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BOOK REVIEW

SUBRATA DASGUPTA: *JAGADIS CHANDRA BOSE AND THE INDIAN RESPONSE TO WESTERN SCIENCE*. OXFORD UNIVERSITY PRESS, NEW DELHI, 1999. pp. 309, Rs. 525.00

This book about Jagadis Chandra Bose is a scholarly work which evaluates Bose as a scientist, provides glimpses of Bose as a person, and dwells on the broader implications of his work for Indian science. The author was born in India, lived less than a mile from the Bose Institute in Calcutta, and went to kindergarten in the school with which J.C. Bose's wife, Lady Abala Bose, was closely associated. He now holds the Eminent Scholar Chair in Computer Science and is Professor of History at the University of Southwestern Louisiana, USA.

J.C. Bose was born in 1858 in an educated family. After graduating from the University of Calcutta in 1880, he proceeded to London to study medicine. But he developed there an illness which was exacerbated 'by the odours of the dissecting room'. Therefore he was advised to abandon medicine. That is why he left London to join Christ's College at Cambridge to study natural sciences. Bose's arrival in Cambridge landed him in the company of men who were the creators of some of the knowledge which he had acquired only through books in Calcutta. Among his teachers was Lord Rayleigh, Cavendish professor of experimental physics. The Cambridge connections were a great help to Bose even after he returned to India. In 1885, when Bose was appointed professor of physics in Presidency College, Calcutta, he became the first Indian to occupy that position. His appointment did not come easily, however. It needed the personal intervention of the viceroy, Lord Ripon, who did not share the prevailing view of his countrymen that Indians were incapable of doing science. After his appointment, for nearly ten years Bose taught physics but did little else which could challenge the British opinion. In 1894, when Bose resolved to become a creative scientist, it was not just the desire to seek knowledge, not just the ambition to acquire name and fame, but also, and primarily, the urge to recover Indian pride. While the scientific value of Bose's work may be questionable, his place as the first Indian scientist to gain world-wide recognition is beyond doubt. In 1897, Jagadis Chandra Bose became the first Indian to give a Friday evening discourse at the Royal Institution in London. By 1898, he had published thirteen papers, most of them in prestigious British periodicals: *Proceedings of the Royal Society, Philosophical Magazine,* and the *Electrician*. Of course, Bose found his Cambridge connection handy. Of his thirteen papers, all the seven published in the *Proceedings* were communicated by Lord Rayleigh, and accepted without further review: the word of Rayleigh was evidently enough. The subject of his papers and discourse was the properties of 'electric' (now called, radio) waves. From this subject, it was a natural transition to move to

receivers of radio waves, called coherers. Bose's coherer, which improved upon those invented earlier, and his creation of a transmitter, are responsible for the popular impression in India that the honour accorded to Marconi by historians rightfully belongs to Bose. The author has given a critical and dispassionate analysis of Bose's place in the prehistory of radiotelegraphy. While there is some truth in the assertion that Bose has been ignored because of the 'Indian factor', there are several other reasons which possibly contributed to his being marginalised. Further, Bose was essentially a scientist, averse to technological and economic exploitation of his work. In contrast, Marconi was essentially a technologist.

Bose's work around 1899 revealed the 'unexpected' behaviour of some metals. Under the action of electric waves some metals first showed an increase in electrical resistance, and only then a decrease ('normal' behaviour). Thus these metals, most prominently potassium, exhibited 'self-recovery'. He called the phenomenon the effect of the electric 'touch'. Another phenomenon that fascinated him was 'fatigue': repeated 'touch' after 'self-recovery' led to total loss of sensitivity of the receiver. The use of terms such as 'touch' and 'fatigue' suggests a tendency to draw parallels between the non-living and the living world. This was the beginning of the drift in Bose's preoccupations from mainstream physics to an unconventional, interdisciplinary area, in which he was utterly alone. His further experiments on the 'responses' of metal and muscle to 'stimuli', and the effects of temperature and certain 'poisons' on these 'responses' strengthened his conviction that the two (metal and muscle) represented 'the same thing'. These conclusions, bearing remarkable similarity to, and probably inspired by, Indian philosophy, won Bose avid admirers among respected personalities such as Swami Vivekananda, his disciple Sister Nivedita, and Rabindranath Tagore. But it cost him credibility among scientists. His papers began to be refereed by both physicists and biologists, and were repeatedly 'archived' (polite word for 'rejected', used by the Royal Society).

Undeterred by criticism and isolation, by 1901 Bose was dreaming about a grand, comparative, parallel study of animal, plant and the inorganic. He had also started feeling that the scope of his research was too large for the confines of a scientific paper. Therefore he decided to write a book. He ended up writing a series of books, all voluminous, published from 1902 onwards by Longmans, Green in London, and based almost entirely on his own work. By 1903, his attention turned almost exclusively to plants. Bose, the physicist, had turned a plant physiologist. And his area of interest was most intriguing: measuring plant responses and drawing parallels between plants and animals, including the possibility whether plants can 'feel'.

Bose's work drew only strong reactions : it fascinated his critics as well as admirers. His strength lay in his capacity to design delicate instruments for his difficult experiments. His weakness lay in that the scope of his conclusions went far beyond his data. The result was that even his enormous data appeared too feeble to justify his conclusions. Thus he combined in a curious

way precision of the west and imagination of the east. But on balance he was a scientist highly respected even by the British establishment. He used the reputation that he had earned to enlist more and more support for his research. His demands were insatiable, his methods for making the demands were exasperating, but he got away with everything as only he could. The process culminated in the inauguration of Bose Research Institute on his fifty-ninth birthday, the 30th of November 1917.

Apart from describing Bose's work, the book also evaluates it as such, and also as the beginning of an independent Indian tradition in the practice of western science. The evaluation runs throughout the book, but is the principal concern of the last chapter. In this chapter, the exercise has been split into the early, middle and late phases of Bose's work. The 'early Bose' (1894-1901) was a mainstream physicist. His work was well accepted but claims of priority in the discovery of the principle of telegraphy made on his behalf reflect parochial passions rather than historical truths. Bose contributed to the prehistory of radiotelegraphy, as did so many others in other parts of the world. The significance of the early Bose lay not in the nature of the work that he did, but in the fact that he was the first Indian to make original contributions to modern physics. The 'middle Bose' (1901-1902) was fascinated by the similarity in the electrical responsiveness of non-living and living matter. From this he deduced that there was no clear barrier between life and nonlife. The deduction was based on a highly questionable assumption: that electrical activity is a *sufficient* condition of life. Electrical activity is in fact a *necessary* condition of life, but not a sufficient condition. The erroneous assumption made by Bose was probably rooted in the Indian philosophical tradition, which has never been (and probably cannot be) subjected to critical scientific enquiry. One wonders how much Bose was influenced by the writings of Sri Aurobindo, who was writing around the same time extensively, in English, his interpretation of the philosophical and spiritual traditions of India using the language and logic of the intellectuals of the early twentieth century. A universal Absolute Consciousness permeating all creation but manifesting itself to widely varying degrees in matter and various forms of life is the core of Sri Aurobindo's philosophy. It was not surprising that the 'Boseian thesis' found little acceptance among scientists firmly grounded in evidence-based science. Although uniting life and nonlife the way Bose did was the work of a genius, and therefore fascinated quite a few, the work was finally dismissed by science as belonging to philosophy. The 'middle Bose' was thus essentially a failure. The 'late Bose' (1903-1937) was a smooth transition from the middle phase, but concentrated on the study of plants. He once again belonged to an existing discipline (plant physiology). His ingenuity in fabricating delicate instruments and his painstaking experiments won the recognition of even his worst critics. But his speculative explanations of his observations always went far beyond his data. He was unable "to abandon or reshape a metaphysical position that was at odds with the 'facts of nature'." Thus the 'late Bose' also failed in

the sense that his work did not become part of the basic indispensable history of plant physiology. However, the ultimate significance of Bose lay in creating a native tradition of modern science. His work, although considered by the British administrators to be of little applied value, was supported as pure science by the British Raj. "Bose made pure science a credible occupation for Indians in the eyes of the world." He demolished the myth that Indians had intrinsic inadequacies which made them unfit for modern scientific research. "In this lay his ultimate success and significance in the history of the western scientific tradition and in the social and cultural history of modern India".

The book has some interesting and educative digressions. For example, Chapter 1 traces the history of the current model of education in India. It seems that before the much-maligned Macaulay's 'Minute' of 1835, the British were rather reluctant to impose their language and system of education on India. It was enlightened Indians such as Raja Rammohun Roy who saw in the English language and western thought the key to India's progress, and therefore asked for them in 1823. Then came Macaulay with his persuasive logic, missionary zeal, absolute respect for western culture, and blatant prejudice against Indian culture born of profound ignorance. That was the beginning of a system of education which has outlasted the British *Raj*. Other notable digressions include discussions on what constitutes originality and what contributes to creativity in science. These reflect the author's special interest in the creative process.

The book is based on intensive research by the author who has consulted, and cited, hundreds of primary references. Then he has gone on to produce a thorough, critical, dispassionate, objective and lucid synthesis of an enormous amount of information. The book is a tribute to Sir Jagadis Chandra Bose without being adulatory, and a valuable contribution to the history of science, specially Indian science. Anyone seriously interested in the past and concerned about the future of scientific research in India will find going through the book a highly rewarding experience. The volume is in hard cover and the production is elegant and tasteful.

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