J. C. Bose
(1858 - 1937)

In 1895, Marconi stupefied the world by transmitting a wireless signal and detecting it with a receiver over a mile away. But two years before this Jagadish Chandra Bose of the Presidency College, Calcutta, gave a public demonstration of wireless communication using wireless waves to ring a bell a mile away. Bose made original contributions in two very different fields of research – radio waves and plants. So great was his understanding of the sensitivities of plants that his students jokingly suggested that he could *talk* to plants.

J.C. Bose was born on 30 November 1858 in Mymensingh, currently in Bangladesh. His father, Bhagavan Chandra Bose was a benevolent bureaucrat. He loved the Bengali language and had deep sympathies for the poor. He tried to provide employment to the needy but his efforts failed leaving him deeply indebted. But his father's idealism and sympathy for the poor inspired Jagadish throughout his life.

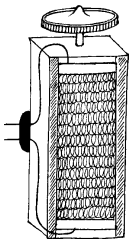
Jagadish went to a Bengali medium school where he mingled with local children of different backgrounds. This rich experience immunised him for life from caste, class and religious prejudices. From the earthy children of the poor he also acquired an abiding love for animals, plants and birds. Later it induced him to study plant behaviour in depth.

In 1875 he joined the St. Xavier's School in Calcutta where he spent all his pocket money on tending plants and pets. He obtained a degree in science from the St. Xavier's College in 1879. Here he met Father Lafont, a superb teacher of Physics. Jagadish wanted to go to England and get into the coveted Indian Civil Service. His father did not like the idea of serving the British, but agreed to Jagadish becoming a medical doctor so that he could later serve the needy.

He went to England in 1880 but soon fell ill. Expert treatment failed to cure him. He suffered from *Kala-azar*. As strong odours of the dissection rooms could aggravate the disease he was advised to give up medical studies. Later he joined Christ's College in Cambridge University for a course in natural science. Here he was taught by the outstanding scientist Lord Rayleigh. Jagadish stuck a life-long friendship with his teacher.

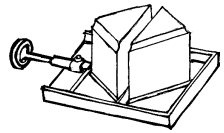
On returning to India in 1885 he was appointed a Professor of Physics at the Presidency College, Calcutta. Here, he was openly discriminated against. An Indian got only two-thirds of what an Englishman was paid for the same job. Bose protested in a novel way. He worked enthusiastically for three long years without salary though his father was deeply indebted. In 1887 he married Abala Bose. But this did not matter. He stuck to his guns and withstood all the hardships. Finally the administration relented and he was paid the full salary, with arrears. This fortune helped him clear his father's debts.

At Presidency College, Bose proved to be a gifted and popular teacher. He found physics exciting and conveyed its magic with experiments and practical demonstrations. Many of his students became famous scientists. Among them was S. N. Bose, the statistical physicist, after whom a family of elementary, subatomic particles, the *Bosons*, is named!



Bose designed this spiral spring receiver to detect short wavelengths of radiation.

His efforts to develop research facilities in Presidency College were repeatedly thwarted by British officials. So finally, Bose set up a laboratory in an abandoned bathroom in the physics department. Here with very rudimentary equipment he commenced serious original research on generation, transmission, refraction, diffraction, polarization and detection of electromagnetic waves. Several familiar microwave components of today – waveguides, lens antennas, polarizers, dielelectric lenses and



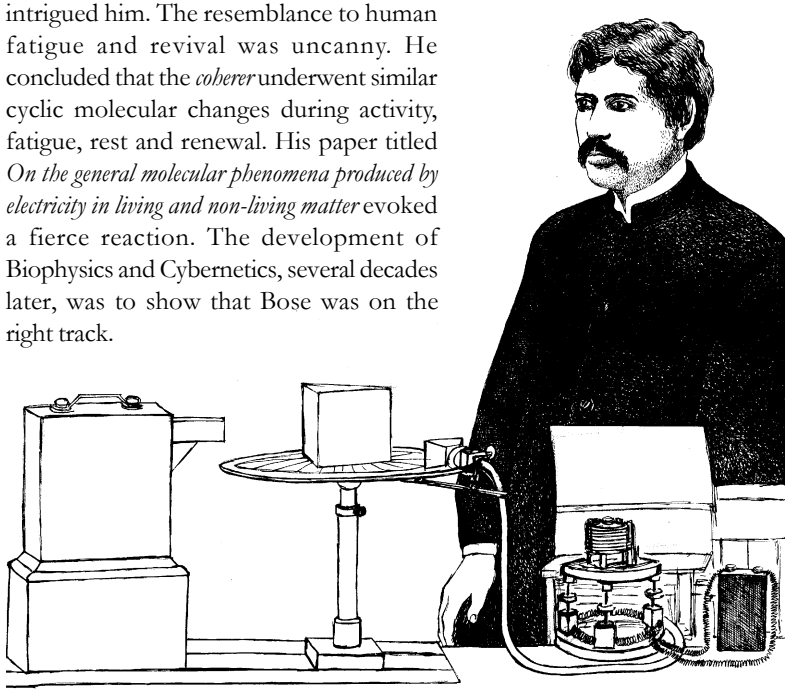
A double prism attenuator

prisms, diffraction gratings – can be found in his experiments. Many were invented by him – including the exotic twisted-jute polarizer! His receivers based on galena (lead ore) crystals were issued patents in 1904. W. H. Brittain, co-inventor of the transistor and Nobel Laureate in 1977 credits Bose with the first use of semi-conducting crystals to detect radio waves. Neville Mott, Nobel Laureate in 1977 for work in solid-state electronics, credited Bose as being at least 60 years ahead of his time, saying that, *"In fact, he had anticipated the existence of p-type and n-type semiconductors."*

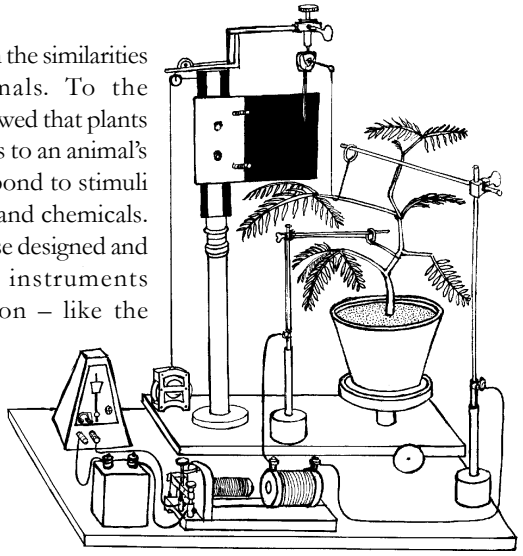
A twisted-jute polarizer

Bose was only interested in the science behind the phenomena and not in patenting it and amassing wealth. His contemporary Marconi on the other hand instantly recognised the commercial potential of *wireless* and exploited it by constructing wireless communication equipment.

Bose went to Europe on a study tour where he met some leading scientists of the world including Lord Kelvin and Professor FitzGerald. Around 1897, Bose's interest began to shift fairly substantially. The receiver (then called *coherer*) which he built to sense radiation showed a *peak* and *low* performance. This intrigued him. The resemblance to human fatigue and revival was uncanny. He concluded that the *coherer* underwent similar cyclic molecular changes during activity, fatigue, rest and renewal. His paper titled *On the general molecular phenomena produced by electricity in living and non-living matter* evoked a fierce reaction. The development of Biophysics and Cybernetics, several decades later, was to show that Bose was on the right track.



Bose next became interested in the similarities between plants and animals. To the astonishment of many, he showed that plants too have something analogous to an animal's nervous system and they respond to stimuli such as electric current, heat and chemicals. Since this subject was new, Bose designed and constructed many of the instruments required for experimentation – like the *Crescograph* which measured the growth rate of plants. With this instrument it became possible to carry out accelerated tests to determine the effects of fertilisers and insecticides on plants.



Bose wrote numerous popular articles in Bengali to spread the excitement of science amongst the common people. Bose's latter career coincided with the rise of the freedom movement. His strong national feelings inevitably drew him close to Rabindra Nath Tagore, Prafulla Chandra Ray and Sister Nivedita - the British-born disciple of Swami Vivekananda.

Bose retired from academic service in 1915. Knighthood was conferred on him and he became Sir Jagadish Chandra Bose in 1917. That very year on his birthday, Bose established the Bose Research Institute – dedicated to interdisciplinary research. Tagore composed the inaugural song for the institute. In 1920 Bose was elected a Fellow of the Royal Society.

Bose was a patriot and a cultural nationalist, proud of the ancient heritage of his land. He realised that colonialism was sapping the self-respect of Indians. He proved to the West that Indians too could do world class scientific research.

Jagadish Chandra Bose passed away on 23 November 1937, a few days before completing his eightieth year. He left behind a rich legacy, for succeeding generations of Indian scientists to carry forward.