



Dr. Chunilal Bose: a forgotten scientist and a science communicator

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Abstract

Modern medical education began in Bengal with the establishment of Calcutta Medical College (CMC) in 1835. Soon it became an important centre for medical education and research in India. Chunilal Bose (1861–1930), an alumnus of CMC, worked in his alma mater as the Chemical Examiner of Bengal for more than three decades and conducted pioneering researches on toxins and poisons, food poisoning, food adulteration, diabetes, small pox, forensic science, effects of narcotics etc. His research publications appeared in reputed journals such as *British Medical Journal*, *Transactions of the Chemical Society of London*, *The Indian Medical Gazette*, and *Calcutta Medical Journal* etc. Bose was also instrumental in passing the Indian Poisons Act (1904) and in creating a public awareness against consumption of narcotics. Bose was an able science communicator of the late nineteenth and early twentieth century Bengal and extensively wrote and lectured in a simple language, both in Bengali and English, on the subjects of public health and hygiene, general science and history of science that were connected to the wellbeing of the common people, with an intention of creating science awareness and scientific temper in the society. Honours and awards showered upon him during his lifetime, but Bose's important contributions to medical sciences and science popularization were less discussed by the historians of science, as the focus generally remained on his more illustrious contemporaries. In the course of time, Chunilal Bose became a nearly forgotten scientist and a science communicator. His 160th birth anniversary was observed in 2021.

Keywords Chunilal Bose · Calcutta Medical College · Medical Research · Poisons Act (1904) · Public Health & Hygiene · Public Science Communication

1 Introduction

The nineteenth century Bengal witnessed a socio-cultural awakening, a social transformation and intense intellectual activities among the Bengal's middle class, which were manifested through religious and social reforms, spread of modern education, literature, art, plays and dramas, journalism, new political ideas, a relatively liberal social order and most importantly, the spread of modern science. The Bengal renaissance, essentially a modernist movement, opened up the doors of modern science to Indian students and scholars.

Among the modern scientific disciplines, medical science was the first to be institutionally taught in India during

the Company's rule for various reasons, and it played an important role in propagating modern scientific thoughts in India. According to Arnold (2004, p. 57), 'Medicine occupied a central place in Western scientific thought and activity in nineteenth-century India. There were many reasons for this. Firstly, the Colonial Medical Service was one of the principal scientific agencies in India during the Company period and for several decades thereafter. Secondly, partly because of their wide-ranging scientific brief, medical personnel had a vital role in the European investigation of the Indian environment Thirdly, to a degree unparalleled in other scientific fields and matched by few aspects of technological change, medicine represented direct intervention in, and interaction with, the social, cultural and material lives of the Indian people. This dual engagement—with the environment and with culture—helped fashion not only the distinctive character and preoccupations of India's colonial medicine, but also the manner of its Indian reception and assimilation.'

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Systematic medical education was introduced to Bengal in 1822 by the East India Company, when a vernacular medical school (NMI or Native Medical Institute) was established in Kolkata with the aim of providing medical training to Indians with Surgeon James Jamieson as its superintendent (Kumar, 1998, p. 19; Paul, 2021; Anshu & Supe, 2016). However, Jamieson died before the institution could open and Peter Breton was appointed the Superintendent. In 1831, John Tytler succeeded him. In the first year, 20 young Indian students were admitted and were instructed through the vernacular medium. European medical texts in anatomy, medicine, and surgery were translated into the Bengali and other languages so that, students, generally not fluent in English, could understand them. Students were exposed to hands-on training, but dissection was not performed. The Institute taught modern as well as Āyurvedic and Unāni medical systems. From 1826, classes in Āyurvedic medicine were conducted in the Sanskrit College, while the classes in Unāni medicines were held at the Calcutta Madrasa. As a result of the establishment of NMI, the attention of some educated people of this country was drawn towards medical education. In 1831, an hospital attached to NMI was established with a significant donation from Babu Ram Commul Sen (Kumar, 1998, pp. 20, 21; Whitfield, 2021). Calcutta School Book Society was the first to publish Science books in Bengali; notable among them were ‘*May-Gaṇit*’ (May’s *Mathematics*, 1817), Harley’s ‘*Gaṇitāṅka*’ (*Mathematics*, 1819), Pears’ ‘*Bhūgol*’ (*Geography*, 1819), Yates’ ‘*Padārthavidyāsāra*’ (*Natural Philosophy & Natural History*, 1824) etc. The Society also took the initiative in publishing books on Medical Sciences. Dr. Britton’s book ‘*Olāoṭhā Bibaraṇ*’ (*Description of Cholera*, 1826) was published at the initiative of the Calcutta School Book Society. Dr. Britton had previously written another book titled ‘*Vocabulary of Medical Terms*’ (Bhattacharya, 1960, p. 3–55).

During the first quarter of the nineteenth century, a great controversy erupted on the nature of education and medium of instruction in schools and colleges. The British Orientalists, led by Horace Wilson and Henry Prinsep, advocated in favour of Sanskrit, Arabic and Persian as the medium of education. On the other hand, the Anglicists, led by Charles Trevelyan and Thomas Macaulay, advocated imparting of Western education through the medium of English. They were supported by Raja Rammohun Roy (Kopf, 1969, pp. 240–252; Sharp, 1920, pp. 81–143). Medical education was an important issue that was debated upon. In 1833, Lord William Bentinck, the Governor General, formed a committee to assess the condition of the then medical schools and to revise and improve the medical system in India. The committee called for the immediate abolition of the teaching of Indian medical systems (Āyurveda, Unāni, Siddhā etc.) and the immediate closure of traditional medical classes. They recommended that a medical college be set up for Indians

and that various aspects of modern medical sciences be taught in that institution. The medium of instruction would be English, Hindustani or Bengali. Lord Bentinck accepted almost all of the committee’s recommendations, with English as the only medium of instruction. The Calcutta Medical College was established on 20 February 1835 (Panja & Ghosh, 1989; Kumar, 1998, p. 23; Paul, 2021; Anshu & Supe, 2016). Dr M.J. Bramley was appointed as the superintendent of the Calcutta Medical College with doctors H.H. Goodeve, Nathaniel Wallich and W.B. O’Shaughnessy as the teaching staff. The books and apparatus of the abolished NMI were made available to the new Medical College. ‘Vaidya Doctor’ Prof. Madhusudan Gupta and his two assistants were transferred to CMC (Kumar, 1998, p. 23). The courses of study were comprised of anatomy, physiology, chemistry, the theory and practice of physics, medical botany, materia medica and pharmacy (Sen, 2002, p. S34). Govt. also decided to stop the financial aids to schools teaching indigenous medical systems. The Native Medical Institution was abolished and the classes held at the Sanskrit College and the Calcutta Madrasa were discontinued in 1835 (Panja & Ghosh, 1989; Paul, 2021; Anshu & Supe, 2016; Sen, 2002, p. S34).

Since the establishment of the Medical College, the public interest in modern medical science aroused. Local writers started writing books on medical sciences in the Western style. The first to be mentioned in this context is Prof. Madhusudan Gupta of the Bāṅglā Department of the Medical College. The contents of Madhusudan Gupta’s ‘*London Pharmacopœia arthāt Inḡlonḡiya Ousadha Kalpāvalī*’ (1849) were translated into Bengali from the 1836 English edition of the *London Pharmacopœia*, published by the Royal College of Physicians, London (Gupta, 1849; Bhattacharya, 1960, p. 353).¹ In 1852, the Company’s Government changed their policy and introduced Bengali-medium medical classes in CMC in addition to the English-medium classes. The change in policy necessitated Bengali textbooks on medical sciences to be available. Therefore, from this time onwards, textbooks on medical sciences began to be written in Bengali as per the need. In addition, there had been an improvement in the composition of medical texts suitable for public reading. In the sixth, seventh and eighth decades of the nineteenth century, books were written on some of the major topics in medical sciences, such as surgery, hygiene, pædiatrics, nursing, the basic theories

¹ *The Pharmacopœia Londinensis*, 1618 was a landmark publication of the Royal College of Physicians, London. It was the first standard list of medicines and their ingredients in England. It was translated into English by Culpeper in 1649. Prof. Madhusudan Gupta used 1836 edition of Culpeper’s book. (Culpeper’s *Pharmacopœia Londinensis* or The London Dispensary, <https://archiv.org/23/items/b2152290x/b2152290x>).



of medical science, pharmacology and special medical methods. Ram Commul Sen's 'Oṣadhasārasaṅgraha', published in 1819, containing description of 56 medicines with their appropriate use according to the European system, was the first work in Bengali on European medicine (Bhattacharya et al., 1989, p. 10). Though the pioneer in writing medical texts in Bengali was Rev. Felix Carey (1785–1822), it was Prof. Madhusudan Gupta who took a leading role in writing medical textbooks in Bengali. Other notable early texts were P. Kumar's 'Oṣadhabyābahārak' or *Medicine User*, 1854, S.C. Karmakar's 'Oṣadha Prastut Vidyā' or *Science of Preparing Medicine*, 1854, Shibchandra Deb's 'Śiṣupālan-Part 1' or *Child Rearing-Part 1*, 1857, Mir Ashraf Ali's 'Bāl Cikitsā' or *Pædiatrics*, 1862, Kashi Chandra Gupta's 'Astra-Cikitsā Prañālī' or *Surgical Methods*, 1873 and 'Ophthalmic Surgery or Akṣitattva', 1877, etc. (Bhattacharya, 1960, pp. 353, 354).

The Calcutta Medical College (CMC) became a trendsetter in medical education in India and medical colleges in other parts of India were established subsequently. CMC soon became an important centre for medical research too in India, particularly on cholera, small pox, and leprosy and later on malaria, kala-azar etc. Among the early researchers were Dr. William Brooke O'Shaughnessy and Dr. Henry Goodeve. In 1846, four students of the Medical College, including two sponsored by Prince Dwarkanath Tagore, travelled to England for higher studies. The group included Dr. Soojacoomar Goodeve (SG) Chuckerbutty, who subsequently made significant contributions to medical research (Sen Gupta, 1970, pp. 183–191). Other important researchers in the CMC were Sir Leonard Rogers, who made important contributions to the treatment of Cholera, Sir U.N. Brahmachari, who conducted pioneering research on Kala-azar and Sir Richard Havelock Charles, who invented the 'Charles Operation' for filariasis (Panja & Ghosh, 1989, p. 248).

2 Medical research publications by native Bengali scientists during the nineteenth century

In 1817, Hindu College (later, Presidency College) was established at Kolkata. The Hindu College was the first institution of higher learning in India for English literature, modern science and for cultivating free and rational thinking. In the same year, Calcutta School-Book Society was established in Kolkata at the initiative of native scholars with the primary aim of writing and publishing text books and supplying them to schools and madrasas in the country. The impact of these two institutions was soon felt. As early as in 1829, six years before the establishment

of CMC, Baboo Ram Commul Sen published the first ever scientific paper titled 'Note on *bel* or *bilwa* (*Aegle marmelos*)' in 'The Transactions of Medical and Physical Society of Calcutta' (Roy & Sen, 2000, p. 1849). In next seven decades, large numbers of research articles or papers on medical sciences were written by Bengali researchers. In the meantime, Calcutta Medical College (1835) was established and a few medical journals, such as 'The Transactions of Medical and Physical Society of Calcutta' (1825), 'Indian Journal of Medical Science' (1834) etc. were launched. Between 1835 and 1854, as many as nine medical journals emerged, such as, *Quarterly Journal of the Calcutta Medical and Physical Society* (1837), *Transactions of the Medical and Physical Society of Bombay* (1838), *Madras Quarterly Medical Journal* (1839), *Āyurveda Darpaṇah* (1840), *Quarterly Medical and Surgical Journal of the North Western Provinces* (1844), *India Register of Medical Science* (1848), *Madras Journal of Medical Science* (1851), *Indian Annals of Medical Science* (1853) and *Hyderabad Medical Journal* (1854). *Āyurveda Darpaṇah* was in Bengali and probably the first journal on Āyurveda. *Hyderabad Medical Journal*, on the other hand, was in Urdu and possibly has the distinction of being the first medical journal in Urdu (Sen, 2002, p. S43).

According to Roy & Sen (2000, pp. 1850–1856), the first paper on medical science, titled 'On the indications of the pulse according to the Hindus, translated from the second section of the *Oṣadh-vaḷi*, a medical treaty in the Bhaka language' was written by Raja Kalikishan Bahadur and was published in the *Journal of the Asiatic Society of Bengal* (1832). In 1854, Brindavan Chatterjee wrote 'Cases in midwifery', in *The Indian Annals of Medical Science*. Next year, two more articles appeared in the same journal, namely 'Cases of tetanus consequent on a lacerated wound and its treatment' by Babu Dayal Charan Basak, and 'Remarks on the epidemic diseases in the Deegah penitentiary during 1852–1853' by Babu N.M. Dutta. Soorjacoomar Goodeve Chuckerbutty (or S.G. Chakrabarti) was a prominent medical scientist of the nineteenth century. In 1856, he published two articles in *The Indian Annals of Medical Science*, 'Note on asthma' and 'Report of dispensary cases'. In 1865, he wrote a booklet titled 'Cases illustrative of the Pathology of Dysentery' (Chuckerbutty, 1865). He also published large numbers of research articles that included 'Iodide of potassium in the treatment of aneurism' (*British Medical Journal*, 1862) (Chuckerbutty, 1862), 'A clinical retrospect of hospital experience of civil medical cases' (*The Indian Annals of Medical Science*, 1867), 'On the Pathology of hepatic abscesses as a result of dysentery' (*The Indian Medical Gazette*, 1867) (Chuckerbutty, 1867), 'A case of lacerated and contused wound of the Scrotum' (*The*



Indian Medical Gazette, 1872) (Chuckerbutty, 1872) etc.² The most prolific researcher, however, was Gopaul Chunder Roy. Between 1865 and 1887, he published more than 50 research papers on medical sciences including ‘Two cases of fracture of skull, extravasation of blood and laceration of cerebral substance, having different symptoms in each’ (*The Indian Medical Gazette*, 1867) (Roy, 1867), ‘Two cases of injuries of the liver, with remarks’ (*The Lancet*, 1871) (Roy, 1871a), ‘On the therapeutical action of quinine on malaria’ (*The Lancet*, 1871) (Roy, 1871b), ‘On the solvent action of papaya juice on the nitrogenous articles of food’ (*Glasgow Medical Journal*, 1874) (Roy, 1874a), ‘On Burdwan fever’ (*The Indian Medical Gazette*, 1874, in two parts) (Roy, 1874b) and (Roy, 1874c), ‘Surgery in the malarious district of Jehnabad’ (*The Indian Medical Gazette*, 1875) (Roy, 1875a), ‘Two cases of poisoning by opium successfully treated by subcutaneous injection by Atropine’ (*The Indian Medical Gazette*, 1875) (Roy, 1875b), ‘The rational treatment of cholera; with chemical and pathological remarks’ (*The Indian Medical Gazette*, 1876) (Roy, 1876), ‘Some remarks on the relation of filaria sanguinis hominis to chyluria and other lymphoid diseases’ (*The Indian Medical Gazette*, 1879) (Roy, 1879), ‘Some remarks on leprosy’ (*The Indian Medical Gazette*, 1881) (Roy, 1881), ‘A case of kidney disease inducing hypertrophy of heart and haemorrhage into the brain’ (*The Indian Medical Gazette*, 1884) (Roy, 1884), ‘The rational method of treatment of hydrophobia’ (*The Lancet*, 1886) (Roy, 1886), ‘On the relative digestive value of Fairchild’s peptonising powders, pepsin, and papaya juice on milk’ (*The Indian Medical Gazette*, 1887) (Roy, 1887) etc. Roy’s 1874 (2nd edition 1876) book on Burdwan Fever (GC Roy, 1874d) is still considered as an important work.

Other native Bengalis who contributed to medical research during the nineteenth century are:

Babu Uday Chandra Dutt (‘A short account of a native medicine called ‘Bakus’, *The Indian Annals of Medical Science*, 1865; ‘Notes on Sanskrit materia medica’, *The Indian Annals of Medical Science*, 1869), Babu Kanny Lall Dey (‘Hindu social laws and habits viewed in relation to health’, *The Indian Annals of Medical Science*, 1866); Mahendralal Sircar (‘Notes on *Caraka Samhitā*’, *Proceedings of the Asiatic Society of Bengal*, 1870); Rajendralala Mitra (‘On a new species of *Scincus*’, *Proceedings of the Asiatic Society of Bengal*, 1871, ‘Reply to enquiry regarding the mention of leprosy by ancient Hindu writers’, *Proceedings of the Asiatic Society of Bengal*, 1875); Rajmohan Banerjee (‘Report of an enquiry into the conditions, during life, of the liver and kidneys in Asiatic Cholera’, *The Indian Medical Gazette*, 1875);

Kalidas Nandi (‘Obstruction of the bowels treated by means of Strychnine’, *The Indian Medical Gazette*, 1875); Radhanath Roy (‘Lithotomy’, *The Indian Medical Gazette*, 1875); Dinabandhu Dutta (‘Sarcomatous tumour of left upper jaw: partial excision of bone’, *The Indian Medical Gazette*, 1878, ‘Cases of Vesical Calculus’, *The Indian Medical Gazette*, 1878); S.C. Chatterjee (‘The effect of lunar influence on disease’, *The Indian Medical Gazette*, 1880); B.C. Sen (‘Nobile age of females in India’, *The Indian Medical Gazette*, 1891, ‘Diabetes mellitus’, *The Indian Medical Gazette*, 1894); B.D. Basu (‘On the study of indigenous drugs’, *The Indian Medical Gazette*, 1892, ‘Tar ointment in chronic Eczema’, *The Indian Medical Gazette*, 1892, ‘A case of Beriberi’, *The Indian Medical Gazette*, 1892); K.P. Gupta (‘Village sanitation’, *The Indian Medical Gazette*, 1892, ‘Medical-legal work in the district of Backergunge from January to June 1892’, *The Indian Medical Gazette*, 1892); A. Mitra (‘Compound fractures treated by Creolin irrigation’, *The Indian Medical Gazette*, 1892, ‘Winter practice in Kashmir’, *The Indian Medical Gazette*, 1892); A. Chatterjee (‘Note on two cases of aphonia’, *The Indian Medical Gazette*, 1893); Kedar Nath Das (‘Vesicular mole’, *The Indian Medical Gazette*, 1893, ‘Idiopathic tetanus with remarks on the etymology of tetanus’, *The Indian Medical Gazette*, 1894, ‘Puerperal eclampsia’, *The Indian Medical Gazette*, 1896); Koilas C. Bose (‘Diabetes mellitus and its prevention’, *The Indian Medical Gazette*, 1896); Sundari Mohan Das (‘Small pox in Calcutta’, *The Indian Medical Gazette*, 1896); Sarat Kumar Mullick (‘Tropical diseases in England’, *The Indian Lancet*, 1899) and N. Chatterjee (‘A note on snakes, snake-bite and their treatment’, *The Indian Medical Gazette*, 1900) (Roy & Sen, 2000, pp. 1850–856). The list is not exhaustive. We shall discuss the publications by Dr. Chunilal Bose separately.

3 Life and career of Dr. Chunilal Bose (Bose, 1924)

Chunilal Bose (1861–1930) was a remarkable personality of this period, who was a contemporary of J.C. Bose and P.C. Rây. Dr. Bose was a qualified doctor, a renowned medical chemist, a forensic scientist, a leader in the public health awareness movement and a crusader against the habit of consumption of narcotics, who inherited the academic traditions of CMC to conduct path breaking researches on poisons and toxicology and extensively wrote on public health and hygiene. Both his research works and his popular writings had considerable impact on the development of medical sciences as well as on the public understanding on health and hygiene issues in India.

Chunilal Bose was born in Kolkata on the March 13, 1861. He was the second son of Babu Denonath Bose of

² A detail account of the contributions of SG Chuckerbutty can be found in Sen Gupta 1970; Kumar 1997, 2010; Mathews 2022.



Shyambazar. The family migrated from their ancestral home in the Changripota village near Harinavi in South 24 Parganas district and settled in Kolkata in the early part of the nineteenth century. Dr. Bose received his early education in a local Upper Primary School (now Shyambazar Anglo-Vernacular School) in north Kolkata. After spending a few years in the Northbrook School (Shyambazar) and Metropolitan Institution (Shyampukur branch), he passed the Entrance Examination of the Calcutta University in 1877 from the Sanskrit Collegiate School. After passing the First Arts Examination (FA) from the General Assembly's Institution (now the Scottish Church's College), he joined the Calcutta Medical College in 1880. Despite financial hardships, he had an excellent academic career in the medical college and obtained gold medals in Botany, Pathology and Medicine and certificates of honour and prizes in Anatomy, Surgery, Midwifery, Medical Jurisprudence, Hygiene, Clinical Medicine and Clinical Surgery. He passed both the First and the Final MB Examinations in the first division.

Dr. Bose joined Government service as an Assistant Surgeon in March 1886. He was appointed in 1887 as the Assistant Chemical Examiner³ of the Government of Bengal and Assistant Professor of Chemistry in the Calcutta Medical College, under Surgeon-Major C.J.H. Warden, but immediately afterwards was transferred to Taungdwungi (now Magwe) in Upper Burma in charge of a Civil Hospital. Eight months later, he returned to Calcutta Medical College in 1888 and joined his permanent appointment in the chemical laboratory of the medical college. In 1894, he was appointed Additional Chemical Examiner. He remained in charge of the Medico-legal Section of the department until April 1915. Between 1889 and 1913, he was appointed on several occasions to officiate as Chemical Examiner to Government and Professor of Chemistry in Medical College, Calcutta. In 1915 he became the 'Chief Chemical Examiner' (Bose, 1924; Basu, 1989; Sen, 2014).

³ 'During the nineteenth century, when the cases of death due to poisoning posed a problem to the law enforcement agencies, a need was felt for isolating, detecting and estimating various poisons absorbed in the human system. The first Chemical Examiner's Laboratory was, therefore, set up for this purpose at the then Madras Presidency, under the Department of Health, during 1849. Later, similar laboratories were set up at Calcutta (1853), followed by one each at Agra (1864) and Bombay (1870). These laboratories were equipped to handle toxicological analysis of viscera, biological analysis of stains of blood, semen, etc. and chemical analysis of food, drugs, and various excisable materials to provide scientific support to the criminal justice delivery system within their limited means' (quoted from Tewari & Ravikumar 2000, p. 303). Arnold (2016, p. 113) states that 'By the early twentieth century, British India had six chemical examiners. It is an indication of the administrative and political importance attached to the post that the chemical examiner reported directly to the provincial government rather than through the head of the medical department....'.

Commenting on Chunilal Bose's career, Arnold (2016, p. 114) states that, 'In 1915, having served as an Assistant or Officiating Chemical Examiner in Bengal for nearly twenty years, Chunilal Bose became Bengal's Chemical Examiner in succession to a series of IMS officers including C.J.H. Warden, L.A. Waddell and C.H. Bedford. In a retrospective account of chemical research in Bengal in 1921, the year after his retirement, Bose paid tribute to the work of his European predecessors and referred to his collaboration with several of them including Warden and Bedford. But he was also keen to stress the contribution Indians had made to the field from the time of Kanny Lall Dey⁴ in the 1860s onwards. Many Indians of Bose's generation were inspired by the career of the Edinburgh-trained chemist Prafulla Chandra Ray.... Ray helped transform chemistry into a prominent field of scientific enquiry for Indians, a form of patriotic as well as public service, and something of this idealistic ethos impressed itself on Ray's contemporary Chunilal Bose'.

In 1882, Chunilal Bose married Tilottama Devi, the eldest daughter of Babu Gour Kishore Sircar of Brahmanipara, Howrah district. Together, they had two sons and two daughters. His son, Jyoti Prakash, who was a qualified doctor (a distinguished medical scientist, Jyoti Prakash was the first Indian doctor to use Insulin to treat diabetes) edited and published the collected works of Chunilal Bose. Bose retired from the Government service in 1920 and spent his last days in Ranchi; he died on 3rd August 1930 (Bose, 1924).

4 Medical research by Chunilal Bose

Chunilal Bose was a practising medical scientist of high calibre. His scientific papers and lectures in English were compiled by his son Dr. Jyoti Prakash Bose in '*The Scientific and other Papers of Rai Chunilal Bose Bahadur*', Vol 1 (1924) and Vol 2 (1925), Kolkata (Bose, 1924, 1925). Chunilal Bose's scientific publications can be divided into four categories, chemical & pharmacological (9 papers), medical (3 papers), medico-legal (12 papers) and temperance (3 papers), apart from 10 semi-technical papers on hygiene & public health. They are listed below:

⁴ 'Kanny Lall Dey's expertise was well recognized, demonstrated in his nomination as Additional Chemical Examiner of Bengal, a position which he retained until 1872. He also held teaching positions in Chemistry at Calcutta Medical College, Campbell Medical School, and Presidency College. Rewarded for his catalogues of indigenous drugs for imperial exhibitions in London (1862) and Paris (1867), he was made an honorary member of the Pharmaceutical Society of Great Britain. Before he died in 1899, he was nominated as a member of the government-constituted Indigenous Drugs Committee, which produced the Report of the Central Indigenous Drugs Committee (1899)' (Quoted from Roy Choudhury 2018, p. 83).



4.1 Chemical and pharmacological

On the analysis of certain samples of tinned meat (with C.J.H. Warden), *Chemical News* (June 1890).

Note on certain reactions of an alkaloid contained in the roots of *Rauwolfia Serpentina* Benth (with C.J.H. Warden), *Pharmaceutical Journal* (August 1892).

False Bikh or Bikhma (with C.J.H. Warden), *Pharmaceutical Journal* (October 15, 1892).

Notes on the presence of a Cholesterol in the roots of *Hygrophila Spinosa* (with CJH Warden), *Pharmacographia Indica* (Index and Appendix, p. 191).

Analysis of East Indian Plantains, *Pharmacographia Indica* (Vol. III, pp. 446, 447) (1901).

On the chemistry and toxicology of *Nerium Odorum* with a description of a newly-separated principle, *Transactions of the Chemical Society*, London (1901) and *The Indian Medical Gazette* (August & November 1901) (Bose, 1901a, b).

The toxic principles of the fruits of *Luffa Aegyptiaca* Mill, bitter variety, (Tita Dhoondhool), *Calcutta Medical Journal* (1906).

A brief Survey of the research work in chemistry in Bengal, *The Modern Review* (April 1921); paper read at the Science Convention, Kolkata, 1921.

A new test for albumin in urine, *The Indian Medical Gazette* (January 1929) (Bose, 1929).

4.2 Medical

A case of snake bite, *The Indian Medical Gazette* (February 1905) (Bose, 1905a).

Some observation on diabetes in India, *Calcutta Medical Journal* (September 1907).

Prevention of small pox, *Calcutta Medical Journal* (March 1915); paper read at YMCA, Kolkata in February 1915.

4.3 Medico-legal

Deposit of yellow arsenic on the endocardium in a case of arsenic poisoning, *The Indian Medical Gazette* (May 1892) (Bose, 1892).

The necessity of an act restricting free sale of poisons in Bengal (with J.F. Evans), *Transactions of the First Indian Medical Congress* (1895) (Evans & Bose, 1895).

Memorandum on the use of a saturated solution of common salt as a preservative for viscera sent for chemical examination, *The Indian Medical Gazette* (March 1897) (Bose, 1897a).

The Bhawanipore food-poisoning case, *Calcutta Practitioner* (January–February 1904).

Poisoning by Sulpho-Cyanide of Mercury, *The Indian Medical Gazette* (March 1905) (Bose, 1905b).

A case of Formalin poisoning, *The Indian Medical Gazette* (April 1905) (Bose, 1905c).

Suicide by inhalation of Chloroform, *Calcutta Medical Journal* (January 1907).

Some points of Medico-legal interest in the Radhabazar murder case, *Calcutta Medical Journal* (March 1907).

A fatal case of poisoning by Arsenite of Copper, *Calcutta Medical Journal* (July 1910).

Cocaine poisoning, *British Medical Journal* (January 4, 1913) (Bose, 1913a).

Two cases of poisoning by white Lead, *Calcutta Medical Journal* (February 1916).

Paka oil in mustard oil as an adulterant (with Satyendra Nath Sen), *The Indian Medical Gazette* (November 1919) (Bose & Sen, 1919).

4.4 Temperance

Physical effects of some intoxicating drugs, *Calcutta Medical Journal* (December 1915); paper read at YMCA, Kolkata in November 1915 in the meeting of Calcutta Temperance Federation.

Temperance movement in India, Presidential Address delivered at the 14th Annual Session of *All India Temperance Conference*, Kolkata (December, 1917).

Growth of drink and drug trade among the educated community of Bengal, *The Modern Review* (January 1920).

Some of the above papers like ‘The necessity of an act restricting free sale of poisons in Bengal’ or ‘Some points of medico-legal interest in the Radhabazar murder case’ are now only of historical interest; but others like ‘Note on certain reactions of an alkaloid contained in the roots of *Rauwolfia Serpentina* Benth’ or ‘The toxic principles of the fruits of *Luffa Aegyptiaca* Mill, bitter variety, *Tita Dhoondhool*’ or ‘Poisoning by sulpho-cyanide of mercury’ had important bearing on analytical chemistry, pharmacology and forensic science and would benefit readers interested in the study of these subjects. In 1901, Bose submitted a thesis ‘On the chemistry and toxicology of *Nerium Odorum*’ to the University of Calcutta for which he was awarded the Coates’ Memorial Prize. Bose also rendered valuable help to Leonard Rogers in his investigation of leprosy by preparing for him suitable soluble salts of Gynocardic acid for injection (Bose, 1924).

Some of his semi-technical writings on hygiene and public health were published in contemporary journals and magazines, e.g. ‘Necessary measures for prevention of food adulteration’ (*Calcutta Medical Journal*, July, 1910), ‘Fixing of standards of purity of milk and its products’ (with Sasi Bhusan Ghose, *Indian Journal of Medicine*, Dec. 1921), ‘A few hints on sanitary reconstruction’ (*The Social Service Quarterly*, Vol. V (1), July 1919), ‘Maternity and child welfare work in India’ (*Journal of Maternity and Child Welfare*,



Dec 1921, March and June 1922), ‘Health of our college students’ (*Calcutta Review*, Oct 1922, based on a lecture delivered at YMCA, Kolkata) (Bose, 1922), and ‘Use of chlorine as a disinfectant of drinking water for Calcutta’ (Note to the Secretary of Calcutta Corporation, 1921). Chunilal Bose also wrote a small biographical essay on scientist J.C. Bose titled ‘Sir Jagadis Bose and his discoveries’ which was published in the May 1917 issue of *Calcutta Medical Journal* (Bose, 1925).

Bose delivered a lecture in connection with the first Science Convention held in Kolkata in 1917 on ‘Some practical hints to improve the dietary of the Bengalis’, which was published in the proceedings of the convention. At the second session of the Convention in 1918, he read two papers, namely, ‘On the Science Association and its founder’ and ‘On some common food-stuff’. These lectures were published in the proceedings of the convention. Bose delivered a public lecture on ‘Choice of food’ during the Seventh Indian Science Congress at Nagpur in January 1920 and two popular lectures on ‘Food’ at the Second Industrial and Social Exhibition held at Dhaka in March 1920. At the Health and Child Welfare Exhibition held at the Town Hall, Kolkata in April 1920, Bose delivered a lecture on ‘Impure air and infant mortality’ (Bose, 1925).

Bose’s two lectures, ‘The history and chemistry of paper making’ and ‘The history and chemistry of matches’, were delivered at the Indian Association for the Cultivation of Science in 1920 (Bose, 1924).

5 Importance and impact of Chunilal Bose’s works on toxins and poisons and the passing of Poisons Act (1904)

One of the major contributions of Chunilal Bose, as a medical scientist, was his works on toxins and poisons. From the list given in the previous chapter, we notice that at least fourteen of his research publications are on toxins, poisons and effect of poisoning.

Our common perception about a poison is of a substance (organic or inorganic) that may cause death or severe illness if consumed (or sometimes inhaled or being injected). Waddell (1904, p. 396) has defined poison from the legal point of view as ‘any substance which is deleterious to the human body to inhale, to swallow, or to take into the blood’.

Bertomeu-Sánchez and Guillem-Llobat (2016) has commented that, ‘Poisons inhabit the twilight zone between nature and culture. Every society and every age has experienced them. While having an indisputable materiality, Many poisons have been everyday materials employed for a wide spectrum of purposes: hunting, pesticides, drugs, colouring products, etc. They have also been employed as tools to perform criminal murders or political assassinations

as well as for legally-accepted crimes (wars, death penalty, etc.)Nineteenth-century toxicologists knew that poisons were far from being just objects of inquiry in medical culture. They were also protagonists in mythological and folk tales reflecting their varied social uses. Apart from hunting and human killing, numerous poisons were also used as drugs in many of the ancient medical traditions in Greece, China and India. These contrasting uses (for healing and for killing) are reflected in the ambiguities of the Greek word “pharmakon” (or *viṣa* in Indian medicine)’.

The importance of poisons in the Indian medical system has been emphasized upon by Arnold (2016, p. 23) as, ‘a notion of *viṣa* as both poison and cure was widely present in Indian medicine, from the written texts of Āyurveda and Unāni medicine through to the many variants of folk medical practice and belief. Indeed, India’s medical traditions can be categorized as being as much systems of toxicology—or poison management—as of therapeutics. As stated in the *Caraka Saṃhitā*, “Even acute poison is converted into an excellent medicine by the right method of preparation; while even a good medicine may act as an acute poison if improperly administered” Or, as paraphrased by Udo Chand Dutt,⁵ “Taken in large doses, poisons destroy life, but, judiciously used, they act as curatives and restore health, even in dangerous diseases’. Toxicity might thus be a power worthy of embrace, not a poison damsel to be shunned’.

The therapeutic use of poisons was, however, not always successful, rather occasionally fatal. Waddell (1904, p. 398) described the case of the death of an Englishman as, ‘In 1901, a Mr. Hicks at Calcutta was taken ill with dysentery, and was advised to take vegetable compound known as “*supāri-kā-phūl*”. This drug was obtained from the grocery of Ram Nath Dass, but with it was a large quantity of aconite, which is a deadly poison. This was administered unwittingly to Mr. Hicks, who succumbed to the effects’.

With such a widespread use of poisons (and easy availability), it was bound to be misused. According to Arnold (2016, pp. 25–29), in India, poisons were not only widely used for criminal abortion, suicide and murder, but also, ‘Substances like opium, aconite and even arsenic were widely regarded as having aphrodisiac powers. By the late nineteenth century, “love potions” of this kind were not only prescribed by local vaidas and hakims but also widely advertised—and, in British eyes, scandalously displayed—for sale in the Indian press’.

Waddell (1904) listed a large numbers of poisons available and used in India, the effect of poisoning and the possible

⁵ Quoted from, Udo Chand Dutt (1877), ‘The Materia Medica of the Hindus, compiled from Sanskrit Medical Works, with a glossary of Indian Plants by George King, Superintendent, Royal Botanical Garden, Calcutta and the author’, Thacker, Spink & Co, Calcutta, 1877, p. 7, <https://archive.org/details/materiamedicaofh00duttuoft>.



treatment and cure. Both Waddell (1904) and Buchannan (1905) have identified arsenic, opium and datura as the principal poisonous substances used in crime or suicide. According to Waddell (1904, p. 400), ‘The two poisons most frequently used in India to take human life are arsenic and opium. Arsenic is especially used for homicide (and also cattle poison), whilst opium is the special favourite for suicide; occasionally it is used for homicide, in case of young children or drunken persons. The next most frequent poison is datura used for stupefying people to facilitate robbery’. Buchannan (1905, p. 875) states that, ‘There is a great degree of sameness in the poisons used by the people of India for various crimes. For homicide, arsenic is by far the most commonly used; then comes aconite and nuxvomica and (in cases of children) opium. For suicide, opium is used in a large majority of cases; then much less frequently arsenic; for stupefying previous to robbery, datura chiefly and more rarely Indian hemp; for abortion *Plumbago rosea* and oleander.’ Arnold (2016, pp. 31–35) further linked poisons to poverty in the sense that poor people are forced to eat *dhoodhool* (*Luffa aegyptica*) and *khesāri dāl* (*Lathyrus sativus*), both having harmful effect on health.

Murder, suicide and other criminal uses of poisons were widespread. Evans and Bose (1895) indicated that during 1876–80, there were 94 reported cases of murder by poison in Bengal, while it was 81 during 1889–1893 (Bose, 1924, p. 211). However, the actual incidents may be much more than that as all the cases were not referred to the hospital or to the Chemical Examiner. For example, in 1893, while 44 cases of murder by poisoning were reported to Police in Bengal, only 18 were referred to the Chemical Examiner (Bose, 1924, p. 213). As for suicide by consumption of poison, there were 126 such cases during 1876–80, while it alarmingly increased to 236 during 1889–93 (Bose, 1924, p. 213). During these two periods, accidental deaths due to poisoning were 14 and 11 respectively. In 1893 itself, 126 cases of poisoning were brought to CMC, of which 103 survived, while for Mayo Hospital, the figures were 39 and 25 respectively for the same year (Bose, 1924, p. 221).

Both Waddell (1904) and Buchannan (1905) have compiled statistics from other provinces also, which showed that the reported cases of poisoning in other provinces were alarming too; nevertheless, there was no restriction on free sale of poisons except for ‘The sale of poisons Act (Bombay act VIII of 1866)’ (Waddell, 1904, p. 397). The Act incorporated the English Arsenic Act (1851). The chief provisions of the Bombay Act were that certain poisons named in schedule A of the Act— (i) May only be sold by licensed vendors (s. 3). (ii) (Except when dispensed as medicine on the order or prescription of a practitioner of medicine) may only be retailed to persons known to the vendor, or in presence of a witness known to the vendor, and to whom the purchaser is also known; and each sale must be entered with the

purchaser’s name and address in a book kept for the purpose (ss. 13, 14 and 19); and (iii) Pounded white arsenic (except in special cases) may only be sold mixed with soot in the proportion of one ounce to each pound of arsenic, or with indigo of Prussian blue in the proportion of half an ounce to each pound of arsenic (s. 17).

In Bombay Act, ‘restrictions apply to the following poisons: (i) aconite, cocculus indicus, datura, henbane, nuxvomica, Saint Ignatius’ bean and calabar bean and (ii) white, red and yellow arsenic, Scheele’s green (Arsenite of copper-author), Schweinfurth green (Aceto-arsenite of copper-author) and corrosive sublimate’ (Buchannan, 1905, p. 875).

Arsenic was of particular concern, as it had many uses other than medicinal and it became the main poisoning agent for murder, as Arnold (2016, pp. 145–146) states, ‘White arsenic and orpiment were employed in a variety of industrial processes, including the preparation of leather, the manufacture of paints, dyes and whitewash, textile production, the jewellery trade and paper making..... Arsenic was present in the brightly coloured sweets and painted toys sold in the bazaars, exposing children to low, but occasionally fatal, doses, and it was used medicinally by vaidas and hakims as well as by practitioners of Western medicine. Arsenic could be found in the Indian or European home in flypapers, rat poison, insecticides, tonics, ‘love philtres’ and abortifacients. Mixed with quicklime, it was widely used as a depilatory..... arsenic became the poison of choice for murderers or would-be assassins – in the 1874 Baroda incident, in the Wagner-Cray case of 1895, in the Agra murders of 1911–1912 and in a large percentage of the suspected poison cases referred to the chemical examiners for analysis.’

Recommendations were made to the government from time to time at least since 1843. Evans and Bose (1895) has enlisted the recommendations made by Mouat (1843), Chevers (1856),⁶ Dey (1876),⁷ Cornish (1879), Warden (1882) and Waddell (1884). The government resolution on Waddell’s report expressed many difficulties in imposing restrictions on free sale of poisons. Commenting on government resolution on Waddell’s report, Warden in 1886, criticized the government for not showing any good intention to

⁶ The details of the initiatives of Dr. Norman Chevers (the Chemical Examiner) can be found in Chevers (1856). Moreover, they have been discussed at length by Evans & CL Bose (1895), Arnold (2016) and Roy Choudhury (2018).

⁷ ‘Dey’s (Dr. KL Dey, Assistant Chemical Examiner) efforts towards rendering herbal substances useful, as against “criminal devices”, (a distinction that Chevers had also made) found expression in his Bengali manual on medical jurisprudence, titled *Boidik Byabohar* (1876). Dey’s book is perhaps first in a series of Bengali texts on medical jurisprudence, but was written as a *Materia Medica* of indigenous drugs. Byabohar, a Bengali rendition of Sanskrit *Vyāvahāra*, has at least eleven uses; however, litigation or law, one of the meanings available in *Dharmaśāstra* has found more acceptability in contemporary scholarship than others’ (Roy Choudhury 2018, p. 93).



restrict free sale of poison. He pointed out that the provisions under Bengal Municipal Act (1884) to restrict sale of poisons were insufficient. Next year, Warden again appealed to the government to legislate an act in this regard. However, the government's response was lukewarm. The matter also attracted the attention of *British Medical Journal*, which, in an article published in October, 1892, urged the government to take up the issue of prohibiting the free sale of poisons seriously (Bose, 1925, pp. 258–265).

The lack of legislation frustrated many, as Waddell (1904, p. 397) put it, 'There was no restriction whatever on the sale of poisons, except in Bombay, notwithstanding the repeated representations by myself and other chemical examiners, up till 1899 when the White-Arsenic Act (of 1899) was passed, but regulations as to the possession and sale of the white arsenic is limited to such local areas as local Governments may direct, the result being that arsenic may still be readily obtained in large quantities in ordinary bannia's shop in most bazaars, with practically no restrictions'.

In 1894, J.F. Evans⁸ and Chunilal Bose presented a paper, 'The necessity of an act restricting free sale of poisons in Bengal' (Bose, 1924, pp. 207–290) at the First Indian Medical Congress (1894) at Kolkata; it was published in the proceedings of the Congress in 1895. Chunilal Bose had a long experience in working with toxins and poisons as evident from the list of his publications. Bose conducted chemical analysis of toxic plants like oleander, *dhoondhool* and *bikhma* (*Aconitum palmatum*), poisoning in tinned meat and chemical properties of medicinal plants like *sarpagandha*, *hygrophila* etc. Bose also conducted the effect of poisoning by mineral poisons like yellow arsenic, sulpho-cyanide of mercury, formalin, chloroform, arsenite of copper, cocaine, white lead, adulteration of mustard oil by *pukka* oil etc. Bose did not restrict his research within the laboratory only, but played the role of a responsible leader of the society as he investigated 'The Bhawanipore food-poisoning case, (1904)' (Bose, 1924, pp. 298–333), where a large number of guests fell severely ill after taking food, of which four died, in a dining party in an elite household in Bhawanipore in southern Calcutta, in which Bose himself was an invitee.

In the lengthy paper mentioned above, which Evans & Bose read in 1894, the authors presented substantial statistics about poisoning and death due to poisoning in Bengal, compared them with that in England, discussed the sources of poisons, classified the nature of poisoning in eight categories, discussed several case-studies and in the final section, discussed previous recommendations to prohibit sale of poisons, then presented their own recommendations and finally discussed the pros- and cons- of such an Act. The paper finally proposed (Bose, 1924, pp. 269–290) the following measures to be taken by the Government: (i) Legislation of an Arsenic Act, (ii) The amendment of those sections of the Bengal Municipal Act and Calcutta Municipal Consolidation Act which relate to the sale of drugs and (iii) The amendment of those sections of the Opium Act I (1878) which relate to the retail sale of opium. The paper was forwarded by the Committee of the Congress to the government for consideration and for such action as they might think necessary to take in the matter. It is interesting to note that Dr. K L Dey also made a proposal to legislate an Act in the same Congress.

Commenting on the importance of the paper and Chunilal Bose's contribution, Arnold (2016, p. 157) writes, 'In the absence of an enquiry by the government itself, the single most important document presented in this renewed debate was a lengthy paper, 'The necessity for an act regulating the free sale of poisons in Bengal', jointly written by J.F. Evans of the IMS and Chunilal Bose, and presented to the first Indian Medical Congress when it met in Calcutta in December 1894. Although the paper appeared under both their names, there is little doubt that Bose was the principal author. Indeed, the judge who presided at the Wagner-Cray trial and commended the Evans-Bose paper to the government, remarked that while he knew nothing of Evans, he believed Bose to be 'a very able man'. Ostensibly confined to Bengal, the paper in fact gave a remarkably wide-ranging account of the use of arsenic, aconite, nuxvomica and other 'deadly poisons' for the purposes of murder, suicide and cattle killing. At the same time, the familiar warning was given that, because of the difficulties of detection and the small number of cases referred to the chemical examiners, too little was known about the true extent of poisoning in India, which was assumed to be far greater than available statistics implied. Arsenic was central to this discussion.'

Government was initially reluctant to legislate any Act and cited several difficulties in doing so. A legal case finally compelled the government in drafting the Poison Act. In 1894, the Empress vs Wagner & Cray case (Roy Choudhury, 2018, pp. 98–99) brought the poison issue in limelight. In 1894, one Mr. W.H. Wagner, a European pipe-player from Kolkata was alleged to have been poisoned by Mrs. Ellen Wagner (who was alleged to have served Mr. Wagner *Jilabi*, a traditional Indian sweetmeat, smeared with arsenic) and

⁸ Surgeon Major John F. Evans was the Professor of Pathology at the Calcutta Medical College. A highly decorated officer, during 1890s he held the post of Professor of Chemistry at the Lahore Medical College, Professor of Pathology at Medical College in Calcutta and Chemical Examiner to the Government of Bengal. Chunilal Bose became the Additional Chemical Examiner of Bengal under Surgeon Evans and went on to become the Chemical Examiner of Bengal in 1915 (Arnold 2016, p. 114).



James Cray. Wagner succumbed to the alleged poisoning. The medical college and the police surgeon gave contradictory reports; the former concluded the cause of death to be cholera, while the later suspected poisoning. Evans, the Chemical Examiner, also substantiated the poisoning theory. However, the society was divided on the issue and the Jury summoned the Evans and Bose (1895) recommendations, which in course of a few years, led to the enactment of Poisons Act (1904).

On January 22, 1904, Governor General of India signed the bill to pass the Act no. I of 1904, ‘An Act to provide for the regulation of the possession and sale’ of all poisons in certain local areas, and the importation, possession and sale of white arsenic generally’.⁹ This Act was called the Poisons Act, 1904 and it extended to the whole of British India. The Act empowered the local governments or local authorities to regulate the sale and possession of poisons, granting licence to sale, wholesale or retail certain poisonous substance, and made provisions for punishment, if anyone is found guilty. Though the Act was not free from defects and shortcomings, it was a victory of persistent efforts of Dr. Chunilal Bose. In the language of Waddell (1904, p. 397), ‘The draft bill recommended to the Medical Congress, Calcutta, in 1894 by Drs. Evans and Chuni L. Bose, doubtless contributed to hasten this measure’.

Roy Choudhury (2018, p. 99) points out that, ‘The department was responding to the proposal for an act along the Arsenic Act of 1851 by a special jury, which had been summoned to reflect on the possibility of an act following what many thought was an example of mistrial in the case of Empress vs. Wagner and Cray (1894). This jury referred to the speech by Surgeon John Fenton Evans and Chuni Lal Bose delivered in the inaugural chapter of the Indian Medical Congress (1894), to support an India wide legislation, replacing what was widely acknowledge to be an ineffective act of 1866 for Bombay.’

Commenting on the Poisons Act (1904), Ilbert (1906, p. 81), wrote that, ‘The provisions of the English law for regulating the sale of poisons have often been criticized as inadequate by coroners and others. Critics of the English law will probably learn with some surprise that until the year 1904, there was no general law for regulating the sale of poisons in British India. There was an act for the Bombay Presidency and another for towns in what are now the United Provinces, but no general act. It was not that the negligent or criminal use of poison has ever been unknown in India—quite the contrary—but that the practical difficulties in the way of effective legislation are always been found to

be insuperable. Restrictions which can only be enforced by subordinate officials without adequate control over them and to do more harm than good. The new Poisons Act I of 1904, which seems to be the result of discussions extending over some eight or nine years, is limited in its scope and permissive and experimental in its character’.

Ilbert (1906, pp. 81, 82) further commented, ‘Local Governments may make rules for regulating the possession for sale, and the sale, of specified poisons in particular towns and cantonments. The Government of India may prohibit the importation of white arsenic into British India except under licence. Local Governments may, with the consent of the Government of India, regulate the possession for sale, and the sale, of white arsenic in the whole or any parts of their provinces, and the mere possession of white arsenic in any area where the drug is used for poisoning human beings or cattle to such an extent as to make restrictions on its possession desirable. The Government of India may, by notification, apply to other specified poisons the provisions relating to white arsenic. It would appear from the statements made in Council that the two poisons most commonly used for homicidal purposes in India are opium and white arsenic. Opium is a Government monopoly, and control over its sale can be exercised through the excise machinery. White arsenic, "the favourite agent of the Indian poisoner," is not produced in India, and therefore can be more easily dealt with than the indigenous vegetable poisons in which India abounds. There are extensive savings for things done in good by medical or veterinary practitioners, chemists, druggists or compounders, and tanners or trade merchants. A cautious measure, which may possibly be useful within its narrow limits’.

The Act I of 1904 was finally repealed and a new Poisons Act (1919)¹⁰ was legislated. Closely related to this was Chunilal Bose’s works on Cocaine Poisoning (Bose, 1913a). Chunilal Bose was a relentless crusader against consumption of narcotics and intoxicating substances. He also published papers and lectured on temperance. Mills (2007, pp. 345–346) has quoted Joseph Spillane ‘British India was one of the first areas, outside of the United States, to develop a serious problem with the overuse of cocaine. The first restrictions on the sale and use of cocaine were imposed in Bengal in 1902, about the same time as the first state regulations in the United States’. Mills (2007, pp. 345–346) further quotes David Courtwright ‘most of the cocaine distributed in India in the 1920s and 1930s was smuggled into Calcutta and then shipped along the two main railway routes through the United Provinces into the Punjab and beyond’. With this alarming situation, Bose’s seminal 1913 paper

⁹ https://upload.wikimedia.org/wikipedia/commons/b/b7/A_Collection_of_the_Acts_passed_by_the_Governor_General_of_India_in_Council%2C_1904.pdf.

¹⁰ https://www.indiacode.nic.in/bitstream/123456789/13675/1/the_poisons_act_1919.pdf.



titled ‘Cocaine poisoning’ published in the *British Medical Journal* (Bose, 1913a) became an important document on consumption of narcotics in India. However, Chunilal was not the first to attempt to elicit opinion against consumption of Cocaine. Mills (2018, p. 220) writes, ‘In 1902, the *British Medical Journal* printed a report by an Indian doctor, Kailas Chunder Bose, which concluded that: Besides the use of cocaine hydro-chlorate as a therapeutic agent its consumption as a drug for intoxication is so great in Calcutta that unless stringent measures be adopted to control its sale, I have reason to fear that its demoralizing effects will soon spread amongst the juvenile members of respectable families and that at no distant date special asylums will be required for the safety and treatment of cocaine inebriates.’ Kailas Chunder Bose further observed that the habit of consumption of cocaine has alarmingly reached the Bengali households as women in many houses have developed a habit of taking a small dose of cocaine with betel-leaf, the drug being smuggled into households by petty sales-women. Writing in *British Medical Journal* in 1913, Chunilal Bose observed, ‘not many years ago cocaine was a drug hardly known to the people of India outside the medical profession and now, sad to reflect, it has taken a vigorous hold of a certain class of people in this country both in town and village. In Calcutta ... there is reason to believe that the cocaine habit has much increased and is rapidly spreading’ (Bose, 1924, p. 369). As the Chemical Examiner, Bose came across cases of death due to Cocaine poisoning.¹¹ Despite Government's active interceptions in Cocaine smuggling, the picture did not change much in next one or two decades. In 1927–28, a report of the Government of the United Provinces of Agra and Oudh complained that: ‘The nefarious traffic in illicit cocaine continued to flourish in spite of the vigilance on the part of the Police and Excise staffs and the heavy sentences which were generally passed in the cases which reached the courts. Most of the bigger cities were affected by the evil and the cocaine habit was undoubtedly wide-spread among the urban population. Very few cases were reported from rural tracts. Illicit cocaine came into the country from Germany, Japan and Holland; and smugglers in these provinces got their supplies from Calcutta, Bombay, Delhi and Ajmer (Mills, 2018, p. 224)’.

¹¹ In his epoch making paper, ‘Cocaine Poisoning’ (BMJ, 1913), Bose has cited six cases of death or illness from Cocaine poisoning from his first-hand experience. Mills (2018, p. 221) confirms, ‘Bose had served in the Chemical Examiner’s Department of the Government of Bengal for 27 years, so was well-placed to chart changes in drugs markets as his office was responsible for analysing samples of substances seized by the police and excise officers. His report included details of those though to have died from cocaine consumption thanks to post-mortem reports passed on by a colleague in the police.’

6 Other significant contributions

Chunilal Bose earned the fame as an accomplished chemist not only in Bengal, but beyond its border. He was one of the founder members of the Board of Directors of Bengal Chemicals & Pharmaceuticals Ltd. (1899) and earned the honorific title *Rasāyanācārya*. The following reference cited by Kochhar (2013, p. 1096) is interesting, ‘The most notable of his private students was Anant Shridhar Kotibhaskar (d. 1910), who went on to secure First Class Honours in MA and win the Chancellor’s gold medal in chemistry. His initiative led to the establishment of Alembic Chemical Works. Another trainee at the laboratory was Bhailal Dajibhai Amin (1878–1950) whose forte was business management and who eventually became the sole proprietor of Alembic. In 1903, Gajjar¹² started a small factory called Parel Laboratories after the location in Bombay for the manufacture of spirit and ‘pharmaceutical products, toilet preparations and certain chemicals’ based on it. Soon it was found necessary to have a factory for the large-scale production of spirit alone. For this it was considered advisable to go out of British India, ‘as the Government of Bombay did not seem to be inclined to grant any concessions’. Kotibhaskar approached the Maharaja of Gaekwad as well as his Dewan Ramesh Chandra Dutt. Accordingly, a factory for the manufacture of spirit was started in Baroda in 1905. The name Alembic, broadly meaning distillation apparatus, was chosen to indicate “that the works were principally started for the manufacture of spirit and its products”. Alembic acquitted itself well at the 1906 Calcutta National Exhibition, where its products were examined by “reputed chemical experts” such as Dr David Hooper, curator of Indian Museum and Dr Rai Chunilal Bose Bahadur, chemical examiner to the Government of Bengal who certified them “as possessing the highest chemical purity”.’

As we had already mentioned, in the first Science Convention held in Kolkata in 1917, Chunilal Bose delivered a lecture titled ‘Some practical hints to improve the dietary of the Bengalis’, where he advocated that Bengalis should change their dietary habit, which contained a lot of carbohydrates and sugars, but less fibre and protein. He suggested that by amending the menu, Bengalis should reduce the consumption of rice, eat bread for dinner and increase the amount of pulses. He advocated adding gram and coconut to vegetable curries for additional protein and fat and also

¹² ‘Tribhuvandas Kalyandas Gajjar (1863–1920) was Western India’s first industrial chemist. To him goes the credit for introducing German synthetic dyes into Indian textile engineering, initiating alcohol production on modern lines and producing synthesis of formal education and industrial chemistry..... Gajjar was the leading light behind Alembic Chemical Works’. (Quoted from Kochhar 2013, p. 1093).



suggested that fried or boiled gram or peanuts and bits of fresh coconut be added to puffed rice for a healthy snack. This prescription is widely followed till date (Palit, 2018). While working in the Chemistry laboratory of the Calcutta Medical College, Bose conducted chemical analysis of various foods and formulated the causes of malnutrition in the eastern part of India. Through a series of publications, Bose focussed on food adulteration that was rampant during World War I and suggested practical ways to tackle it (Palit, 2018). CL Bose (1930, pp. 99–100) wrote, ‘The most common defect in the Bengali diet is that it is too rich in starch, cane sugar and far too poor in protein (the muscle forming element). Bengali, old and young, as a rule, take a large quantity of rice which is rich in starch and poor in protein, salts and vitamins. No doubt, rice is an easily digestible article of food, but when taken in large quantity, tends to distend the stomach and interfere with its normal movement and function..... If the people of Bengal have a great bias for rice, most of them entertain a prejudice against dal, which they generally take in small quantities, lest they suffer from indigestion. Going to financial consideration, the average Bengali cannot afford to have a regular allowance of sufficient milk in his daily diet, and for the same reason, satisfy himself with an insignificant quantity of fish. The result is that the protein building elements in his daily food are insufficient and he tries to balance the diet by consuming a large quantity of rice’. Choudhury (2018) has, however, criticized Bose for supporting tinned baby food. Nevertheless, in the early twentieth century, when the modern jargons on health and hygiene were not known, he spoke of the importance of a balanced diet and daily exercise. Bose sought to spread awareness about the benefits of hygiene and sanitation in rural Bengal and spoke out against adulterated food as well as environmental pollution (Palit, 2018). A scholarly article by Bose, namely, ‘Some Observations on Diabetes in India’ (Bose, 1924, pp. 269–290), was an important step towards creating awareness against this disease in India. The importance of Bose’s work, and subsequently of his son JP Bose, has been discussed by Mohan et al. (2021).

In a review of the Volume II of the *Scientific & Other Papers* of Rai Chunilal Bose Bahadur, JP Bose eds., Kolkata, 1925, *The Indian Medical Gazette* (February 1926), the reviewer summarized Bose’s contribution as, ‘A reprint from the *Calcutta Medical Journal* of 1910 deals with the measures necessary for the prevention of food adulteration, an exceedingly important problem in India. An essay on common Indian foodstuffs is followed by an admirable one on practical hints for the improvement of the dietary of Bengalis; this last indeed is a chapter which should be read by all medical men practising in Bengal. The milk supply of Calcutta is dealt with frankly and with no attempt to minimise the dangers from dishonest gowallahs and conditions of sale;—on the whole it may be said that some 40

per cent, of all samples analysed from various sources were found to be adulterated. It is indeed largely owing to the advocacy of Rai Bahadur Chunilal Bose as Chairman of the Calcutta Municipality that legislation has been introduced in the recent Municipal Act to improve what was a shocking state of affairs. Further, a standard of purity for Indian milk supplies is suggested in detail for buffalo’s milk which the public health worker will find interesting and of important practical value. In dealing with Indian infant mortality, the author pleads for improved sanitary conditions in lying-in rooms and for the employment of skilled help during labour, whilst maternity and child-welfare schemes for Calcutta are outlined, one of which at least is now in being. The health of Bengali college students—a most important racial question—is fully dealt with. The drink and drug traffic is dealt with forcibly and from the point of view of the future of the temperance movement in India.’ (*The Indian Medical Gazette*, February, 1926, pp. 99–100).

7 Science communication in the nineteenth and early twentieth century Bengal

The nineteenth century Bengal Renaissance ushered in a cult of rationality, science education and scientific temper, thereby, resulting in an appropriation of the modern science by the Bengali middle class in the colonial India. Intellectuals like Rammohun Roy, Akshay Kumar Dutta, Ishwar Chandra Vidyasagar, Rajendralal Mitra and others responded in their own way to the emerging discourses of science and modernity (Madhumita Roy, 2016). Even Bankimchandra Chattopadhyay and Rabindranath Tagore were not indifferent to such discourses and assumed a significant role in shaping the public understanding of science. Scientists like J.C. Bose, P.C. Rây and Chunilal Bose contributed significantly to science popularization in Bengal. In the early twentieth century, Ramendrasundar Tripathy, Sukumar Ray, Jagadananda Ray, Charuchandra Bhattacharya and others nurtured this tradition further.

In the early nineteenth century, Śrīrāmpur Baptist Mission and the Calcutta School Book Society pioneered the practice of Public Science Communication in vernacular languages in Bengal. The popularity of the science books published by the School Book Society inspired some Europeans and Indians to publish popular science articles and science news in literary magazines and periodicals and even in newspapers. *Digdarśan* (launched in April, 1818), published by the Śrīrāmpur Baptist Mission, was the first periodical in Bengali and also the first to publish articles on Science. It regularly published articles on physics, geology, geography and geographical discoveries like that of Columbus with a few articles on agriculture, zoology, chemistry and astronomy. In 1822, School Book Society published six monthly



issues of *Paśvāvalī* or ‘*Animal Biography*’. Each issue was dedicated to the description of an animal. The writing was in a story-telling manner and there was hardly any scientific information in them. However, the stories were interesting. Publication of *Paśvāvalī* stopped after six issues. The new series of *Paśvāvalī* appeared in 1834 due to the efforts of Ramachandra Mitra (Sanyal, 2021, pp. 254, 255).

The first attempt to compile a Bengali encyclopaedia was undertaken by Felix Carey (1786–1822), who was the son of Reverend William Carey (1761–1834) of Śrīrāmpur and the first lexicographer of the Burmese language. In 1819, he began the translation of the fifth edition of *Encyclopædia Britannica*, naming it *Vidyāhārāvalī*. From October 1819 till November 1820 the book was printed by Felix Carey every month in 48-page instalments. Thus completed, the first part of *Vidyāhārāvalī* was compiled into the 638-page *Vyāvachchedavidyā* (anatomy), the first book on anatomy and surgery in Bengali (Bhattacharya, 1960, pp. 17–19, p. 34).

The tradition of public science communication in Bengali continued through the 1830s and 1840s and from 1830s, more and more magazines and periodicals started publishing articles and news on science and technology. Among them, *Jñānānveṣaṇ* (1831), *Jñānodaya* (1831), *Vijñānasāra Saṃgraha* (1832) and *Vijñāna Sevadhī* (1833) were notable. *Vijñāna Sevadhī* was probably the first periodical to use the Sanskrit vocabulary ‘*Vijñāna*’ in Bengali as a suitable translation for the English ‘*Natural Sciences*’. However, high quality science writings first appeared in *Vidyādarśan* (1842). Among the newspapers of this era, *Samācāra Darpaṇ* (launched on May 23, 1818 from the Baptist Mission Press, Śrīrāmpur), regularly published news and articles on Science (Sanyal, 2021, pp. 254, 255).

In 1849, Ishwarchandra Vidyasagar published Bengali *Jīvanacarita*, a free translation of the lives of Copernicus, Galileo, Newton, William Herschel, Grotius (Hugo Groot), Carolus Linnaeus, B.J. Duval, William Jones and Thomas Jenkins from “Chamber’s Exemplary Biography”. For his *Jīvanacarita*, Vidyasagar coined, for the first time, the Bengali/Indian equivalents of 74 scientific/technical terms, many of which survive even today. Vidyasagar’s *Bodhodaya* (1851) was compiled on the basis of information in several English books such as *Rudiments of Knowledge* by Chambers; this included various topics in physics, biology, geography etc. Under physics or material science, the compiler referred to dimensions, their measurements, non-metallic and metallic substances, eight types of metals including zinc and alloys such as bronze and brass, glass and diamond. Vidyasagar commented on the recently obtained knowledge: “It is a matter of great surprise (*atyanta āścaryer viṣaya*) that the precious stone diamond and black coal have the same elemental composition”. Under the animate objects, the compiler discussed varieties of animals, plants and their economic importance. Vidyasagar touched upon not only

medicinal plants as in Āyurveda but also economic zoology, wax, honey, silk, lac, pearl etc. Agricultural and mining products such as coal and kerosene were discussed. Under geography came the topics of day and night, lunar month and solar year, rivers, oceans, ebbs and tides etc. (Biswas, 2012, pp. 389, 390).

Tattvabodhinī Patrikā, launched in 1843 by Tattvabodhinī Sabhā and edited by Akshay Kumar Datta, played a remarkable role in science communication in Bengal. It was a widely read periodical in educated Bengali society. As a writer and editor, Akshay Kumar contributed substantially to the creation of a scientific temper in the society through this magazine and to the improvement of Bengali science journalism and the evolution of modern Bengali science vocabulary. *Tattvabodhinī Patrikā* published high quality science articles in much simpler language compared to the earlier magazines. Articles on animals and plants, natural wonders, electricity, chemistry, physics, mathematics, astronomy etc. were regularly published. Akshay Kumar Datta’s books namely, *Cārupāth (Elementary Lessons, 1853–54)*, *Bhūgol (Geography, 1851)* and *Padārthavidyā (Physics, 1856)* had been serialized in this magazine before they appeared in the form of books. The magazine had a separate section called *Vijñāna Bārtā*, where science related news items were regularly published (Bhattacharya, 1960, pp. 59–80; Sanyal, 2021, pp. 254, 255).

The success of *Tattvabodhinī Patrikā* inspired others to publish science articles in magazines and periodicals. Two names in this connection are worth mentioning for the mid-nineteenth century period: *Vividhārtha Saṃgraha* (first published in October 1851) and *Rahasya Sandarbha* (first published in March 1863). *Vividhārtha Saṃgraha*, modelled after Charles Knight’s ‘*The Penny Magazine*’ (1832–45), had a big impact on public understanding of science, mainly because of the interesting and diverse nature of the content and fluent writing style by Rājendralāla Mitra, who was not only the editor of the first six issues, but continued to write in the subsequent issues. Most of the articles were on zoology, botany, chemistry, physics, geography and a few on astronomy. *Vividhārtha Saṃgraha* was the first Bengali periodical to publish high quality articles on Physical Geography. It was also the first magazine to use photographs and illustrations with its science articles. Rājendralāla Mitra was perhaps the first of the nineteenth century thinkers to lay emphasis on the applied sciences. His book ‘*Śilpik Darśan*’ or ‘*Industrial Science*’ was published by Vernacular Literature Committee in 1860. After *Vividhārtha Saṃgraha* closed down in 1861, Rājendralāla Mitra launched *Rahasya Sandarbha* in 1863. In these two magazines together, he published nearly 300 science articles (Sanyal, 2021, pp. 254, 255; Sanyal, 2022, pp. 28–42).

The other literary magazines of this period who contributed substantially to the science popularization were:



Baṅgadarśan (launched in 1872, editor Bankimchandra Chattopadhyay), *Āryadarśan* (launched in 1874, editor Jogendranath Vidyabhushan) and *Bhāratī* (launched in 1877, editor Dwijendranath Tagore) (Sanyal, 2021, pp. 254, 255).

Bhudev Mukhopadhyay was a distinguished writer and thinker, writing essays, textbooks and novels to convey his ideas which combined nationalism and rational thinking. Among his important books on science was *Prākṛtik Vijñān* (in two parts, 1858 and 1859) and a book on geometry—*Kṣetrattva* (1862). Rev Krishna Mohan Bandyopadhyay was another reputed scholar who compiled thirteen-volume encyclopaedia, *Vidyākālpadruma* (1846–1851), first of its kind in Bangla (Bhattacharya, 1960, pp. 81–109).

Bankimchandra Chattopadhyay's popular science writings began with his entry into the world of Bengali journalism. It is for his monthly journal *Baṅgadarśan* (1872) that he began writing these essays. The aim was to popularise science among interested men, schoolboys of advanced levels and educated, modern women. The essays written for the *Baṅgadarśan* between 1872 and 1875 were essentially adaptations from the writings of European scientists, who lived and worked between the seventeenth and nineteenth centuries. In 1875, a collection of nine Bengali essays on elementary science, titled *Vijñāna Rahasya* (Mysteries of Science), was published. Bankimchandra articulated a philosophy of science through which he attempted to understand not only its technical functions or properties but also the social and intellectual (Majumdar, 2014, pp. 308–310).

During this period, several magazines and periodicals for women and children also appeared, which published science articles regularly. Notable among them were *Bāmābodhinī Patrikā* (launched in 1863, first editor Umeshchandra Datta), *Paricārikā* (launched in 1878, first editor Pratapchandra Majumdar), *Abodhbandhu* (launched in 1867, editor Biharilal Chakrabarti), *Jyotirīngana* (launched in 1870, editor Brajamadhab Basu), *Jñānānkura* (launched in 1875, first editor Shrikanta Das), *Sakhā* (launched in 1882, first editor Pramadacharan Sen) etc. which created an immense impact on the young minds. *Sandēśa* (launched in 1913, first editor Upendrakishore Ray Chowdhury) was highly popular among children (Sanyal, 2021, pp. 254, 255).

During the same time several Bengali periodicals on medicine started publications e.g. *Cikitsā-Sammilanī* (Kolkata, 1885–1894), *Cikitsaka* (Rajshahi, 1889–1926), *Cikitsaka o Samālocaka* (Kolkata, 1895–1896), *Swāsthya* (Kolkata, 1898–1902), *Swāsthya Samācāra* (Kolkata, 1912–1928) etc. Noted medical practitioners of those days regularly wrote in these periodicals (Bandyopadhyay, 1952).

In the second half of the nineteenth century, the Bengal Renaissance was in full bloom and people were appreciative of the power of modern Science; they were eager to get themselves acquainted with the latest development of science and technology in Europe and the USA. The science

articles published in the magazines and periodicals mentioned above, aimed to present the modern science in a simple language to the Bengali speaking people so as to create an interest in science in the society (Sanyal, 2021, p. 255). The role of Chunilal Bose as a Science Communicator must be evaluated in this light.

8 Public science communication: contribution of Chunilal Bose

Contribution of Chunilal Bose to public science communication in India is immense. His profound contribution to the spread of scientific awareness in India needs to be studied and appreciated. Bose has written many books and articles on science in Bengali and English. He also delivered some simple lectures on science to inculcate scientific awareness and critical thinking among the students. Unlike his more illustrious contemporaries, J.C. Bose and P.C. Ray, he directly addressed the scientific topics which are connected to the concern and wellbeing of the common people and communicated them to the public in a simple language.

Chunilal Bose wrote two Chemistry textbooks in Bengali, namely '*Falita Rasāyana*' (*A Treatise on Practical Chemistry*, 1895) and '*Rasāyana-Sūtra*' (*Elementary Chemistry*, 1897; the English title of the book is given as '*A Treatise on Elementary Physics and Chemistry*'). In the sub-title, it is written to be '*Containing a full course in Physics and Chemistry for Vernacular Medical Schools in Bengal*'.¹³

Bose explained the rationale behind writing '*Falita Rasāyana*' in the preface (Bose, 1895), 'Last year while lecturing at the Calcutta Medical School¹⁴ on Practical Chemistry, I felt the want of a textbook on the subject written in Bengali and subsequently at the request of Dr. R.G. Kar, the Secretary of the School, I undertook the task of writing such a book, a task which find its completion in the present volume. It is, I believe, the first work of its kind in Bengali language: and though suitable for students studying Practical Chemistry for the first time, it is not entirely of an elementary character. The subjects taken up have been treated at some length and special care taken to bring them up to date. The subject selected are those described by the Calcutta University for the first MB and LMS examinations and consequently Bengali students working in the practical chemistry classroom of the Calcutta Medical College may find the book useful to them in their work. The chapters

¹³ Bengal Province had three Medical Schools- Calcutta Medical School and Campbell Medical School in Kolkata and Dacca Medical School in Dhaka.

¹⁴ Initially, Carmichael Medical College and now Dr. RG Kar Medical College, Kolkata.



on the analysis of urine, calculus and vegetable alkaloids have been drawn up so as to be of use to Bengali assistant surgeons, hospital assistants and independent medical practitioners. The arrangement of the tables is to a considerable extent that adopted by Valentine from whose work on practical chemistry have derived great help’.

It is now clear that the book was meant for medical students.¹⁵ The book has nine chapters and an appendix, viz. (i) fundamental laws of chemistry; (ii) base, solvent & salt; (iii) reagents & indicators; (iv) analytical methods; (v) tests for basic radical; (vi) tests for solubility; (vii) plant alkaloids; (viii) urine tests; (ix) tests for stones, appendix: procedures for preparation of reagents, Bengali-English chemistry glossary.

The next book ‘*Rasāyana-Sūtra*’ (Bose, 1897b, 1898) had two volumes¹⁶: the first part of the first volume deals with physics having chapters on (i) definition of physical science; (ii) heat; (iii) electricity and the second part is on chemistry with chapters (i) elements & compounds; (ii) water; (iii) hydrogen. Bose began the first volume with an article elaborating the relation between chemistry and medical science. The second volume contains chapters on (i) introduction to metals; (ii) alkali metals; (iii) alkaline earth metals; (iv) aluminium group of metals; (v) zinc group of metals; (vi) iron group of metals; (vii) tin group of metals; (viii) copper group of metals; (ix) noble metals; (x) organic substances; (xi) organic acids; (xii) vegetable alkaloids; and (xiii) urine & urinary calculus.

In the preface of the first volume, Bose stated that, ‘Last year when listening to the students of the Campbell Medical School,¹⁷ Sealdah, I noticed that the want of a comprehensive Bengali text book containing of all the subjects constituting the course in Physics and Chemistry as prescribed by the Director of Public Instruction for vernacular medical schools in Bengal was strongly felt by the students. This book is intended to supply the one that it embodies my lecture notes delivered to the students of the Campbell Medical School during the session 1896–1897 and contents in addition to the subjects laid down in the course short notices on various matters connected with heat electricity and chemistry which it is necessary for all medical students to know.’

Apart from these textbooks, Chunilal Bose wrote several science books in Bengali for the general public. Chunilal's popular science books began to be published from the beginning of the twentieth century. His first book ‘*Jal*’ (water)

(Bose, 1900), written for non-experts, was published from the Sāhitya Sabhā of Śobhābāzār Rājbarī¹⁸ in 1900 (Bose, 1900; Bhattacharya, 1960, p. 274).

Chunilal Bose's ‘*Jal*’ is a primer on the science of water for the general public. It is a small book of about 60 pages. In the introduction, the author has lamented the lack of science awareness in the country. Even, according to the author, the initiatives of the Indian Association for the Cultivation of Science (IACS)¹⁹ had been able to attract only college students. Bose regretted that, ‘In our country, the respect literature, philosophy, history or archaeology, etc. command, not even a fraction of it is commanded by science. Discussion of various theories on literature, philosophy, history can be found in newspapers and periodicals. But thought-provoking scientific essays seldom find a place in them’ (Bose, 1900).

The content of the book was presented in the fourth session of the Sāhitya Sabhā. At the beginning of the book, there is a discussion on the composition of water and the method of analysis, the nature of oxygen and hydrogen, etc. The author has discussed several physical–chemical experiments to explain the properties of water. Towards the end, the method of water filtration is discussed in a simple language. Discussion on chlorine and hardness of water etc. is also informative (Bose, 1900).

Besides ‘*Jal*’, Chunilal wrote a few books on other subjects of public interest. Chunilal's next book, ‘*vāyu*’ (air) (Bose, 1903), was first published in 1903. Most of the topics in the book were read at the Sāhitya Sabhā. The author had earlier read an essay on water at the Sāhitya Sabhā. Many present at the meeting requested the author to compose a book on common substances, and Chunilal wrote the book in honour of the previously published book, *Water*. Dedicated to the memory of Mahendralal Sircar, the book is divided into four chapters: the first chapter discussed the composition and chemical and physical properties of air, the second chapter discusses pollution of air and the relationship between air and our health, the third chapter is on air- and

¹⁵ In the nineteenth century, Medical courses were taught in both English and Bengali medium, particularly in the Medical Schools offering Diploma in Medicine. Good science books in Bengali were in high demand.

¹⁶ A combined volume appeared in 1913.

¹⁷ Now Dr. Nilratan Sarkar Medical College, Kolkata.

¹⁸ Śobhābāzār Rājbarī, situated in the north Kolkata, is the residence of the Śobhābāzār Royal Family. Patronized by the royal family, this palace became the hub of Bengali cultural activities during the colonial period. It is here, Swami Vivekananda was accorded civic reception after his return from the Congress of Religions, Chicago. The Sāhitya Sabhā or the Literary Meeting was established at the Śobhābāzār Rājbarī in 1899 to cultivate and nurture Bengali literature. Chunilal Bose had presented his early lectures on popular science topics here, which were later published as books. Chunilal Bose was associated with this literary meeting from the very beginning. In 1910, he was elected president of the Sāhitya Sabhā.

¹⁹ IACS, the first scientific institution in India, was established at Kolkata in 1876 by Dr. Mahendralal Sircar. Chunilal Bose was associated with it (IACS Annual Report 2007–08, p. 9) and delivered many lectures here. In 1930, CV Raman was awarded Nobel Prize in Physics for his research work at IACS.



dust-borne diseases and the fourth is on purity of air and air purification (Bose, 1903).

Chunilal's next book, '*Kāgaj*' (*Paper*, 1906), had been presented before Sāhitya Sabhā before it was published. In this book Chunilal discussed in detail about the Indian and English methods of paper-making. Chunilal's profound erudition is found in the detail discussion of the history of paper-making in the ancient period. Apart from the above mentioned books, other popular scientific works of Chunilal Bose include '*Ālok*' (*Light*, 1909), '*Khādya*' (*Food*, 1910) (Bose, 1910), '*Śārīr Swāsthya-Vidhān*' (*Personal Hygiene*, 1913) (Bose, 1913b), '*Pallī-Swāsthya*' (*Village Sanitation*, 1916) (Bose, 1916) and '*Swāsthya Pañcak*' (A collection of five articles on health, published earlier in newspapers like *Basumatī* etc., 1928) (Bhattacharya, 1960, p. 274).

Chunilal Bose's books on food, health and public health & hygiene are worth discussing as they were also major focus areas of his research works. His book '*Khādya*' (*Food*, 1910) (Bose, 1910) was a collection of his lectures presented at the Sāhitya Sabhā and the book was also published by the Sabhā. In the preface of his book, Chunilal writes, 'Misconceptions about food prevails among the common public. Moreover, many people even lack the essential knowledge about food. The subject is vast and is closely related to medical science and chemistry. With my limited capability, I am trying to make a brief and simplified presentation of this complex subject....' The chapters are as follows: 'The relationship of food with health', 'What is food?', 'Food requirements', 'Digestive system', 'Different ingredients of food and their properties', 'Calculate the amount of food', 'Other food ingredients', 'A few words about everyday food', 'Digestibility during digestion of food', 'Cooking', 'The quantity and timing of meals depending on the age', 'Moderate diet and longevity benefits', 'Non-vegetarian diet', 'Food adulteration and its determination' and 'Ways to prevent food adulteration'. The book is supplemented with large numbers of tables with contents of various foods and their nutrition value etc. It is interesting to note that Bose has cited all examples from common Bengali food and has advised such food habit (e.g. eating more fruits and vegetables for good health, preferring *atta* over *maida* to have more fibres etc.) which is prescribed by dieticians even today. But his preference to Bakery bread and fried Luchi (Poori) over Chapatti, as the later contains incompletely cooked wheat flour particles which are difficult to digest, will surely be disputed by many physicians today! Nevertheless, Bose was the first to write such a useful book on food and food habits in Bengali for the common public, which has both scholarly as well as historical value.

'*Śārīr Swāsthya-Vidhān*' (*Personal Hygiene*, 1913) (Bose, 1913b) was based on Bose's articles published in *Bhāratī*²⁰ magazine. In the preface, Bose lamented that personal hygiene of members of a family, particularly that of

children, are taken care of by elderly women in the family, who themselves are not fully aware of the fundamental of hygiene. This book was expected to enlighten them. The book include chapters on early rise, bathing, face washing, eating, drinking water, mouth freshening & smoking, physical work & exercise, resting & sleeping, dressing, dwelling, ways to prevent infectious diseases and restraint.

In the preface of his book '*Pallī-Swāsthya*' (*Village Sanitation*, 1916) (Bose, 1916), Chunilal Bose wrote that at the request of Acharya J.C. Bose, he delivered a lecture on village sanitation at Rammohun Library on February 11, 1916. Later, he delivered another lecture on malaria at Sāhitya Sabhā. These two lectures were combined to form the basis of '*Pallī-Swāsthya*'. The English title of the book clearly indicates its intention. While addressing the dinner party of St. Andrews in Kolkata in 1888, Lord Dufferin, the then Viceroy of India, said:

Where is there a more crying need for sanitary reform than amongst those who insist upon bathing in the same tank from which they obtain their drinking water, and where millions of men, women and children die yearly, or what is even worse become the victims of chronic debility, disease and racial deterioration, from the preventable cause?' (Dufferin, 1890, p. 240).

Chunilal Bose must have felt this crying need to make public aware of the 'causes' that are 'preventable', as he planned for the lectures. The book has chapters on—pathetic conditions of our villages and the duties of educated people; water; few words on food; constituents of air; dwelling houses; malaria; small pox; and ways to overcome the present deplorable conditions of villages.

Among his popular science books in English were: (i) *A Lump of Coal*, (ii) *Combustion*, (iii) *A Pinch of Common Salt*, (iv) *The Tip of a Match*, (v) *The Health of Indian Students*, (vi) *Milk Supply of Calcutta: Its Hygienic, Social and Commercial Aspects*, (vii) *Prevention of Small Pox*, and (viii) *A few Hints on Sanitary Reconstruction*. The first three books were based on the series of popular lectures delivered at the Calcutta University Institute (Bose, 1925).

Why did a working scientist like Chunilal Bose write science for the public and particularly for the youths? Most of the science writers in Bengal in the nineteenth and early twentieth century were science enthusiasts. It is true that J.C. Bose and P.C. Ray wrote science for the public, but they were not as prolific as Chunilal Bose. Sanyal (2021, p. 257) explains, 'It was a general feeling in the early twentieth

²⁰ *Bhāratī* was an important literary magazine of the late 19th and early twentieth century Bengal. Established in 1877, the magazine was run by the famous Tagore family of Jorasanko, Kolkata. Dwijendranath Tagore, elder brother of Rabindranath Tagore, was its first editor. This magazine also published science articles.



century (when Indian nationalism was taking shape in Bengal and fast spreading into the other parts of India) that the children must be empowered with science who can intellectually challenge the British and can take the Indian nation forward in future'. Like many of his compatriots, Chunilal Bose, though worked under the British, was a patriot by heart, which was manifested through his writings as he was always anxious of the well-being of his fellow countrymen.

9 Honours and awards

Chunilal Bose had a remarkable scientific and social life and honours and awards showered upon him for his contribution to science and social Service. For his thesis 'On the chemistry and toxicology of *Nerium Odorum* with a description of a newly-separated principle' published in the *Transaction of the Chemical Society*, London in 1901, he was awarded Coates' Memorial Prize. Bose was elected a Vice President of the first Indian Medical Congress in the medico-legal section held in Kolkata in 1894. He was elected a Fellow of the Chemical Society, London in 1894 and Fellow of the Calcutta University in 1898. Since then he had been a member of the faculties of science and medicine and a member of the Boards of Studies in medicinal chemistry, physiology, zoology and botany and had been acting as an examiner for science and medicine. He was a member of the Council of Post Graduate teaching and was appointed teacher of chemistry and physics in the Campbell Medical School (now Nilratan Sarkar Medical College), Kolkata in 1896. He was also associated with the Carmichael Medical College, Kolkata (now R.G. Kar Medical College) first as a teacher and then as an Executive Committee Member and Life Member of the Institution. Dr. Bose was a pioneer in the Temperance movement in India and, he was elected as President of All India Temperance Conference held in Kolkata in 1917. Since 1898, he delivered several lectures on industrial & applied chemistry at the Indian Association for the Cultivation of Science. He was editor of the *Calcutta Medical Journal*, the organ of the Calcutta Medical College. He was associated with many other organizations. Dr. Bose was Vice-President of the Indian Association for the Cultivation of Science and a member of the Board of Trustees. He was also the Secretary of Calcutta Blind School and Calcutta Orphanage. He was involved in the management committee of Bethune College and Bethune School. Dr. Bose was the President of the first Board of Directors of Bengal Chemical and Pharmaceutical Works. He was also a Director of Calcutta Chemical Co. Ltd. and Calcutta Soap Works Ltd (Bose, 1924, 1925).

Chunilal Bose was elected Vice-President of Baṅgīya Sāhitya Paṛiṣad and President of Science Branch of the Paṛiṣad. In 1917, he was nominated as President of Acharya

Jagadis Chandra Bose Paṛiṣad. Chunilal presided over the science branch in the thirteenth session of the Bengal Literary Conference held at Medinīpur in 1922. For his contributions to the field of chemistry, food science and medicine, the British Government conferred on him the title of 'Rai Bahadur' in 1898. He was appointed 'A Companion of the Imperial Service Order' in 1915 and in 1922 on the occasion of the King Emperor's birthday, Bose was made 'A Companion of the Order of the Indian Empire'. After retiring from that post in 1920, he became the Sheriff of Kolkata in 1921. He was also a prominent functionary of Kolkata's iconic Mohunbagan Athletic Club since its foundation in 1889 (Bose, 1924, 1925).

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Declarations

Conflict of interest There is no conflict of interest.

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