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ARTICLE

Acharya Prafulla Chandra Ray and Quest for Innovation and Entrepreneurship in Colonial India

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ABSTRACT

Acharya Prafulla Chandra Ray (1861-1944) was a legendary scientist born in India. Acharya PC Ray, as he was popularly known, was an enthusiastic entrepreneur wholeheartedly devoted to chemical research and innovation. He became a pioneer in chemical innovations in modern India. His innovations led to successful entrepreneurship. While the country is celebrating "*Aatmanirbhar Bharat*" initiatives in 2020-22, no big bash celebration was offered to mark his 160th birthday last year. He was also an outstanding scholar who wrote a seminal monograph titled "*A History of Hindu Chemistry: From the Earliest Times to the Middle of Sixteenth Century*," published in two volumes, the first in 1902 and the second volume in 1909.

In this book, he introduced the chemical heritage of India to the global scholars from original Sanskrit texts. He translated several Sanskrit texts into English for the readers. He was also at the forefront of the new education movement for producing scientists and entrepreneurs with a Swadeshi bent of mind. His autobiography is a testimony of a Swadeshi entrepreneur who worked in an adverse environment during the colonial British Raj to promote locally manufactured chemical and pharmaceutical products. He had entrepreneurial vigour and necessity; at the same time, he was an outstanding teacher producing brilliant chemists and scientists for the country. This paper explores his thoughts and approaches to the integration of innovation and entrepreneurship while conceptualising a Swadeshi enterprise during the British Raj.

Keywords: Innovation, Entrepreneurship, Swadeshi Enterprise, Pharmaceutical Industry, India, British Raj, Colonial Period, History of Entrepreneurship, History of Science.

Introduction

Multifaceted Acharya Prafulla Chandra Ray (1861-1944) was a legendary scientist and amongst the league of brightest scientists during the Colonial British rule in India. He was a nationalist chemist and taught chemistry at the Presidency College, Calcutta, during 1889-1916, and later at the University College of Science, the University of Calcutta (popularly known as Rajabazar Science College) as its first "Palit Professor of Chemistry" during 1916-1936. He was also an adjunct faculty at the Indian Association for the Cultivation of Science (IACS), Calcutta, which is a centre for advanced scientific research founded by Dr Mahendralal Sarkar in 1876.

He was born in a village in the Jessore district of present-day Bangladesh. After his primary education, Prafulla Chandra moved to Calcutta to study secondary-level education at Albert School and passed the Entrance Examination (known as matriculation) with first division. He then got admitted to the Metropolitan Institution as a First Arts (FA) student. As he was very keen to study science, and the Metropolitan Institution did not have facilities for science courses, Prafulla Chandra attended physics and chemistry lectures as an external student at the Presidency College. He got inspired by his chemistry professor Alexander Pedler, an experimental chemist and widely called the founder of chemistry education in India.

After completing his FA, Ray joined a BA course at the University of Calcutta. Eventually, he was awarded the 'Gilchrist Prize Scholarship' to study in England through a competitive examination conducted by the University of London. For this examination, a knowledge of at least four different languages was essential. He already studied English, Latin, French, and Sanskrit in his courses in his FA, BA and earlier. He was one of two awardees of the 'Gilchrist Prize Scholarship' that year. He moved to Great Britain to join the BSc at the University at Edinburgh in 1882. He studied chemistry under Professor Alexander Crum Brown and his assistant Dr John Gibson.

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During his years in Edinburgh, he became a popular essayist and was appraised for his socio-political essays "India before and after the Mutiny", and "Essay on India". The first essay was widely publicised. A reply to this essay from a British Parliamentarian titled "John Bright's Letter to an Indian Student" appeared in all leading newspapers of Great Britain (Ray, n.d.). PC Ray continued his study after completing his BSc in Chemistry in 1885 and joined DSc in Chemistry under the supervision of Professor Alexander Crum Brown. He received the Hope Prize Scholarship from Edinburgh University, which facilitated him to continue his doctoral research for a year.

In 1887 was awarded DSc for his thesis titled "Conjugated Sulphates of the Copper-Magnesium Group: A Study of Isomorphous Mixtures and Molecular Combinations". While a doctoral student, he was elected as Vice President of the Chemical Society of Edinburgh University. PC Ray is famously known for his discovery of Mercurous Nitrite, which was first communicated to the *Journal of the Asiatic Society of Bengal*, a non-core scholarly journal of that time. Its review in the *Nature* applauded its worthiness, "during a preparation of mercurous nitrate by the action of dilute nitric acid in the cold on mercury, yellow crystals were deposited which upon examination, proved to be mercurous nitrites" (Ray, 1932, pp. 114; Visvanathan, 1985, pp. 13). A detailed account of his research on mercurous nitrate found a place in the Encyclopedic Treatise on Inorganic Chemistry, prepared by Henri Moissan – a French chemist and laureate of the Nobel Prize in Chemistry in 1906.

Swadeshi Entrepreneurial Journey

Acharya Ray founded the Bengal Chemical Works (BCW) in 1892 with a capital of Rupees seven hundred only from his meagre personal savings for fulfilling the nationalists' calls to establish Swadeshi enterprises in the country. He was then a Professor of Chemistry at the Presidency College. During the evening, after his academic duties at the College, Ray devoted his energy, time and creativity in his home laboratory to develop certain chemical products, or improvements of the same, for BCW. He even spent his vacations and weekends working for BCW.

After a lukewarm response from the local market in Bengal, in 1901, BCW was converted into a Limited Company, named the Bengal Chemical & Pharmaceutical Works Ltd (BCPW), the first pharmaceutical company in India. While establishing a pharmaceutical company, he kept referring to the indigenous sources for the pharma-chemical formulations (Chakrabarty, 2021). Ray started experimentation with the production of sulfuric acid, sodium carbonate (sajimati, or washing soda), superphosphate of soda, superphosphate of lime, ferrous iodide syrup, liquor arsenicals, liquor bismuth, spiritusaetherisnitrosi, green vitriol (ferrous sulfate B.P.), sodium phosphate B.P., Aitken's tonic syrup, syrup of hypophosphite of lime, tonic glycerophosphate, Parrish's chemical food, etc.

Some of these are household chemicals or fertilizers, while others are allopathic, ayurvedic, or homoeopathic formulations and tinctures. Ray initially produced these formulations in his home laboratory and then upscaled the production. The penetration of these products into the local markets was difficult, as there were biases towards foreign-produced or imported chemicals and pharmaceuticals. After an initial failure to have commercial viability or get a good market response for a few products, the chemical and pharmaceutical products produced by BCPW became very popular amongst the Swadeshi-minded medical practitioners and other users, such as small-scale Swadeshi industries (Ray, 1932).

For the pharmaceutical products, BCPW got support from the famous medical practitioners and educators in Bengal, such as Dr Nilratan Sarkar, Dr Radha Gobinda Kar, and Dr Mahendralal Sarkar, which helped them to improve the market penetration and acceptance. Presently, Kolkata city has medical colleges named after Nilratan Sarkar and Radha Gobinda Kar. Later these products penetrated national and South Asian markets. Eventually, BCPW established factories in Kolkata, Panihati (North 24-Parganas), Bombay, and Kanpur.

BCPW was nationalised on 15 December 1980 and became India's first government-owned pharmaceutical enterprise. He even got his former students and laboratory assistants in the works of BCPW. Kochhar (2013) compared PC Ray with Tribhuvandas Kalyandas Gajjar (1863-1920), the founder of

Alembic Chemical Works. These were contemporary in the chemical industries in India. While BCPW was founded in 1892, Alembic was founded in 1907 at Vadodara in Gujarat. However, the entrepreneurial culture in Bengal was contrastingly different compared to western India regarding acquiring capital and running their factories. While Ray was a professional chemist turned entrepreneur arranging capital from his meagre savings, DrGajjar was western India's first industrial chemist-cum-educator acquiring capital from his earlier industrial ventures and his fellow Gujarati industrialists and businessmen. In an article, Gupta and Goswami (2020) demystified Ray's involvement in the discovery or manufacture of hydroxychloroquine, a pharmaceutical formulation since 1950.

A Role Model for the Swadeshi Entrepreneurs in Bengal

During Acharya Ray's time, several Swadeshi enterprises were established by the entrepreneurs in the Bengal province, while some of them used the term 'Bengal' affixed in the enterprise names, *viz*., the Bengal Waterproof Works, founded by Surendra Mohan Basu, Bengal Lamps by founded Kiran Shankar Roy and Suren Roy, Bengal Potteries Ltd founded by Maharaja Manindra Chandra Nandy, and the Calcutta Chemical Company founded by Khagendra Chandra Das. The famous brand Duckback was promoted by Bengal Waterproof (Sarkar, 2014). Other important Swadeshi enterprises included the Bande Match Factory and Oriental Match Company (safety matches), and two newspaper groups, namely the *Ananda Bazar Patrika* (ABP), founded by Prafulla Kumar Sarkar and Suresh Chandra Majumdar, and the *Amrita Bazar Patrika-Jugantar*, founded by Sisir Kumar Ghosh and Motilal Ghosh.

The promoters in these enterprises were often men of outstanding technical calibre (Damodaran, 2012). For example, Bengal Lamps' founder Kiran Shankar Roy was educated at the University of Oxford in Great Britain, and Bengal Lamps' Khagendra Chandra Das and Bengal Waterproof's Surendra Mohan Basu were educated at the University of Stanford in the United States of America (Seth, 2018). They joined the Edinburgh-educated PC Ray in establishing the Swadeshi enterprises in the Bengal province to produce the products

frequently used by the general public as well as the sympathisers of Swadeshi movements in India.

These enterprises created many innovative and creative products at their small R&D setups in Bengal, involving educated, enthusiastic Bengali youths. Thus, the concepts like "*Make in India*" and "*Aatmanirbhar Bharat*" started happening in Eastern India before the independence of India, involving Swadeshi entrepreneurs, local merchants, and a group of consumers who were the sympathisers of Swadeshi movements in India. Some of these enterprises even survived after the independence in 1947, while others were closed due to the death of the promoters or acquisitions by the big corporations. Except for BCPW, no other Swadeshi enterprise on the list became a public sector enterprise.

Ray mentored many of the Bengali entrepreneurs while they were establishing respective Swadeshi enterprises, and he described their entrepreneurial journeys in his autobiography (Ray, 1932). In his autobiography, he keenly observed the struggles of Swadeshi ventures, namely the Calcutta Pottery Works and Bangiya Steam Navigation Company (Ray, 1932, pp. 337-45, 347-360). In the same book, Ray closely observed the success story of another Swadeshi enterprise, namely the Bengal Enamel Works Ltd, founded by Dwijendra Nath Bhattacharyya and his brother Devendra Nath Bhattacharyya in 1921 (Ray, 1932, pp. 345-47).

Acharya Ray was a founder of the first School of Chemistry in India, the first Indian scientist to turn entrepreneur, and a great authority on ancient Hindu chemistry. The Indian School of Chemistry was established at Presidency College in Calcutta when he joined as the assistant professor in the postgraduate teaching programme in chemistry in 1889. He narrated the journey of the Indian School of Chemistry in chapters 13 and 14 of his autobiography (Ray, 1932, pp. 160-195; Mazumdar, 2010). He got several brilliant research scholars in his newly founded school who became famous scientists and educators, namely Nilratan Dhar, Jnanendra Chandra Ghosh, Jnanendra Nath Mukherjee, Satyendranath Bose, Priyadaranjan Ray, Pulin Behari Sarkar, Rasiklal Datta, besides others (Choudhuri and Singh, 2018).

The Indian School was also instrumental in the creation of the Indian Chemical Society (ICS) in 1924, founded by Acharya Ray as its founder President (Zachariah, 2006). Many of his research students later became active in the activities and proceedings of the ICS. Many of his later research students served the chemical and pharmaceutical industries and laboratories to make India self-reliant (Chakravorty, 2019). As a university professor, he became an active member at the University of Calcutta under the leadership of Sir Ashutosh Mukherjee for introducing a vigorous science education in the country. While the Massachusetts Institute of Technology in the United States of America was encouraging its faculty members for entrepreneurial leadership in addition to their regular teaching and research responsibilities during the early 20th century, Acharya Ray had played a similar role while teaching at the University of Calcutta and Presidency College in Calcutta.

Conclusion

Acharya Ray is attributed to different Swadeshi activisms during his lifetime. In an article, Ghosh (2022) narrates Ray's proximity to the Freedom fighters in Bengal, particularly in preparing chemical bombs and explosives for the freedom fighters. In another article, Mazumdar (2012) narrates Ray's involvement in the political and economic projects of Swadeshi and his advocacy for the Gandhian beliefs of khadi and charkha. Ray also later got associated as a Patron with an indigenous Swadeshi enterprise named BangaSree Cotton Mills, which altered the shareholding pattern to save the enterprise from oblivion (Chakrabarti, 2018). His contributions were also earmarked as a prelude to science museums in India (Banerjee, 2020).

While Acharya Ray established India's first pharmaceutical company, probably he could not foresee India would recognise as the "Pharmacy of the World" within a century, producing and supplying the bulk of generic medicines and vaccines to the developing countries as well as to the developed nations. During his lifetime, he became a role model for the Swadeshi entrepreneurs in British colonial India, as pointed out by Sengupta (2022). His Make-in-India mantra is still relevant for the self-reliant movements in India in the 21st century that helps

in imbibing the entrepreneurial spirits amongst the young entrepreneurs and start-up generations in India.

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