Bose Credited With Key Role in Marconi's Radio Breakthrough

DELHI, INDIA—The Italian physicist Guglielmo Marconi holds a secure place in the history books for decoding the first wireless message sent across the Atlantic Ocean. That achievement, on 12 December 1901, ushered in the modern era of electronic communications. But it also triggered a century-long debate over who should get the credit for developing the receiving device that captured the famous message, sent from England to Newfoundland via Morse code.

This month, an article in a special issue of *The Proceedings of the IEEE*, marking the 100th anniversary of the diode and the 50th anniversary of the transistor,* makes a definitive case for Jagadis Chandra Bose, an Indian biologist and physicist. Bose announced the invention in an 1899 paper presented at the Royal Society in London, writes Probir Bondyopadhyay, a satellite and communications engineer at Johnson Space Center in Houston and also an amateur historian. In contrast, says Bondyopadhyay, Marconi "was like a honeybee collecting honey from different flowers" to improve his wireless transmitter. "And he never gave credit to those who deserved it."

The device, called a self-recovering coherer, contained a sequence of iron-mercury-iron in a vacuum tube that was able to receive a long-distance message by continually resetting itself before each pulse. Bondyopadhyay says Marconi may have deliberately tried to divert attention from Bose's contribution by leaving the impression that it came from others, including an Italian naval officer.

Ironically, Bondyopadhyay was drawn into the dispute more than a decade ago at the request of Marconi's daughter, G. Marconi Braga, who was upset about media reports (including a 1984 article in *The New York Times*) stating that Marconi should share credit with Nikola Tesla and others for inventing wireless radio. Braga, who died last year, "asked me to look into the matter," says Bondyopadhyay. But instead of buttressing Marconi's claims, his investigations led him to Bose's role in advancing the technology. "I'm a historian. I find the facts and publish the facts. ... By clarifying this thing, all I am trying to do is to set the record straight."

Amplifiers were not available in the early days of radio telegraphy, so the reception of messages depended on receiver sensitivity. Although Marconi and Bose succeeded in communicating across a few kilometers in separate experiments during 1895, a better version was needed for long-distance signals.

Questions about the coherer's true origin arose shortly after Marconi announced his results. The editor of a prominent Italian technical magazine, *L'Elettricista*, made the case for an Italian navy signalman, P. Castelli. In response, Marconi said the receiving device he used was a gift from the Royal Italian Navy through his childhood friend, Luigi Solari, a Navy lieutenant. But in a July 1902 letter to the editor of *The Times of London*, Solari wrote that the idea came to him "in some English publication which I found myself unable to trace." One year later, in the same newspaper, he declared that he "did not invent the coherer." This sequence of events was first pointed out by a British historian, Vivian Phillips, in a 1993 paper in *IEEE Transactions*. But Phillips didn't mention Bose or speculate about the identity of the real inventor—the author of the mysterious publication to which Solari referred.

Received wisdom. New evidence documents Marconi's use of J. C. Bose's iron-mercury coherer, below, as receiver in landmark experiment.

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The solution, however, was readily available in the literature. Bose, a maverick scientist working out of a one-room laboratory in Calcutta, offered it in a paper that appeared in the April 1899 issue of the *Proceedings of the Royal Society*. Titled "On a Self-Recovering Coherer and the Study of the Cohering Action of Different Metals," the paper described the use of an iron-mercury coherer for detecting radio waves, then called electric radiation.

"For very delicate adjustments of pressure," Bose wrote, "I used in some of the following experiments an U-tube filled with mercury, with a plunger in one of the limbs; various substances were adjusted to touch barely the mercury in the other limb. ... I then interposed a telephone in the circuit; each time a flash of radiation fell on the receiver the telephone sounded." After a series of experiments, Bose concluded that "there can be no doubt that the action was entirely due to electric radiation."

In his *IEEE Proceedings* paper, Bondyopadhyay describes how Marconi, in the years after the experiment, "shifted attention" away from Bose's contribution through a "careful choice of words ... and clear diversionary tactics." And he suggests that the obfuscation was deliberate. "Marconi didn't disclose immediately what he used in receiving his message," says Bondyopadhyay, noting the inventor's vagueness about the device in a New York speech 1 month after his landmark experiment and later that spring in London. "There was a bad motive involved, I suspect, but I don't come down too hard on him for that," the engineer adds.

Bondyopadhyay also explains why the controversy wasn't nipped in the bud, pinning some of the blame on Bose's scientific colleagues. "It is embarrassingly obvious that the British learned men of the day ... never discovered Bose's work, [despite its being] so prominently displayed in the most prestigious publication of the British empire. It is clear that they never read this esteemed publication [or] did not connect Bose's work with Marconi's use of the device."

Prasanta Kumar Ray, a biochemist and current director of the Bose Institute in Calcutta, applauds Bondyopadhyay for correcting "a grave historical injustice" that robbed Bose of a share of Marconi's 1909 Nobel Prize. "No one can deny that it was Marconi who used and utilized this discovery for the larger benefit to mankind, but Bose made the actual scientific discovery," says Ray. As to why Bose himself didn't clear up the mystery, Ray notes that "Bose was in a search for true knowledge, and he shunned crass commercialization of inventions."

Even Italy's former science minister, Umberto Colombo, says he's glad for the new information. "I am not surprised about this revelation against Marconi," he told *Science*. "But it will not undermine Marconi's solid position in the history of science and in commercializing wireless telegraphy."

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