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RE: Dr Alex May[33786] *AE:* Revd Professor Judith Brown [614]
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Bose, Sir Jagadish Chandra [Jagadis **Chunder**] (1858–1937), physicist and biologist, was born in the district of Vikrampur, close to Dacca, Bengal, India, on 30 November 1858, the son of Bhagaban Chandra Bose, deputy magistrate of neighbouring Faridpur, and his wife, Bamasundari. Though a Hindu, his father was one of the early members of the Western-influenced Hindu reform movement known as Brahmoism, along with his more traditionally Hindu wife.

Brahmoism and Hinduism—as well as Buddhism—would be important to Bose, as a man and as a scientist, throughout his life. However, his early education was unconventional for an intellectually ambitious Brahmo. His father decided, against local public opinion and the remonstrations of his friends, to send his son not to the relatively exclusive English-medium government school in Faridpur but rather to the Bengali-medium school, so that he should know his own language and people. In later life, speaking in Vikrampur in 1915, Bose attributed his adult values and his scientific success partly to this decision:

> In the vernacular school . . . the son of the Muslim attendant of my father sat on my right side, and the son of a fisherman sat on my left. They were my playmates. I listened spellbound to their stories of birds, animals and aquatic creatures. Perhaps these stories created in my mind a keen interest in investigating the workings of Nature. When I returned home from school accompanied by my school-fellows, my mother welcomed and fed all of us without discrimination. Although she was an orthodox old-fashioned lady, she never considered herself guilty of impiety by treating these 'untouchables' as her own children. It was because of my childhood friendship with them that I could never feel that there were 'creatures' who might be labelled 'low-caste'. I never realised that there existed a 'problem' common to the two communities, Hindus and Muslims. (Mukherji, 5)

Bose had a fairly adventurous, semi-rustic childhood, including a body-scarred, story-telling guardian who was a convicted dacoit (robber), employed after his release from jail by Bose's magistrate father to carry the small boy to and from school. On one occasion an impetuous young Bose, having observed village surgery on a man mauled by a tiger and been ticked off for this by his mother a few days later, went off to the sugar-cane plantation where the tiger had attacked the man, intending to offer himself as a victim, until his courage failed him and he returned home. Animals—both wild and tamed—strongly interested him from an early age; in his teens Bose, an experienced rider, even tried big-game hunting in Assam. But he showed no recorded interest in practical experimentation and the design of machines, which would prove to be his forte as a scientist.

Bose's scientific turn appeared during his English-medium education in Calcutta, at the Jesuit-run St Xavier's School and College. There he learned physics from Father Eugène Lafont, founder of the first scientific society in India, a teacher reputed for his

'patient skill, his subtlety, as well as brilliance of experimentation', according to Bose's first biographer, the biologist Patrick Geddes (Geddes, 23).

With a BA degree, Bose hoped to study in Britain, despite the opposition of his mother. However, his father was in severe financial straits after the failure of various schemes and investments. Bose therefore considered trying for a career in the Indian civil service, but this idea was vetoed by his father on the grounds that becoming an administrator would separate his son from the people. Eventually money was found, and after his mother's change of heart Bose left Bengal to pursue medicine at University College, London. But he lacked the strength for the medical course after experiencing sustained bouts of fever, probably caused by malaria. Rescue came via a scholarship to study natural sciences at Christ's College, Cambridge, in 1882, where he settled down to regular work in physics, chemistry, and botany with excellent tuition, most notably from the physicist (and future Nobel laureate) Lord Rayleigh, who became Bose's constant scientific supporter in Britain. In 1884 he graduated from Cambridge University and faced a highly uncertain prospect for a budding scientific researcher in India, where the colonial authorities routinely assumed that Indians lacked aptitude for the exact sciences.

On the recommendation of Lord Ripon, a viceroy sympathetic to Indian aspirations, Bose was made officiating professor of physics at Presidency College, Calcutta, against the wishes of officials. But his salary, two-thirds that of his European colleagues, was further reduced by half since his appointment was only officiating. Rather than accept one-third of the full European salary, Bose, as a protest, carried out his professorial duties for three years without payment, after which the government recognized his value and gave him his full pay as a lump sum. The money immediately went to creditors of his father, whose entire debts Bose in due course discharged. In accepting real privation at this time, Bose was supported by his Brahmo wife, Abala Das, a graduate whom he married in 1887 and who aided him for half a century.

In 1894 Bose at last felt able to begin research at Presidency College, without any laboratory to speak of or financial support from the authorities, with the assistance of one untrained tinsmith. These primitive conditions persisted for some years, but did not deter Bose from creating apparatus of extraordinary sophistication and sensitivity during the next two or three decades, including his 'magnetic crescograph', a device capable of magnifying the imperceptible growth of plants by ten million times. Apathy from officials changed to qualified support after 1895, when Bose began to receive accolades from European scientists including Lord Kelvin; in 1896 Bose received Indian government funding to visit Britain.

Bose's Calcutta-based work in physics followed the path blazed by Heinrich Hertz, who proved the existence of electromagnetic waves in the 1880s. Bose developed equipment for generating, transmitting, and detecting waves as short as five-millimetre microwaves. As early as 1895, ahead of Guglielmo Marconi's work on radio in Europe, at a public lecture in Calcutta, Bose demonstrated how waves could travel from a transmitter with an antenna in the lecture room through three solid walls to a detector with a second antenna in another room and thereby set a bell ringing. Indeed, one of Bose's designs for a wave detector using iron and mercury in a vacuum tube, his so-called 'self-recovering coherer', which he published in the *Proceedings of the Royal Society* in London in 1899, was apparently used by Marconi, without credit to Bose, in his famous wireless transmission across the Atlantic in 1901 (Mervis and Bagla, 476). Unlike Marconi, Bose had no interest in patenting his inventions, firmly believing that commercial motives had no place in science; he also preferred to avoid public controversy with Marconi. Another of his detectors, using galena (lead sulphide), was an early type of semiconductor diode.

This detector was at the heart of the 'crystal sets' that popularized radio until the arrival of valve radios in the 1920s. 'J. C. Bose was at least 60 years ahead of his time. In fact he had anticipated the existence of P-type and N-type semiconductors', remarked the solid-state physicist and Nobel laureate Nevill Mott (Mitra, 151).

His electromagnetic research with metals led Bose to a maverick change in scientific direction towards his childhood interest, biology, which became his preoccupation after 1900. Geddes recorded a conversation between Bose and the veteran physiologist Michael Foster, one of Bose's old teachers at Cambridge. 'Come now, Bose, what is the novelty in this curve? We have known it for the last half-century.' 'What do you think it is?', asked Bose. 'Why, a curve of muscle response, of course.' 'Pardon me; it is the response of metallic tin.' Shortly afterwards, giving a discourse at the Royal Institution in 1901, Bose remarked: 'how can we draw a line of demarcation, and say, here the physical ends, and there the physiological begins? Such absolute barriers do not exist' (Geddes, 97). Most physiologists deeply disagreed, convinced of a dualistic divide between the non-living and the living, though a few, including Foster, were more open-minded. While Bose's work in physics was greeted with general acclaim by physicists, his work in physiology was generally rejected by physiologists, not least because of his Hindu monistic belief. The physicist C. V. Raman, India's first science Nobel laureate, later privately remarked: 'Bose did some very clever physics before he started on all his mumbo-jumbo' (Tagore, 55). Subsequently, though, with the growth of a new scientific field, plant neurobiology, Bose's research came to be viewed more sympathetically by some physiologists. 'More than a hundred years after Bose's seminal work had fallen into disrepute, concepts of plant intelligence, learning, and long-distance electrical signalling are established in the mainstream literature of plant science' (Shepherd, 205).

Although angered by this scientific rejection, Bose remained highly productive in biology, both before and after his founding of the Bose Research Institute in Calcutta in 1917. There Bose regarded his co-workers as 'disciples' and treated them accordingly. He was 'an artist in his sensibilities and romantic by temperament', wrote one former pupil, the astrophysicist M. N. Saha; 'an essentially selfish, ruthless old man', thought another, the theoretical physicist S. N. Bose (Saha, 4; Nandy, 51). He travelled extensively in India, Europe, and the United States, accompanied by his wife, and received a number of honours, including a knighthood in 1917 and a fellowship of the Royal Society in 1920—the first Indian scientist (though not the first Indian) to be so honoured. Yet the Nobel prize that Bose should probably have shared with Marconi in 1909 eluded him. He died of heart failure while staying with relatives at Giridih, Bengal, on 23 November 1937, and was cremated the following day in Calcutta according to Brahmo rites. He was survived by his wife.

Andrew Robinson

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SOURCES SHEET

Article: Bose, Sir Jagadish Chandra also known as Jagadis Chunder Bose *(1858–1937)* [107307]

MATERIAL USED IN THE PREPARATION OF THE ARTICLE

1. P. Geddes, *The life and work of Sir Jagadis C. Bose* (1920) [S]
2. *The Times* (24 Nov 1937) [C]
3. *Times of India* (24 Nov 1937); (25 Nov 1937) [C]; (26 Nov 1937) [C]
4. M. N. Saha, 'Sir Jagadis Chunder Bose', *Obits. FRS*, 3 (Jan 1940) [C]
5. V. Mukherji, *Jagadis Chandra Bose* (1983) [S]
6. B. Mitra, 'Early microwave engineering: J. C. Bose's physical researches during 1895–1900', *Science and Culture*, 50 (1984), 147–54 [C]
7. A. Nandy, *Alternative sciences: creativity and authenticity in two Indian scientists*, 2nd edn (1995) [S]
8. {R. Tagore} *Selected letters of Rabindranath Tagore*, ed. K. Dutta and A. Robinson (1997) [S]
9. J. Mervis and P. Bagla, 'Bose credited with key role in Marconi's radio breakthrough', *Science*, 279 (23 Jan 1998) [C]
10. V. A. Shepherd, 'At the roots of plant neurobiology: a brief history of the biophysical research of J. C. Bose', *Science and Culture*, 78 (2012), 196–210 [C]
11. Burke, *Peerage* [P]
12. *WWW* [P]

ARCHIVAL DEPOSITS

Named collections
Bose Institute, Kolkata [U]
RS [U]

Important deposits in other collections
Unknown

Moving-picture archives
Unknown

Sound archives
Unknown

LIKENESSES

1. photograph, 1896, repro. in Geddes, *Life and work* [W] [*CR*]
2. portrait, 1907, repro. in Geddes, *Life and work* [W] [*CR*]
3. portrait, *c.*1920, Science and Society Picture Library, London [*P*]
4. photograph, *c.*1920–1929, Rex Features, London [*P*]
5. photograph, 1930, Alamy, Abingdon, Oxfordshire [*P*][14909]
6. obituary photographs [*CR*]
7. photographs, Bose Institute, Kolkata [*CR*]

WEALTH AT DEATH
Unknown

Sources queries and comments:

