu religion. Such a view, however, is incorrect. The word "Hindu" in the title was intended in a broad sense to represent ancient India. In particular, P. C. Ray accords high praise to the Buddhists for their contribution to Indian chemistry.

The following passage identifies the great Indian Chemist Nagarjuna as a Buddhist [30, p. xxiv]:

[R20] The *Susruta*, such as has been preserved to us, is generally held to be a comparatively modern recension by the celebrated Buddhist Chemist, Nagarjuna, who is said to have added the Uttaratantra or the Supplement.

As mentioned in Section 2.4, P. C. Ray made a financial contribution towards the instituting the Nagarjuna Prize. This shows the high esteem in which P. C. Ray held Nagarjuna's role in the history of Indian chemistry. There are several prominent Nagarjunas in ancient India, and P. C. Ray writes [30, p. xciv]:

[R21] It is doubtful, however, if Nagarjuna, the philosopher, is the same as Nagarjuna, the alchemist, ...

Another passage identifies the renowned physician Vagbhata also as a Buddhist [30, p. xlviii–xlix]:

[R22] Next to the Charaka and the Susruta, the medical authority, who is held in the highest estimation throughout India, is Vagbhata, the author of Astangahridaya (lit. heart or the kernel of the eight limbs or divisions of the Ayurveda).

> The opening salutation of Ashtanga, which is addressed either to Buddha or some Buddhistic emblem, clearly reveals the religious faith of its author,
>
> ...
>
> Internal evidence also fully supports our author's proclivities towards Buddhism.

P. C. Ray identifies a possible reason for the contribution of the Buddhists to medicine [30, p. lviii]:

> **[R23]** The religion of *Sakyamuni* inculcates the alleviation of distress and suffering, both moral and physical, as one of the essential articles of faith, and hence we find throughout Buddhistic India hospitals attached to the numerous monasteries for the treatment of man and beast alike.

Regarding the Tantras, P. C. Ray distinguishes between Brahminic, Buddhist and mixed Tantras [30, p. lxx]:

> **[R24]** There are however two distinct classes of Tantras—Brahminic and Buddhistic—dealing in magic, alchemy, sorcery, and allied subjects, which will claim our attention here.
>
> ...
>
> We have also a class of Tantras which is an admixture of Buddhistic and Saiva cult.

In a footnote to the salutation in *Rasaratnasamuchchaya* P. C. Ray states [30, p. 76]:

> **[R25]** The salutation is strictly Buddhistic and is on all fours with the opening lines of Vagbhata's *Ashtangarhridaya* and of *Amarakosha*, both of which are known to be by Buddhist authors.

The above quotations from his *A History of Hindu Chemistry* themselves clearly identify the Buddhist contributions. Regarding the contributions of Buddhists to medicine and chemistry, P. C. Ray explicitly states in his essay *Bengali Brain and Its Misuse* [34, p. 7]:

> **[R26]** To the Buddhists India is deeply indebted for the cultivation and improvement of the sciences of medicine and chemistry.

4 Socio-Religious Outlook

Starting from around 1909–10, P. C. Ray wrote extensively on various social issues. A major theme of his writings was advocation of rationalism. He was also a strident critic of the caste system, and of rigid adherence to scriptural dictates. In the following sections, we provide brief overviews of various aspects of his socio-religious outlook, including rationalism, caste system, as well as how he viewed his membership of the Brahmo Samaj, and his admiration for Rammohan Roy.

4.1 Rationalism

In 1909, P. C. Ray published his first major Bengali essay titled *Bangalir Mastishka O Tahar Apababohar*, and in 1910 he published an English version of the essay with the title *Bengali Brain and Its Misuse*. While the two essays contain mostly the same ideas, the English version is not a direct translation of the Bengali version. There are passages in the English version which are not present in the Bengali version, and vice versa. The two essays contain many strands of his core ideas. We refer to our article [40] for an analytical study of the essays. Below we provide examples from the English version of the essay to illustrate the rationalistic strands of thought of P. C. Ray.

At various places, the essay repeatedly stresses the role of rationalism in the development of a nation. This point is succinctly expressed in the following sentence [34, p. 3]:

> **[R27]** Rationalism is the very fountain of a nation's life; the down fall of the Bengali nation commenced from the time when this fountain began to dry up and with it originality and the spirit of inquiry disappeared.

The essay identifies the Rationalistic Age of ancient India which extends from about 600 BCE to 700 CE. The characterising features of this age were rationalism and the spirit of inquiry, and P. C. Ray mentions [34, p. 8] that this was "an age prolific of the best specimens of the Hindu brain-power." To illustrate his point about rationalism, P. C. Ray provides two concrete examples of free thinking in ancient India. The first example is that of Sage Kapila who was the propounder of the school of philosophy known as *Samkhya Darshan*. P. C. Ray writes [34, p. 5] that the Sage Kapila went to the extent of calling into question the very existence of God, since "it cannot be proved to demonstration." While Sage Kapila challenged the notion of God, he did accept the authority of the Vedas. P. C. Ray mentions that Sage Charvaka challenged even the authority of the Vedas, and called into question the various practices advocated in the Vedas. P. C. Ray highlights the importance of the Charvaka view [34, p. 6]:

> **[R28]** The philosophy of Charvaka bears eloquent testimony to the spirit of inquiry in ancient India.

It is interesting to note that P. C. Ray's appreciation of the Charvaka view was despite him being a believer in (the Brahmo view of) God as can be understood from the following passage as part of his presidential address at the Tangail (Mymensingh) Session of the Bengal and Assam Brahmo Conference in 1936 [1, p. 101].

> **[R29]** I adopted worship of the Supreme Reality as the highest achievement of life, and I have travelled through life always keeping meditation and worship of the Divine Truth and the motto, 'To love God and to do work dear to Him is real worship' before my mind to guide me as the pole star.

In the Bengali version of the essay, P. C. Ray explicitly states that ancient India achieved excellence due to rationalism and free thinking, and further, if India has to regain excellence then that spirit must arise once more [33, p. 37]:

[**R30**] এককালে ভারতবর্ষের উন্নতি হইয়াছিল— স্বাধীন চিন্তা ও স্বাধীন আচারের দ্বারা। আবার যদি ভারতের উন্নতি হয়, তবে তাহাও স্বাধীন চিন্তা ও স্বাধীন আচারের অনুষ্ঠান দ্বারাই হইবে।

...

হারবার্ট স্পেন্সার বা শঙ্করাচার্য উভয়েই বলিয়াছেন বলিয়াই কোনো কথা মানিয়া লইতে হইবে তাহা নহে। নিজের যুক্তি ও বিচারের দ্বারা উহার যথার্থ প্রমাণিত হইলেই তবে তাহা গ্রহণ করিতে হইবে। ইহাই স্বাধীন চিন্তার মূল সূত্র।

Our translation:

> In the ancient age, India achieved excellence due to freedom of thought and action. If India is to improve in the future, then such improvement will also be based on free thought and action.
>
> ...
>
> One should not accept something only because Herbert Spencer or Shankaracharya said so. One should only accept a statement after determining its appropriateness using one's own judgement and reason. This is the core principle of free thought.

The Rationalistic Age did not last. At some point, India entered what P. C. Ray calls the Dark Age. He provides an explicit characterisation of what he means by the Dark Age of a nation [34, p. 4]:

> [**R31**] The world's history, however, reveals the fact that when nation is reduced to [a] state of intellectual stagnation, it loses the capacity to think for itself and places unshakable faith in the past. It forgets that the world moves—that progress is the law of nature—that a nation, if it means to survive, must alter its manners and social customs according to the exigencies of times. When a nation is reduced to this abject and fallen state, it begins to look upon the scriptures as infallible and borrow light therefrom for its guidance in every-day life. This stage in the life of a nation may be characterised as its Dark Age.

Looking to the past, and rigid implementation of scriptural dictates led to the loss of inventiveness. P. C. Ray makes this explicit point in the following passage [34, p. 27]:

> [**R32**] The Hindu put on the shackles of the *Shastras* and *Smritis* and the result was that from morn to noon and from noon to dewy eve his life was a dreary routine of rites and observances. He became an automaton—all his movements being controlled from outside. He had no time to think for himself. No wonder he ceased to produce any work betokening originality.

The effect of rigid implementation of scriptures on the progress of science was pointed out by P. C. Ray in his *A History of Hindu Chemistry*; see (R14) and (R17).

In a later essay entitled *Satyer Sandhan*, P. C. Ray provided an important viewpoint about not only understanding truth, but publicly accepting it. He mentions that as a teacher he taught generations of students about the true cause of eclipses, that they are caused by the motion of the Moon and the Earth, and has nothing to do with the superstitious notion of *Rahu*

swallowing the Sun, and then later releasing it. P. C. Ray goes on to say that he taught this to thousands of students and they also understood it quite well. However, during eclipses, they discarded all their understanding and knowledge and followed the prejudices and superstitions of the society at large. As the moral of the story, P. C. remarks [10, p. 585]:

> **[R33]** আমি অশিক্ষিত অথবা নিরক্ষর লোকেদের কথা বলিতেছি না; কারণ জনশ্রুতি, লোকাচার এবং দেশাচারই তাহাদের নিকট ধর্ম— যুক্তির দ্বারা সত্য-মিথ্যা বাছিয়া অথবা বিচার করিয়া লইবার মত শিক্ষা বা সামর্থ্য তাহাদের নাই। যে জাতির শিক্ষিত সম্প্রদায় সত্য কি তাহা জানে এবং বোঝে, কিন্তু জীবনে বরণ করিয়া লইতে প্রস্তুত নহে,— মনের গোপনে, লোকচক্ষুর অন্তরালে যে সত্যের নিকট লজ্জায় মস্তক অবনত করিতেছে,— অথচ, বাহিরে জনসমাজে এবং সভার মাঝারে তাহাকে স্বীকার করিবার সাহস নাই— সে জাতি কেমন করিয়া জগতের নিকট সগর্বে মাথা তুলিয়া দাঁড়াইবে তাহা আমার বুদ্ধির অতীত।

Our translation:

> I am not talking about the unlearned and the illiterate people; for them tradition and long-held customs constitute religion – they do not have the education to differentiate between truth and falsehood based on reason. A nation whose educated class knows and understands what is truth, but is not prepared to accept it in their lives – in their minds, and in privacy they are willing to bow to truth, – but publicly in society, they do not have the courage to accept truth – how that nation will raise its head in the world is beyond my comprehension.

The charge of P. C. Ray to the educated to publicly accept truth remains valid in all ages.

Even as a young boy, P. C. Ray noticed irrational behaviour of people. In his autobiography, he relates [36, p. 19] a tale from August 1870 when he visited Calcutta for the first time. He writes that the a new system of water-works had been completed which supplied filtered water, but "the orthodox Hindu still hesitated to make use of it as being impure." However, he goes on to write that due to the superior quality of the water, slowly "reason and convenience triumphed over prejudice," and the people generally began to use the water from the new facilities.

In his later life, P. C. Ray not only preached rationalism, but also practised it. In the 1890s he was trying to set up the production of chemicals from locally available raw material. As part of this endeavour, he procured cattle bones from local butchers and burnt them down to obtain bone ash. The bone ash was treated with sulphuric acid to obtain super phosphate of lime which after neutralisation by soda yielded a solution of phosphate of soda that upon evaporation provided phosphate of soda crystals. While this part of the story is itself interesting, the rationalism aspect is illustrated by the next part of the story as related by P. C. Ray [36, p. 99]:

> Here I pause for a while to draw attention to my way of lecturing to students. I used to place on the table samples of burntbones, which had now nothing to do with the sources they came from; they might have been derived from the sacred cow, or the horse or the human skull. The burnt bone was almost a pure chemical compound, absolutely free from organic impurities—being to the chemists, *phosphate of calcium* and in the powdered form it is prescribed as a nerve tonic. I would often put a bit

> of the burnt bone into my mouth and chew it and even swallow it wholesale and invite my pupils to do the same. Some of them would readily come forward; but others hesitated and could not shake off their orthodox notions.

The above pertains to P. C. Ray's teaching at Presidency College in the 1890s and 1900s. We leave to the reader's imagination to guess as to what would happen if a chemistry teacher tried the above 'experiment' in a modern day College.

4.2 Criticisms of Casteism

P. C. Ray was a life-long strident critic of the caste system. There are at least three aspects to his criticisms of the caste system. Firstly, he held the caste system to be one of the factors for the decline of science in India. Secondly, he realised the political aspect of casteism, and how it divided society. Thirdly, P. C. Ray criticised the basic lack of empathy towards fellow humans which was a feature of the prevalent caste system.

Regarding the effect on science, in his work *A History of Hindu Chemistry*, P. C. Ray criticised the caste system for being responsible for the dying out of scientific research in India; see (R15). Further, P. C. Ray also quotes the passage in (R15) from his *A History of Hindu Chemistry* in his essay *Bengali Brain and Its Misuse*, thus bringing it to the notice of a more general readership, compared to the more specialised readership of *A History of Hindu Chemistry*; see [34, p. 10].

As to how the rigid caste system arose, in *A History of Hindu Chemistry*, P. C. Ray pointed to the rise of such system as a consequence of the rise of Brahminism following the decline of Buddhism [30, p. 192]:

> **[R34]** In the Vedic age the Rishis or priests did not form an exclusive caste of their own but followed different professions according to their convenience or natural tastes,
>
> ...
>
> But all this was changed when Brahmins reasserted their supremacy on the decline or the expulsion of Buddhism.
>
> The caste system was established *de novo* in a more rigid form. The drift of Manu and of the later Puranas is in the direction of glorifying the priestly class, which set up most, arrogant, and outrageous pretensions.

Political aspects of the caste system was pointed out by P. C. Ray in his 1917 presidential address to the Indian National Social Conference. This address provided an extensive analysis and severe criticisms of the caste system. His overall diagnosis of the problems of the country included the caste system and also emphasised the backwardness of women in the contemporary Hindu society [38, p. 20]:

> [T]hanks to the cumulative effect of centuries of social inequalities and oppression, of the degradation of the condition of women and of large sections of the people, and the walls of differences raised between man and man by custom and tradition, India now lies at the feet of nations — powerless and helpless.

An explicit reference to the political dimension of the caste problem was made by P. C. Ray [38, pp. 1–2]:

> **[R35]** It is our failure to recognise that the question which presses for solution at the present moment is as much a political as a sociological one.

In fact, regarding the solution to the caste question, he makes an even stronger statement [38, p. 15]:

> **[R36]** The future of India – her claim to call herself a nation – depends upon the solution of this burning question.

The essay *Jatibhed O Tahar Prayschitto* (in Bengali) extensively analyses and criticises the caste system [32, p. 317]. Another essay *Satyer Sandhan* (in Bengali) also criticises the caste system. In particular, the essay makes a passionate criticism of the lack of empathy shown by higher castes towards lower castes; see [10, p. 588]. His autobiography devotes an entire chapter to the caste system and its "baneful effect on Hindu Society" [36, p. 502].

In several of his writings and speeches, P. C. Ray pointed to the example of Japan to show that it is indeed possible to completely get rid of social barriers. The point that he made was that while Indians viewed Japan with admiration as an example of how an Asian achieved significant political progress, the same Indians would overlook the tremendous social change that Japan introduced leading to a homogeneous nation which resulted in the political progress. P. C. Ray's description of the Japan example is captured by the following passage from his Presidential Address at the Indian National Social Conference [38, pp. 11–12]:

> **[R37]** Up till the seventies of the last century, the *Samurai* clans had monopolised to themselves all the privileges now arrogated by our Brahminical castes. The *eta* and the *hinin* (the *untouchables* of Japan) were regarded so impure and unclean that they were not even allowed to dwell in the ordinary villages but had locations assigned to them ... But on the memorable day of 12th October in 1871, the *Samurai*, with a spirit of chivalry no less of patriotism voluntarily parted with their vested interests and abolished the artificial and invidious caste distinctions and thus laid the foundations of a compact and homogeneous nation.

4.3 Brahmo Samaj

In his adulthood, P. C. Ray became part of the Brahmo Samaj, though his father was not part of this Samaj. From his writings, it becomes clear that his rationalistic outlook played a major part in his becoming a member of the Brahmo Samaj. Writing about his college days in his autobiography, P. C. Ray remarks [36, pp. 30–31]:

> **[R38]** Strange as it may appear, from my boyhood I was unconsciously drawn towards the Brahmo Samaj.
>
> ...
>
> I was not under the influence of any particular dominating personality in the shaping of my religious bias. Revealed religion I have had an innate disbelief in.

...

Later on the discrepancy between the Mosaic Chronology and the geological age of this habitable globe of ours further shook my faith in the so-called revelations. Moreover, the caste-system, as it is in vogue in the existing Hindu Society, with its pernicious appendage of untouchability, appeared to me the very negation of the relation existing between man and man. Enforced widowhood, child-marriage and other customs were equally my abomination.

...

It was the social aspect of the Brahmo Samaj that specially appealed to me.

We note two aspects in the above passage – his aversion to revealed religion which was a consequence of his rationalistic outlook, and his dislike of the divisive aspects of the caste system, and the other ills of the prevalent Hindu society – which shaped his decision to become a member of the Brahmo Samaj. He writes more explicitly about the positive aspects of the Brahmo Samaj [36, p. 146]:

[R39] The Brahmo Samaj movement aimed at the abolition of caste-system, the removal of social inequalities and uplifting of women by the spread of education among them. It was altogether democratic in its tendency.

He became a member of the Sadharon Brahmo Samaj and actively took part in its activities [36, p. 85]:

[R40] Work in connection with social service has also been my hobby; as a member of the Brahmo Samaj I threw myself heart and soul into its activities. It fell to my lot to organise the *Brahmobandhu Sabha* and its evening parties, so as to bring together members of our church scattered throughout the town. The Sadharan Brahmo Samaj is founded entirely on a democratic basis and is a commonwealth of the church of God. I was elected a member of its Executive Council and served in that capacity for several years.

4.4 Rammohan Roy

In his whole life, P. C. Ray came into contact with many leading personalities, including Gokhale and Gandhi. While talking about such figures, P. C. Ray refers to them with reverence. One such figure whom P. C. Ray mentions with utmost respect in various writings is Rammohan Roy (22 May 1772 (1774?) – 27 September 1833), who was a visionary thinker and a social reformer. Understanding P. C. Ray's views about Rammohan Roy provides a glimpse into some of the core thoughts of P. C. Ray himself.

In 1823, Rammohan Roy wrote a letter to Lord Amherst where Roy put forward the proposal that instead of the government setting up a Sanskrit College, the money should be spent by the government in setting up an educational institute to teach science. About this letter P. C. Ray writes [36, p. 141]:

[R41] The value of this letter becomes all the more significant when it is borne in mind that the great reformer, the Maker of modern Bengal, or, for the matter of that, of modern India, was himself a great Sanskrit scholar. It was he who for the first time gave an impetus to the study of the Upanishads in Bengali, some of which he rendered into Bengali and afterwards into English. Ram Mohon though deeply imbued with *Vedanta* had a vision of the India of the future in which the study of the physical sciences was to play a conspicuous role.

The passage clarifies the context of Rammohan Roy's letter by saying that even though Rammohan Roy was a great Sanskrit scholar, he still understood the necessity of starting modern science education in India.

The following passage shows that P. C. Ray viewed Rammohan Roy as a phenomenon which is difficult to explain [36, p. 150]:

[R42] When Ram Mohon Ray appeared on the scene, Hindu society was wrapped in Cimmerian darkness. Rank superstition stalked over the land. One might with impunity violate the unwritten moral code and hold his head aloft in the social circle. How in the midst of such environments a man of such transcendent genius, towering personality and far-seeing vision like the great Reformer could spring up is not easy to explain.

In a Bengali essay *Sadhana O Siddhi* P. C. Ray starts by paying homage to the various contributions of Rammohan Roy [32, p. 196]:

[R43] কথারম্ভে মহাত্মা রামমোহন রায়ের পবিত্র নাম গ্রহণ করি,—যাঁর সাধনায় বর্তমান ভারতের সকল প্রচেষ্টার সিদ্ধির বীজ উপ্ত হয়েছিল; যিনি নব্য ভারতের সৃষ্টিকর্তা; অজ্ঞানকুসংস্কারাচ্ছন্ন অমানিশায় যিনি জ্ঞানের বর্ত্তিকা হস্তে জীবনের সকল পথে অগ্রসর হয়েছিলেন; ১০০ বৎসরেরও পূর্ব্বে যিনি জীবনবাঁশীতে জাগরণের সুর তুলে সুপ্ত দেশবাসীকে নূতন পথের পথিক হ'তে আহ্বান করেছিলেন; ধর্ম্ম, সমাজ ও রাজনীতি ক্ষেত্রে যিনি সর্ব্বপ্রথম সংস্কার-চেষ্টা আরম্ভ করেছিলেন;

Our translation:

[R44] Let me starting by taking the revered name of Mahatma Rammohan Roy – whose dedicated work led to the planting of seeds of achievements of modern India in various fields; who is the creator of the new India; who progressed in all walks of life with the lamp of knowledge amidst the prevalent ignorant and deeply prejudiced society; more than 100 years ago who played the role of the pied piper to show the new way to his countrymen; who was the first to attempt reform in the fields of religion, society, and politics.

In another short essay entitled *Raja Rammohan Roy O Tahar Mahatyo* dated 12 October 1933 (but was written a little while before the death centenary of Rammohan Roy) P. C. Ray writes [11, p. 415]:

[R45] মহাত্মা রামমোহন রায় নব্য বাংলার এমন কি নব্যভারতের সৃষ্টিকর্তা বলিলেও অত্যুক্তি হয়না। তিনি একাধারে যুগপ্রবর্ত্তক, ধর্ম ও সমাজ সংস্কারক,

...

বাস্তবিকের তাঁহারই নির্দ্দিষ্টপথ অবলম্বন করিয়াছি বলিয়াই আজ আমাদের নানাবিধ কর্ম্মক্ষেত্রে যাহাকিছু উন্নতি পরিলক্ষিত হয় তাহা সম্ভব হইয়াছে।

Our translation:

> Mahatma Rammohan Roy can be called the creator of the new Bengal, even of the new India. He was a pioneer of his age, a reformer of society and religion
>
> ...
>
> It is by following the path that he showed that we have made advances in the various fields of our activities.

In his presidential address at the Tangail (Mymensingh) Session of the Bengal and Assam Brahmo Conference in 1936, he made the following remark about Rammohan Roy [1, p. 101].

> **[R46]** In those dark days Raja Rammohun Roy, the great soul, began the fight against all blind customs and superstitions and it was through his effort that our country got the first taste of mental and spiritual freedom. It was Rammohun Roy who removed the heavy granite load of blind customs and rituals from the heart of the country and sounded the trumpet of Truth and Immortality to the dying race.

P. C. Ray admiration for Rammohan Roy went beyond praise; he translated from French into English an account of Rammohan Roy published by Victor Jacquemont in the *Indian Messenger* sometime between 1829–32 [7, pp. 45–50].

In 1828, Rammohan Roy founded the Brahmo Samaj, and the Brahmo Samaj Trust Deed was legalised in 1830. P. C. Ray became a member of one of the branches of the Brahmo Samaj several decades later. One may argue that since P. C. Ray was a member of the Brahmo Samaj, it was natural for him to praise Rammohan Roy, and one should not read too much into it. While there may be some merit in this argument, we note that P. C. Ray praised Rammohan Roy in several of his writings, which indicates his deep reverence for Rammohan Roy. Also, none of the passages quoted above, or any other that we are aware of, praise Rammohan Roy for founding the Brahmo Samaj. So the appreciation for Rammohan Roy that P. C. Ray expressed throughout his career cannot be said to be based on the Brahmo Samaj issue. Rather it was a recognition of the versatile genius of Rammohan Roy by P. C. Ray, in a manner that one stalwart can recognise another.

4.5 Appreciation of Different Religions

While P. C. Ray was a member of the Brahmo Samaj, he had a broad appreciation of different views within Hinduism as also of other religions. In Section 4.1, we mentioned his appreciation for the rational views of Sage Kapila and Sage Charvaka of ancient India. P. C. Ray expressed high praise for Chaitanya, whom he called the "the Prophet of Navadwipa." He mentions [34, p. 15]:

> **[R47]** The religion of love which Chaitanya preached did away with the inequalities and barriers of caste. The depressed classes rallied round his banner, nay, some of the best intellects of the day responded to his call.

As discussed in Section 3.1, P. C. Ray expressed great appreciation for the Buddhist contribution to chemistry in ancient India. Regarding the universal appeal of Buddhism and its effect on spread of knowledge, P. C. Ray writes [34, pp. 6–7]:

> **[R48]** The religion of Buddha later on preached the creed of universal love and brotherhood. The gates of learning were thrown wide open to every class of people and thus every class in its turn contributed its humble mite.

In the context of the caste system of *kulinism* prevalent in Bengal, P. C. writes [34, pp. 13–14]:

> **[R49]** The downtrodden "low-caste" people whom the cruel tyranny of the hierarchy drove to the condition of the "untouchables" ... writhing in agony and smarting under indignity, now sought relief by embracing Islamism, which not only preaches but practises the brotherhood of man.

The passage shows P. C. Ray's appreciation of equality in Islam, as also his view that caste system drove a large section of the population to embrace Islam. He put forward the following view of *Vaishnavism* that was preached by Chaitanya [34, p. 15]:

> **[R50]** Still it is not too much to say that but for Vaishnavism 95 per cent. of the population of Bengal would have embraced Islamism.

This same idea was repeated by P. C. Ray in his 1917 Presidential Address at the Indian National Social Conference [38, p. 17].

> **[R51]** Within the last three centuries, and from time to time there have arisen also in our midst saints and prophets like Guru Nanak and Kabir and Chaitanya to preach the Doctrine of the Brotherhood of Man and had it not been for their teachings a far larger proportion of the people of N. India would have embraced Islamism.

In his Convocation Address at the Aligarh National Muslim University, P. C. Ray made very interesting, and possibly quite unique, juxtaposition of the idea of *Tapovana* and the idea of simplicity in Islam [7, p. 443]:

> **[R52]** ... our tradition is that of the Tapobana, where under the sheltering bough of Nature's forests, the poor, ascetic Brahman with no thought for the morrow imparted his sacred lore to his enquiring disciples. Plain living and high thinking has ever been the Oriental ideal and Islam tells the same tale. When Heraclius, the Byzantine Emperor, sent envoys to Khalif Omar to negotiate a treaty, they could not discover the mighty Khalif and then found him asleep among the beggars on the steps of the Mosque of Medina. So ideal was their simplicity.

The address itself is a masterly overview of Islamic contribution to science and world civilisation. Towards the end of his address, P. C. Ray says [7, p. 445] that the

> **[R53]** message of equality and of fraternity, of democracy and of love is Islam's message.

4.6 Exhortation to Bengali Youth

During the late nineteenth century and the early twentieth century, one of the major problems faced by the educated youth in Bengal was that of unemployment. P. C. Ray's diagnosis of the problem is outlined in his essay *Bengali Brain and Its Misuse*. He put down the issue to the lack of enterprise among the Bengali youth. According to P. C. Ray, Bengali youth of that age considered a university degree as a passport to a government job, or alternatively the youth attempted to build a career in law. The law profession could accommodate only a very small fraction of the aspirants, and similarly government jobs were limited in number. This resulted in unemployment among youth with graduate degrees.

In the essay, P. C. Ray exhorted the youth to take up business as a profession. He pointed to the example of Bombay which had successfully set up a flourishing textile industry, while a similar industry in Dhaka had declined. Further, P. C. Ray stated that Bengalis had lost business acumen and needed to acquire it from other Indian communities.

The call for Bengali youth to adopt business as profession was made by P. C. Ray in several subsequent writings. The editorial of the later edition of *Bangalir Mastishka O Tahar Apabyabahar* mentions several such further essays [33, pp. 4–5, editorial] published over a number of years.

While some of his criticisms towards Bengali youth in *Bengali Brain and Its Misuse* were harsh, P. C. Ray ends the essay with the following rousing call [34, p. 31]:

> **[R54]** It is time we were roused from our torpor. Let the vast latent potentialities of the nation be roused to activity. Let the Bengalee distinguish himself in the field of researches and scientific investigations; let him organise industries. He will soon have his place in the comity of nations and thus fulfill the will of God.

5 Contemporary Narrative About P. C. Ray

Starting from the early 2000s, a number of articles which discuss Acharya Prafulla Chandra Ray have appeared over the last two-and-half decades [25, 4, 26, 18, 21, 17, 13, 20, 42, 39, 9, 27, 24]. The 2013–14 publication by Dutta [18] is a 6-part article running into 72 pages. It is by far the longest among all publications on P. C. Ray in contemporary times and also the broadest in scope. Another long publication is the 3-part 36-page article by Chakrabarty [13]. The other articles on P. C. Ray published since 2002 are short pieces. Also, in the cases of [39, 9], the discussion on P. C. Ray is part of an overall discussion of other related issues.

The articles in general discuss and positively mention P. C. Ray's science and nationalism. Depending on the scope, some of the articles also positively discuss his entrepreneurship in setting up Bengal Chemical and Pharmaceutical Works. On the other hand, regarding P. C. Ray's views on socio-religious issues, as also the discussion of his *A History of Hindu Chemistry*, there is a wide variance in the coverage.

P. C. Ray's involvement with Brahmo Samaj is mentioned by Majumdar [26] only as part of the chronology of his life, and Chakrabarty [13, Part III, p. 225] only mentions that he donated to Brahmo Samaj causes. None of the other articles mention P. C. Ray's membership of the Brahmo Samaj, and in particular, do not discuss how his rationalism shaped his decision to

become a member of the Brahmo Samaj. Rammohan Roy is mentioned by Banerjee [4] as part of the general narrative on the growth of rationalism. No other article mentions Rammohan Roy. As a result, P. C. Ray's great reverence for Rammohan Roy is not part of the contemporary literature. On the issue of appreciation of different religions, Banerjee [4] and Singh [42] mention that P. C. Ray was opposed to religion based politics. The general appreciation of broad religious ideas that comes across several of P. C. Ray's writings do not also appear in these articles.

In Table 3, we summarise the coverage of the above articles with respect to three aspects – Buddhist contribution to chemistry, rationalism, and criticism of casteism. From the table we first note that none of the articles identify the Buddhist contribution to chemistry. On the other two issues, Banerjee [4] provides the strongest coverage of rationalism and criticism of casteism. Also, Bhattacharyya [9] covers rationalism reasonably well even though he discusses P. C. Ray in the overall context of the National Education Movement. Among the other articles, Chakrabarty [13] covers rationalism and caste criticism in a manner that is unlikely to be missed by a reader. The other articles either omit these issues, or make only a passing mention.

The treatment of P. C. Ray's major work *A History of Hindu Chemistry* in the above publications is incomplete. Dutta [18] provides a footnote reference to Buddhists and Jains, which we discuss below. The only other reference to the Buddhist contribution to chemistry in the articles published in the last two-and-half decade is in Debnath's article [17] which merely mentions that a chapter in volume 2 of P. C. Ray's work is entitled "Alchemy of Nagarjuna and Buddhist period." Neither Dutta [18], nor Debnath [17], nor any of the other articles which discuss *A History of Hindu Chemistry* clearly identify the Buddhist contribution to medicine and chemistry which was highly praised by P. C. Ray himself; see Section 3.1. This creates the false impression that the contribution to chemistry in ancient India was made only by the practitioners of Hinduism.

Banerjee [4] and Bhattacharyya [9], mention P. C. Ray's clear-cut identification in *A History of Hindu Chemistry* of how the decline of science in general, and chemistry in particular, came about in India due to the caste system and the rigid adherence to scriptures. Majumdar [26] and Dutta [18] make a single-sentence reference to this important point. All other articles omit this point altogether.

In this context, we note the somewhat surprising title of the article at [45]: "Acharya Prafulla Chandra Ray: The Father of Hindu Chemistry." Chakrabarty [13, Part III, Reference 76b] also refers to an article with the same title dated 2 August 2021 and identifies the author to be A. K. Mitra. It is worth pointing out that calling P. C. Ray the "Father of Hindu Chemistry" is meaningless, since as established by P. C. Ray's historical work on "Hindu Chemistry," the practice of chemistry in India started in ancient times, and so it clearly did not start with the work of P. C. Ray.

So overall the discussion of the various strands of P. C. Ray's work that we have provided in this article is considerably more detailed that what is available in the contemporary literature. At the same time, we would like to point out that we make no claim of providing a comprehensive treatment. Given the extent of P. C. Ray's writings, it would require an enormous effort and great many pages to even attempt a comprehensive treatment of his ideas.

Table 3: Three aspects of P. C. Ray's thought in contemporary articles about him. A dash (—) means that the aspect is not discussed.

Publication	Buddhist contribution to chemistry	Rationalism	Criticism of casteism
Mahanti [25] *2002, Dream 2047, 7 pp.*	— (Nagarjuna only as "the great Indian alchemist").	— (quotes Ray's remark that "reason and convenience triumphed over prejudice" in using filtered water).	One sentence: Ray a "great critique" of the caste system; his 1917 address a "passionate appeal for removal of the caste system".
Banerjee [4] *2011, Breakthrough 15(1), 13 pp.*	— (calls the *History* an "unbiased scientific" study; Nagarjuna only as "great Indian alchemist").	Central theme, but the illustrations are brief: bone ash chewing demonstration to students and the eclipse story in "Search for Truth." Ray called a "pioneer in the struggle against unscientific beliefs".	Extensive: Ray's three causes of the decline of science (caste, quoting the Boyle passage; Manu's rule on corpses; the Vedanta of Samkara); his attacks on untouchability and on Congress's compromise on caste.
Majumdar [26] *2011, Indian J. Hist. Sci. 46(3), 11 pp.*	—	— (*Bengalee's Brain and its Misuse* appears only by title in the chronology, p. 530).	Reports Ray's thesis that science declined because the privileged upper classes neglected it and left it to artisans (p. 527), without the word caste. Chronology: 1917 speech against untouchability; 1933 part in the Harijan temple-entry movement (pp. 531–532).
Dutta [18] *2013–14, Mother India (6 parts), 72 pp.*	Only a footnote (Part III, p. 43) saying "Hindu" includes Jain and Buddhist; Nagarjuna and Vagbhata are not identified as Buddhists.	— ; *Bengali Brain* is mentioned once, through Sri Aurobindo's review (Part III, p. 54).	One passing sentence (Part III, p. 50): Ray "believed" that science declined with the hardening of caste; it adds a Vedanta/Shankara factor and a remark on a "Europeanised standpoint", without quotation.
Organiser [21] *2013, Organiser, online*	—	—	—
Debnath [17] *2016, Organiser, online*	Only the title of a chapter of volume 2 of the *History* ("Alchemy of Nagarjuna and Buddhist period"); no discussion.	—	—

(continued on next page)

Table 3 (continued)

Publication	Buddhist contribution to chemistry	Rationalism	Criticism of casteism
Chakrabarty [13] *2021–22, Science and Culture (3 parts), 36 pp.*	— (Parts II–III; Nagarjuna only as a prize name).	Part II (p. 115): notes the success of *Bengali Brain* and Ray's later articles on the "misuse of Bengali brains"; no discussion. Part III (p. 222): casteism and superstition as obstacles to a nation's growth.	Part II (p. 115): only lists Ray's Bengali books on casteism and social reform. Part III (pp. 222–224): casteism and untouchability "moved him most"; quotes his autobiography and 1917 address; recalls Vivekananda's aim to end caste distinctions.
Dutta [20] *2021, Dream 2047, 6 pp.*	—	—	—
Singh [42] *2021, Science India, online*	—	—	—
Sahasrabudhe [39] *2021, Science India, online*	—	—	—
Bhattacharyya [9] *2022, Abhikhhep, online*	Cites Ray's view that the decline of Buddhism and the rise of an "exclusive" Brahminism ended Hindu learning; Nagarjuna appears (iron in medicine, distillation) but not as a Buddhist.	Quotes *Bengali Brain*: rationalism as "the very fountain of nation's life", surrender of judgement to the Shastras; Kapila and Charvaka; loss of the spirit of enquiry.	No discussion of caste as such; quotes Ray that cultured Hindus "began to look down upon the lower classes".
Mitra [27] *2023 (first published 2021), Organiser, online*	— (Nagarjuna only as "great Indian alchemist").	—	One sentence on the 1917 Social Conference address, "passionate appeal for removal of the caste system" (same wording as in Mahanti).
Ghose [24] *2025, Science India, online*	—	—	—

6 Analysis of Dutta's Coverage of P. C. Ray

In this section, we focus on Dutta's 6-part 72-page article [18]. It is a very well written article with numerous anecdotes and extensive citations. The article paints P. C. Ray as a warm human being, extremely committed to the cause of science, industry building, nationalistic activities,

and making tremendous contributions to social service and philanthropy. Since the article is quite long, the impression that a reader will obtain is that the article is comprehensive. The image of P. C. Ray that comes out from Dutta's seemingly authoritative biography, however, is incomplete. It misses out on some of the core strands of P. C. Ray's thoughts. In particular, as stated above his socio-religious views including rationalism, his Brahmo Samaj identity, and admiration for Rammohan Roy, are completely missing from the picture. P. C. Ray's criticism of casteism and its effects are treated only in passing. Below we discuss in detail some of the points in Dutta's treatment of P. C. Ray which shows that the picture of P. C. Ray that Dutta paints do not do justice to certain crucial strands of P. C. Ray's views and thoughts.

6.1 On the 'Hindu' in 'Hindu Chemistry.'

In Part-III, p. 43 of his article [18], Dutta mentions in a footnote to the title *A History of Hindu Chemistry*:

> **[D1]** In early Indological discourses, the adjective "Hindu" was inclusive of Jain and Buddhist, and may be read as a synonym for "ancient Indian".

For one thing, a footnote (in smaller font than the main text) is likely to be overlooked by a reader. Secondly, and more importantly, simply saying "Hindu" is to be understood as a synonym for "ancient Indian" does not provide the reader with information about whether practitioners of religions other than Hinduism actually contributed to the development of chemistry in ancient India. Further, Dutta mentions Nagarjuna (the Chemist) several times (Part II, p. 1042; Part II, p. 1043; Part II, p. 1048 (twice); Part III, p. 48; and Part VI, p. 413) and Vagbhata is mentioned once (Part II, p. 1042), but these two figures are not identified by Dutta as Buddhists, unlike P. C. Ray who clearly identifies them as Buddhists; see (R20) and (R22). So a reader going through Dutta's 72-page essay gets the impression that the development of chemistry in ancient India was done only by the practitioners of Hinduism. This is contrary to P. C. Ray's own statements about the Buddhist contributions to Indian chemistry (see Section 3.1). The effect of the footnote in (D1) reminds one about the *Ashwatthama hata iti gaja* episode during the *Kurukshetra* battle in the *Mahabharata*.

In his 2021 article, Dutta while mentioning P. C. Ray's *A History of Hindu Chemistry* states [20, p. 20]:

> **[D2]** As he wrote in Volume 2 of this book, "The Hindu nation with its glorious past and vast, latent potentialities may yet look forward to a still more glorious future, and, if the perusal of these pages will have the effect of stimulating my countrymen to strive to regain their old position in the intellectual hierarchy of nations, I shall not have laboured in vain."

The quote attributed to P. C. Ray appears at the very end of the Preface in [31, Preface, last paragraph]. While in his 2013–14 article, Dutta had provided the footnote (D1), in his 2021 article Dutta does not qualify the passage in (D2), by clarifying the sense in which the word 'Hindu' was used by P. C. Ray. While the footnote (D1) given in [18] is inadequate as discussed above, in [20] Dutta does not even provide such a qualification to the word "Hindu." A reader

going through [20] will be led to the incorrect belief that the contributions to chemistry in ancient India were made only by the practitioners of Hinduism.

6.2 *Bengali Brain and Its Misuse*

The essay is mentioned in exactly one place by Dutta [18, Part III, p. 54]:

> **[D3]** In his review of P. C. Ray's book The Bengali Brain and its Misuse, Sri Aurobindo, while expressing reservations about some of its contents, observed: "Nevertheless the article is ably written ..."

Sri Aurobindo's review is available from [2] and also as an appendix to [34]. In (D3), Dutta refers to Sri Aurobindo's review as "expressing reservations." This is a gross understatement. While in his review, Sri Aurobindo indeed acknowledges P. C. Ray as an acclaimed scientist and does not proscribe reading P. C. Ray's essay, Sri Aurobindo is scathing in his criticisms. Among other criticisms, Sri Aurobindo states that P. C. Ray's mind was the result of "denationalising influence" of education, calls into question P. C. Ray's competence in dealing with certain themes in the essay, calls the essay itself to be "narrow and intolerant" and "void of the note of hope, encouragement and energy."

In this context, we note that in a recent article [40], we have put forward a rebuttal of Sri Aurobindo's review of P. C. Ray's essay.

6.3 Criticism of the Caste System

At only two places in his long essay Dutta makes passing mention of the caste and untouchability issues which were severely criticised by P. C. Ray.

Regarding untouchability, there is only one reference: Dutta [18, Part V, p. 314] paraphrases (R4) to mention that one of the reasons for which P. C. Ray toured India in the period 1921–26 was to campaign against untouchability (but drops the clause "great curse of Hinduism" that P. C. Ray used to qualify the notion of untouchability; see (R4)).

Regarding P. C. Ray's criticism of the caste system, there is only a passing mention by Dutta [18, Part III, p. 50]:

> **[D4]** Ray believed that the scientific spirit of ancient India declined as a consequence of the hardening of the caste system. Another factor, in his opinion, was the turn given to Vedanta philosophy by Shankara as a result of which the material world came to be regarded as an illusion causing a loss of the natural curiosity. Here again Ray seems to have been influenced by a Europeanised standpoint in looking at Indian history, an approach that needs a critical re-examination.

Since (D4) is the only mention of the criticism of the caste system by P. C. Ray in Dutta's article, we do not find Dutta mentioning the social and political effects of the caste system which P. C. Ray vigorously criticised in several of his writings; see Section 4.2.

Dutta's statement in (D4) refers to P. C. Ray's view that the caste system was a major factor which led to the decline of science in India. However, Dutta omits mentioning that P. C. Ray did not just merely "believe" that science in India declined due to the caste system. In fact,

P. C. Ray put forward strong reasoned arguments in support of his statement; see (R14), (R15) and Section 4.2.

Regarding the point that P. C. Ray considered the *Vedanta* philosophy of Shankara to be a factor in the decline of natural curiosity, Dutta does not provide a reference. The relevant references are (R16) and (R18).

The reference to "Europeanised standpoint" reflects a phrase in Sri Aurobindo's review [34, p. 50] of P. C. Ray's essay *Bangalir Mastishka O Tahar Apabyabahar*: "complete expression of the Europeanised standpoint in looking at Indian problems." Dutta does not credit Sri Aurobindo for the use of the phrase "Europeanised standpoint."

Regarding the issue of P. C. Ray adopting some standpoint, we note that P. C. Ray was a fiercely independent minded person – for example, while in general supportive of Gandhi, P. C. Ray opposed the Khilafat movement, see (R7), which Dutta also notes [18, Part V, p. 314]; for another example see (R30) for his advocacy of judging things for oneself; and there are various other examples scattered throughout P. C. Ray's writings. So saying that P. C. Ray was "influenced by a Europeanised standpoint" whereby implicitly suggesting that he did not apply his own mind is to undermine P. C. Ray's capacity for original thinking. Somewhat contrarily, in his 2021 article, Dutta himself notes [20, p. 19] that P. C. Ray was "intellectually independent."

More importantly, neither Sri Aurobindo, nor Dutta provide any reference, or argument in support of the attribution of "Europeanised standpoint" to P. C. Ray. At various places in his essay, Dutta [18] provides pin-pointed references and explicit citations, but fails to do so in (D4). We note that while Sri Aurobindo as a reviewer of P. C. Ray's essay would have been expected to provide evidence in support of his statement, the responsibility for providing supporting evidence devolves on a much larger scale to a biographer writing about seventy years after P. C. Ray passed away. P. C. Ray indeed made various references to several European scholars in many of his articles, but that is not the same thing as adopting their standpoints. In the various writings of P. C. Ray that we are aware of, it cannot be made out that he held a "Europeanised standpoint" whether on Indian problems in general, or on his views about the *Vedanta* philosophy of Sankaracharya in particular.

Finally, we note that in (R16) and (R18), P. C. Ray does not only call into question the *Vedantic* view propagated by Shankaracharya, but appears to be distinctively sympathetic to the atomic theory in the *Vaiseshika* philosophy of Kanada. So on the issue of Shankaracharya, P. C. Ray was on the side of another *Indian*, rather than adopting a "Europeanised standpoint." While this point does not apply to Sri Aurobindo's criticism of P. C. Ray, its effect on Dutta's view as stated in (D4) is quite damaging.

6.4 P. C. Ray's criticisms of the Dark Age.

Dutta notes [18, Part III, p. 49]:

> **[D5]** One should, however, remember that P. C. Ray was intolerant of any idle glorification of the past. In a speech at Rajshahi, Ray thundered:
>
> > For nearly a thousand years the Hindu nation has been as good as dead.

> As the son of a rich man having wasted his paternal property has to live a life of penury, but is full of conceit and vanity because of the wealth once possessed by his ancestors, so is the Hindu of the present day.
>
> In view of various historical facts that are coming to light, the validity of the first sentence is debatable, but the passage gives us an indication of the agony of the author of History of Hindu Chemistry at the fallen state of his country. Indeed, in some of his utterances, one can see a reflection of the general spirit of self-depreciation and indiscriminate fault-finding that characterised the early stages of the Renaissance in India.

The passage attributed to P. C. Ray in (D5) actually appears in his English essay *Bengali Brain and Its Misuse*, where P. C. Ray refers to his presidential address at the Rajshahi Literary Conference in 1909 [34, p. 1]. The presidential address was in Bengali, and in the Bengali version of his essay, P. C. Ray quotes from the original Bengali passage of his presidential address.

There is an tension in (D5): in the first part, Dutta mentions that P. C. Ray was "intolerant of any idle glorification of the past," – which suggests that P. C. Ray was discriminating in glorification, – but later says that his statements reflect "indiscriminate fault-finding." If we consider his various writings, P. C. Ray was very clear in his view of the past, and in particular what to criticise and what to praise. As discussed in Section 4.1, in his essay *Bengali Brain and Its Misuse*, P. C. Ray clearly distinguished between the Rationalistic Age and the Dark Age of India. P. C. Ray criticised people who glorified the Dark Age, for example he said that [34, p. 3]:

> **[R55]** those who base their estimate of past glories of the ... Hindu nation, in the light of the writings of Bankim Chandra ... are unconsciously led into cherishing mistaken ideas.

The figures that Bankim Chandra praised belonged to the Dark Age identified by P. C. Ray; see [34, p. 2]. This passage shows that the first part of (D5) is indeed correct.

The later part of (D5) is problematic. The terms "self-depreciation" and "indiscriminate fault-finding" in (D5) are also from Sri Aurobindo's review of P. C. Ray's essay; Sri Aurobindo writes about the essay [34, p. 49]: "It is couched in that general spirit of self-depreciation and indiscriminate fault-finding which was a characteristic of our people when national hope and energy were at their nadir." Dutta does not attribute the use of the terms "self-depreciation" and "indiscriminate fault-finding" to Sri Aurobindo. Again, like Sri Aurobindo earlier, neither does Dutta specify any concrete example of "self-depreciation" and "indiscriminate fault-finding" nor does Dutta specify who the figures were in the "early stages of the Renaissance in India" who indulged in such "self-depreciation" and "indiscriminate fault-finding."

The issue of Dutta providing pin-pointed references and quotations throughout his essay, but not doing so in the context of his statement about "Europeanised standpoint" also applies to the context of his statement regarding "self-depreciation" and "indiscriminate fault-finding." Further, as also mentioned in the context of the discussion on "Europeanised standpoint," as a

biographer writing about seventy years after P. C. Ray passed away, the responsibility of Dutta to provide references is on a much larger scale than that of Sri Aurobindo in 1909.

It is true that there were great social reformers in the nineteenth century who performed *self-criticism* with the goal of improving society. Such self-criticism is not the same as "self-depreciation" and "indiscriminate fault-finding." In effect, it turns out that (D5) refers to unspecified accusations ("self-depreciation" and "indiscriminate fault-finding") and to unspecified (Dutta names no one) figures.

Dutta refers to the "view of various historical facts that are coming to light," without providing any specific detail, or any specific reference of what such historical facts are. Again, Dutta's article is precise in providing references and quotations at various places, but fails to do so at this place. This makes a reader wonder what exactly was Dutta contesting in (D5). In a recent article [40, Section 4.1], we identified certain figures which provide counter-examples to P. C. Ray's assertion about the Hindu nation being "as good as dead" for the last thousand years. These examples, though, do not detract from the main thrust of P. C. Ray's comment. Since Dutta does not provide details, one does not get to know to what extent Dutta considers P. C. Ray's statement to be inaccurate.

We note that in his Presidential Address to the Seventh Indian Science Congress in 1920, P. C. Ray provides a variant of the thousand-year statement [7, p. 716]:

> **[R56]** for the last 1000 years or more India has been a *tabula rasa* so far as the cultivation of Physical Sciences in concerned.

P. C. Ray's 1000-year statement at the Rajshahi Literary Conference as cited in (D5) was broad and rhetorical. The examples in [40, Section 4.1] show that the statement cannot be taken in a literal sense. The main thrust of P. C. Ray's assertion, however, was the decline in the cultivation of the physical sciences in India. The statement quoted in (R56) makes this precise, and matches his "India for once bade adieu to experimental and inductive sciences" in (R15). Most of the examples in [40, Section 4.1] do not belong to the physical sciences category and hence do not count as counter-examples to (R56). A biographer of P. C. Ray writing in 2013–14 who contests the 1000-year statement at the 1909 Rajshahi Literary Conference should have taken into consideration his similar statement made at the 1920 Indian Science Congress.

6.5 Oriental Education

Dutta writes [18, Part II, p. 1050]:

> **[D6]** P. C. Ray would advocate the Eastern conception of Education — the tradition of the Tapovana, the ideal of plain living and high thinking. In a convocation address at the Aligarh National Muslim University in 1923, the Acharya remarked:
>
> > Oxford and Cambridge with their costly appurtenances will not do for us; in the rage for forms and furniture and machinery, we must not lose the substance. We cannot allow our Mother Saraswati to be enmeshed in the toils of wood and brick and mortar and strangled to death.

The passage attributed to P. C. Ray in (D6) is available from [7, p. 443]. We note the following points regarding (D6). Firstly, the above statement was made by P. C. Ray after declaring [7, p. 442]: "We must not make education too expensive so as to place it beyond the reach of the masses of our people." In fact, his message was that institutes like the Aligarh National Muslim University were playing an important role in this context.

Secondly, in the quote, P. C. Ray urges the recognition of substance and not appearances. It can hardly be assumed that P. C. Ray was criticising Oxford and Cambridge as such. Rather he was saying that merely trying to build up infrastructure ("furniture and machinery"), one must not ignore the basic purpose for such infrastructure, which is the pursuit of knowledge. In fact, in his essay *Sadhana O Siddhi*, P. C. Ray was full of praise for the kind of research carried out in various universities of England and the dedication of their researchers [32, p. 199]:

> [**R57**]
>
> লণ্ডন, অক্সফোর্ড, কেম্ব্রিজ, বার্মিংহাম, লীডস, এডিনবরা প্রভৃতি স্থানের বিশ্ববিদ্যালয় পরিদর্শন করেছি। ... নানা বিদ্যাশীলনের জন্য বিভিন্ন বিভাগ রয়েছে আর প্রত্যেক বিভাগেই পাঁচ ছয় জন ছাত্র সেই বিশেষ বিদ্যা সম্বন্ধে মৌলিক গবেষণা করছেন। আর পর পর এমন বড় লোক ঐসকল বিদ্যামন্দির থেকে বাহির হয়ে আসছেন, যা ভাবলে আশ্চর্য হয়ে যেতে হয়। এঁদের অনেকে একটা বিশেষ বিষয়ের গবেষণার নেশায় ভরপুর হয়ে সারা জীবন উৎসর্গ করে দিয়েছেন।

Our translation:

> I have toured London, Oxford, Cambridge, Birmingham, Edinburgh and other universities. ... There are different departments for different subjects, and in each department, there are five to six students who are carrying out basic research. One after the other, great researchers are being produced by these temples of education, which makes one wonderstruck. Many of them are so engrossed in their research that they devote their entire lives to it.

6.6 *Brahmacharya*

Dutta mentions further about P. C. Ray's Convocation Address at the Aligarh National Muslim University [18, Part II, p. 1050]:

> [**D7**] He continues on the ideals of a student's life:
>
> > I would even go further. I would, if I could, revive the Brahmacharya traditions of our ancient schools, that ascetic discipline that laid the foundations of a virile and self-controlled manhood, that enabled the young men in after-life to stand four-square to all the winds that blew.
>
> The above statement reminds us of a passage from Sri Aurobindo's "The Brain of India" written in The *Karmayogin* in 1909.

Regarding the reference to Sri Aurobindo's *The Brain of India* in (D7), the editorial footnote to Dutta's article refers to pp. 1006–08 of the same issue for the passage referred to by Dutta. The content of pp. 1006–08 is indeed part of Sri Aurobindo's *The Brain of India*, where he

discusses *Brahmacharya*; it is, however, not the complete description of *Brahmacharya* by Sri Aurobindo in his essay. In particular, the content of pp. 1006–1008 does not include Sri Aurobindo's view of what constitutes *Brahmacharya* and the reason for practising it. This is found in other parts of his essay *The Brain of India*. In a long discourse, Sri Aurobindo describes the metaphysical concepts of *tapas*, *tejas*, *vidyut*, and *ojas* and finally states [23, p. 29]:

> **[A1]** It follows that the more we can by *Brahmacharya* increase the store of *tapas*, *tejas*, *vidyut* and *ojas*, the more we shall fill ourselves with utter energy for the works of the body, heart, mind and spirit.

The passage attributed to P. C. Ray in (D7) is part of a fuller statement as follows [7, p. 443]:

> **[R58]** I would even go further. I would, if I could, revive the Brahmacharyya traditions of our ancient schools, that ascetic discipline that laid the foundations of a virile and self-controlled manhood, that enabled the young men in after-life to stand four-square to all the winds that blew. I would like that the students should discard all luxuries, should clothe themselves in strong homespun Khaddar, should cook their own food, should wash their own rooms and utensils, should sweep their own clothes and should keep everything tidy. On this matter, about the supreme necessity of simplicity in life, I am absolutely at one with Mahatma Gandhi, the great apostle of our national renaissance.

In the above remark, P. C. Ray essentially advocates "simplicity in life" and a rigorous training during student life which will make a student resilient to stand up and face the various challenges of society. This is a down-to-earth statement.

When P. C. Ray and Sri Aurobindo talk about *Brahmacharya*, there is indeed a similarity in the sense that both of them talk about a rigorous early life preparation. The similarity, however, ends there. The main difference between P. C. Ray and Sri Aurobindo is in the purpose of practising *Brahmacharya*. P. C. Ray advocates *Brahmacharya* as a simple and austere training in student-life so as to prepare a person to face the various challenges of later life, while Sri Aurobindo advocates *Brahmacharya* for metaphysical and mystical ends.

6.7 Omissions

Going through Dutta's treatment of P. C. Ray's views, we find that there are some obvious omissions. We provide some examples.

Perhaps most important among the omissions is that Dutta does not discuss P. C. Ray's emphasis on rationalism, which formed a central theme of P. C. Ray's outlook and is found in his major work *Bengali Brain and Its Misuse* and also in many of his other writings.

In Section 6.1, we discussed the omission by Dutta of the Buddhistic contribution to ancient Indian chemistry that P. C. clearly identified. Also, the appreciation of Buddhism expressed by P. C. Ray as can be understood from (R48) and (R23) are not mentioned by Dutta. Neither do we find the appreciation of Chaitanya by P. C. Ray (see (R47)) in Dutta's treatment. In (D6) Dutta mentions P. C. Ray's view of "plain living and high thinking," but omits the immediate

reference to Islam that P. C. Ray made; see (R52). Further, (D6) mentions the reference to Tapovana in the Convocation Address at the Aligarh National Muslim University, but does not mention the unique juxtaposition of Tapovana and Islamic approach that P. C. Ray suggested in the same context; again see (R52). To take another example, we note that while quoting the passage which shows P. C. Ray's objection to India's involvement in the Khilafat movement, Dutta [18, Part V, p. 314] quotes only the last part of (R7) starting from "We must not allow ...," omitting the previous part which shows P. C. Ray's appreciation of the Pan-Islamic movement. These omissions cut out from the reader P. C. Ray's appreciation of different religions and in particular his appreciation of broad themes of empathy and simplicity.

As a last example, we point to the truncation of (R58) in (D7), which misses out on what P. C. Ray means by *Brahmacharya* and his point about agreeing with Gandhi regarding "the supreme necessity of simplicity in life." This is a different kind of omission which does not allow the reader to properly grasp what P. C. Ray understood by *Brahmacharya*.

6.8 Viewing P. C. Ray Through an Aurobindo-esque Lens

In Section 6.2 we mentioned that Dutta understates Sri Aurobindo's criticism of P. C. Ray's essay *Bangalir Mastishka O Tahar Apababohar*. Also, in Section 6.6, we discussed how Dutta points to a similarity in the views of P. C. Ray and Sri Aurobindo regarding *Brahmacharya*, where arguably the similarity is only superficial. Further, in (D4) and (D5), Dutta uses Sri Aurobindo's words – without attribution – to express disagreement with certain ideas put forward by P. C. Ray. Due to the absence of attribution, a reader does not get to know that Sri Aurobindo had actually strongly criticised one of P. C. Ray's most important writings. These points taken together would suggest that Dutta was perhaps trying to make P. C. Ray compatible with Sri Aurobindo.

An example of Dutta viewing P. C. Ray through an Aurobindo-esque lens is the following passage from Dutta's 2021 article [20, p. 17]:

> **[D8]** Let us revisit the life of Acharya Prafulla Chandra in the light of the following patriotic ideals formulated by Sri Aurobindo towards the end of his Farewell Address to the students of Bengal National College in 1907:
>
> "If you will study, study for her sake; train yourself body and mind and soul for her service. You will earn your living that you may live for her sake. You will go abroad to foreign lands that you may bring back knowledge with which you may do service to her. Work that she may prosper. Suffer that she may rejoice. All is contained in that one single advice."
>
> Acharya Prafulla Chandra was verily an embodiment of the ideals so powerfully formulated by Sri Aurobindo.

The passage in (D8) needs to be seen in the proper context. P. C. Ray was about eleven years senior to Sri Aurobindo. In 1907, when Sri Aurobindo made the speech from which (D8) quotes, P. C. Ray was already an established eminent scientist who had earned a D.Sc. degree abroad and had come back to India, had put in many years of work in starting a successful indigenous enterprise, had published the first volume of his acclaimed scholarly work *A History*

of Hindu Chemistry, had already established himself as an excellent teacher and mentor, and was involved in various nationalistic activities. So one may correctly say that when Sri Aurobindo made the speech to his students in 1907, he could have pointed to P. C. Ray as the real-life inspiration, though Sri Aurobindo did not do so. Standing in the present age, one may note a broader context than what could have been noted in 1907. This broader context includes for one thing, P. C. Ray's own rousing message to the Bengali youth in 1910; see (R54). Further, as part of the broader context, one may note that P. C. Ray continued and expanded all his aforementioned activities till the end of his life, whereas within a few years of the 1907 speech, Sri Aurobindo withdrew from active politics. Without providing the appropriate context, a casual and uninformed reader reading "embodiment of the ideals" may be led to the mistaken belief that it was Sri Aurobindo's words which motivated P. C. Ray even though (D8) does not explicitly say so.

There is a fundamental difference between P. C. Ray and Sri Aurobindo. This is regarding the role of reason in human civilisation. As discussed in Section 4.1, P. C. Ray put forward the view that rationalism was crucial to the development of civilisation. On the other hand, in his *The Brain of India* Sri Aurobindo writes [23, pp. 2–3]:

> **[A2]** the ... supermind or faculty of direct knowledge, ... which is above reason and imagination, the faculty which in Sri RamKrishna, the supreme outcome of the race, dispensed with education and commanded any knowledge he desired easily and divinely.

In (A2), Sri Aurobindo places the metaphysical notion of "supermind or faculty of direct knowledge" above "reason and imagination." Further, he states that an appropriately evolved mind can command any knowledge "easily and divinely." Such a metaphysical view sits uneasily, to say the least, with P. C. Ray's emphasis on rationalism. For example (R30) shows that P. C. Ray considered reason and judgement to be the core principle of free thought which was the defining feature in determining the rise and fall of Indian civilisation; nothing can be accepted without applying the test of reason irrespective of whether Shankaracharya made the statement or not. So Dutta's attempt to create compatibility between P. C. Ray and Sri Aurobindo amounts to an attempt to create compatibility between incompatibles.

6.9 To Dadhichi-fy or not to Dadhichi-fy Acharya Prafulla Chandra Ray?

Towards the end of his 6-part 72-page article published in 2013–14, Dutta mentions an analogy of P. C. Ray to Rishi Dadhichi [18, Part VI, p. 414], and refers to Bagchee [3] and Bhattacharya [6] for this analogy. In comparison, in his short six-page article in 2021, Dutta [20] makes the analogy the sub-title of the essay making it prominent and unmissable. Dutta states that P. C. Ray was: "A Rishi Dadhichi in the Service of his Nation." The 2021 article by Dutta [20] does not refer to either Bagchee [3] or Bhattacharya [6] for the analogy.

One may question as to what changed between 2013–14 where a 72-page article makes only a passing reference to the Rishi Dadhichi analogy, while the 2021 article by the same author makes the analogy the central theme? While an answer to this question cannot be determined with certainty, we note that the Dadhichi analogy has begun to catch on. Chakrabarty's 2022

article [13] mentions the analogy and refers to Dutta's 2013–14 article (but not to Bagchee or Bhattacharya). Further, Dutta has delivered a lecture on P. C. Ray with the Rishi Dadhichi tagline [19].

Given the above situation, we take a detailed look at the analogy to determine its appropriateness, and whether it helps us to obtain a better understanding of P. C. Ray's work. By way of introduction, we mention that Rishi Dadhichi is a mythological figure who gave up his life so that his bones could be used by Indra, the king of the *Devas*, to make the weapon *Vajra* with which he defeated a powerful *asura* called Vritrasura. While the story itself has other aspects, many Indians get to know this broad outline in their childhood.

The question that we ask is whether there is anything in P. C. Ray's life and work that is similar to the story of Rishi Dadhichi? Due to P. C. Ray's life-long philanthropic activities, the straightforward answer would be the notions of giving and sacrifice for the greater good. There are two different aspects to these notions, namely the type and the purpose.

If we look at the story of Rishi Dadhichi, we find that it is a single act of supreme sacrifice of giving up one's life. P. C. Ray, on the other hand, helped people throughout his life. Briefly put, the difference in the nature of the giving and sacrifice between the Rishi Dadhichi story and P. C. Ray's life is that of 'giving up one's life' versus 'giving throughout one's life.'

Next, let us consider the purpose giving and sacrifice. The Rishi Dadhichi story is about giving up his life for the immediate purpose of constructing a powerful weapon. P. C. Ray's life-long commitment to helping others was, on the other hand, based on empathy towards fellow human beings which was an outgrowth of his sense of nationalism; see (R2). The weapon aspect, which forms an integral part of the Rishi Dadhichi story, is missing from P. C. Ray's life-long humanitarian activities.

In [20, p. 22], Dutta quotes from a tribute by Rabindranath Tagore to P. C. Ray, where Tagore mentions an Upanishadic view to say how the 'one' P. C. Ray became 'many' through his numerous pupils, which was possible due to P. C. Ray giving himself unreservedly to his students. Dutta provides this passage as one of his justifications for the Rishi Dadhichi analogy. The notion of giving and self-sacrifice that Tagore invokes is that of a teacher or a mentor selflessly imparting knowledge and wisdom to his students. This notion has very little in common, if anything at all, with the Rishi Dadhichi story. So it is perhaps out of place to use the Tagore reference as a justification for calling P. C. Ray to be Rishi Dadhichi.

As argued above, the Rishi Dadhichi – P. C. Ray analogy does not seem to be well constructed. In particular, it does not help us better understand or appreciate the life and works of P. C. Ray. On the other hand, such an analogy may encourage uninformed people to associate with the idea of Rishi Dadhichi qualities embodied by P. C. Ray, such as nationalism, scientific achievement, and public service, even though these do not belong to the mythological story about Rishi Dadhichi. In particular, the formulation "A Rishi Dadhichi in the Service of his Nation," may suggest to a reader to map the modern notion of nationhood back to the mythological story in which there was no such notion.

A more appropriate description of P. C. Ray's social service and philanthropy is to say that these aspects of his works were Vidyasagar-ian in spirit and nationalistic in approach. Similar to Vidyasagar, P. C. Ray gave freely as much as he could. Further, both Vidyasagar and P.

C. Ray were rationalists and reformers. Regarding the similarity in philanthropic activities between P. C. Ray and Vidyasagar, Dutta also notes in his 2013 article [18, Part VI, p. 412]: "The incredible extent of his donations reminds one of the great Vidyasagar." However, in his 2021 article, instead of the more suitable Vidyasagar analogy Dutta employed the arguably less suitable Rishi Dadhichi analogy.

7 Concluding Remarks

As a dynamic person who was involved in multifarious activities, P. C. Ray understood the idea of progress. In his words [34, p. 12]:

> **[R59]** Progress—social, political and intellectual—is the law of Nature. A nation which refuses to move with the altered condition of the times is doomed to stagnation and decay.

We end the essay with the vision for future India that P. C. Ray wrote about in 1910 [34, p. 30]:

> **[R60]** In the India of the future there should be a harmonious comingling of the new and the old, a fusion of the West and the East. There should be equal opportunity for the growth and development of the Hindu and the Mussulman; of the high and the low; of the Brahmin and the Pariah.

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