

A superb teacher–learner

An obituary of D. S. Kothari (1906–1993)

With the passing away of Daulat Singh Kothari on 4 February 1993 an era can be said to have ended. Of the giants who dominated the Indian science and education scene, after independence, he was probably the last one. His presence and influence was felt in many areas.

He was the founder of the post-graduate department of physics at Delhi University. In the early forties Kothari and V. K. R. V. Rao were among the first batch of four professors appointed at the University of Delhi. Both influenced—in fact dominated—the University in their earlier days and were important figures on the national (and to some extent international) scene for a long time in their later years. Rao was the architect of the department of economics while Kothari built up the physics department. While the economics department became Delhi School of Economics, the physics department retained its simple name. In a way this was typical of the way the two people worked. While Rao was flamboyant, Kothari worked in a simple but effective way, keeping a low profile. Among the many traditions established by Kothari at Delhi, two may be mentioned. Every faculty member, be he trained in theoretical or experimental physics, participates in the laboratory supervision of students in the physics department at Delhi. This is based on the advice of Lord Rutherford to Kothari when he was returning from Cambridge to India. Rutherford urged Kothari to keep using his hands (in the laboratory) even if he was doing theoretical work.

The second tradition is partially due to the advice that Niels Bohr gave to Kothari. He stressed the importance of an atmosphere where even the younger members could express their opinion freely. A very large degree of freedom and autonomy has characterized the functioning of the physics department in contrast to that of some other science departments in the university. In following Bohr's advice, his innate confidence and politeness must have also helped Kothari.

Kothari had the help of R. C. Majumdar and F. C. Auluck among

others in nurturing the physics department at Delhi. It was the first, and for several years the only, department to teach the methods of quantum mechanics and quantum field theory at the MSc level. Kothari and Majumdar taught quantum mechanics in alternate years. While Majumdar followed the Schrodinger's differential equation approach (as described in Pauling and Wilson's book) Kothari preferred to follow the operator approach of Dirac, who was a kind of hero to him. He firmly believed that one would never understand quantum theory until one mastered Dirac's famous 'The Principles of Quantum



Mechanics'. For a student of physics, even at the post-graduation level, this was not an easy task as the book, despite its elegance and lucidity, was terse. But till the early seventies, even while holding posts outside the department, Kothari made it a point to give a course of lectures, once a week, based on Dirac's book to MSc students in his characteristically freewheeling and absorbing style. And he loved Dirac's chapter on Quantum Perturbation Theory which he would dwell upon for weeks on end.

Kothari was a natural and highly gifted teacher—in fact he should be

described as a superb teacher–learner. He strongly believed in the necessity for 'a teacher to be always a student and keep learning'. As a teacher, and even in small groups, he was highly sensitive to the atmosphere among listeners. His switch from English to Hindi to drive home a point was very effective in communication.

Around the time of India's independence, Kothari was offered the post of Defence Science adviser to the Government of India. He accepted it after laying down some, rather unusual, conditions. One was that he would continue to draw the same salary as that of a university professor and not the enhanced one, he was entitled to, as adviser. The second was that he would continue to reside in the university campus and also continue with his teaching. He continued to do this even with his later assignments till the late sixties. After that though he stayed on in the campus he could not take regular courses. He, however, continued to be in touch by giving lectures to the students once a week.

His work as adviser to the defence ministry soon led to his getting close to Prime Minister Jawaharlal Nehru. His simplicity, sincerity, nobility and other traditional Indian virtues coupled with his sharp intellect which enabled him to penetrate to the core of any problem, made politicians, beauracrats, scientists and others seek his opinion and advice right till his last day. When Nehru wanted a tutor in science and mathematics for his grandsons Rajiv and Sanjay, it was Kothari who was approached and he promptly persuaded one of the research students (now a professor in the department) to do the job.

His appointment as Chairman of the University Grants Commission in 1961 brought him into the wider educational scene. It led to his appointment as Chairman of the Education Commission in 1964. Kothari Commission, as it has come to be known, had educationists of all hues from India and other countries. Kothari was successful in welding them into a homogeneous team and producing

a remarkable report. Among the recommendations which were implemented was the 10+2+3 system as we know it to-day and probably more importantly the introduction of science as a compulsory subject for every student up to 10th standard. Universal primary education still eludes us while the suggested use of mother tongue and Hindi in higher education is still being debated in the country. The report elevated him to the position of a leading expert on education and he was an adviser on educational issues and problems till the end. He was a member of the Central Advisory Board on Education at the time of his death.

He was also directly and indirectly connected with the programmes of the NCERT (National Council for Educational Research and Training) in writing textbooks on science, in standardizing technical terms in Hindi and in several other innovative programmes. He was chairman of the commission on scientific and technical terminology during 1961–64.

Kothari came under the influence of Meghnad Saha, the eminent physicist and nationalist, when he joined the Allahabad University for his M.Sc. Saha encouraged him to go to Cambridge, England. At Cambridge he got to know Subrahmanyan Chandrasekhar, the famous astrophysicist and Nobel laureate. R. C. Majumdar who was to help him later in building up the physics department at Delhi University was then studying at Jena in Germany and used to visit Cambridge. Influenced by Chandrasekhar both Kothari and Majumdar worked in quantum statistical mechanics and its application to degenerate stars and planets. In particular Kothari calculated the effects of pressure ionization in cold compact objects. He showed that bodies having masses greater than that of Jupiter would be unstable against collapse. Later he went on to apply quantum statistical mechanics to a wide class of systems. In this he was helped by F. C. Auluck at Delhi. They were among the first to apply in this context Ramanujan's famous theory of partitions to high polymers. In his capacity as Defence Science advisor he also studied the behaviour of metals

under intense pressure of explosive loads. With Saha he also studied the magnetic monopole which had been proposed by P. A. M. Dirac.

His association with Chandrasekhar continued and whenever he visited USA he would either meet him or talk to him on the phone. The concern expressed by Chandrasekhar about the Ramanujan Institute at Madras to Kothari during one of his visits in the late sixties made him direct the special attention of the government to that institute.

Kothari was the author of one of the earliest books on the *Effects of Nuclear Explosions* (1956). This was an impartial scientific study motivated partially by a request of Bertrand Russell, the philosopher to Pandit Nehru. It predates Samuel Glasston's famous work by two years. The book provided an unbiased study of the actual damage and destruction and other effects of nuclear explosions. It was translated into several other languages.

In later years he was the elder statesman consulted by visiting scientists, educationists and politicians. His amicable nature, wide-experience and extraordinary curiosity made him accessible to a wide variety of persons. Ilya Prigogine, the Nobel prize-winning chemist, was one such who quotes him in his book on *Order and Chaos* (Bantam Books, 1984). Larry Dossey dedicated his book *Meaning and Medicine* (Bantam Press, USA, 1991) to Kothari. The list can easily be enlarged to include many more such references. Some experimental physicists from national laboratories would, also, take their findings to him to get his advice on their significance.

Honours and awards came to him in plenty and hardly affected his humility. He was awarded the Padma Bhushan in 1962, Padma Vibushan in 1973. He was elected the General President of the Indian Science Congress in 1964. He was elected the Foreign member of the USSR Academy of Sciences in 1973, President of Indian National Science Academy in 1973–74. He was a fellow of the Third World Academy. He also received the UNESCO award for distinguished contribution to UNESCO objectives.

He had a certain ascetic streak in

him. He had protested, in lectures, against scientists staying in expensive hotels, but he had refrained from imposing his views on others. At a meeting of a UGC Committee, of which he was the Chairman, held five years ago, he not only agreed to good hotel accommodation for university participants in a conference but even advocated other generous measures. Being sensitive to current trends, he was quite aware of the demand for generous facilities to scientists, if world standards are demanded from them.

In the last decade he became increasingly interested in the relationship of science, religion and philosophy. He lectured widely about the relationship between Upanishads, Bhagavad Gita, Syadvad of Jain texts and the ideas of science. Two, very carefully presented, lectures may be mentioned. One was the anniversary address to the Indian National Science Academy in 1975 on 'Some thoughts on Truth' and the other his Meghnad Saha Medal Lecture on 'Atom and Self' delivered in 1978 again to INSA at Delhi.

Apart from his philosophical ideas on the nature of time he was also interested in the physics point of view. With a few younger colleagues he had started, five years ago, to study Dirac's views, expressed in 1963 (in *Scientific American*) that General Relativity may have to give up covariance under four-dimensional coordinate transformation. He was also interested in the conflict of semi-classical quantisation and four-dimensional covariance. He used to remark that the questions about nature of time in General Relativity indicate the fusion of physics and philosophy. Even earlier, for more than forty years, he has been pointing out similarities between quantum physics and Indian thought—long before Fritjof Capra and the modern holistic thinkers.

He was one of the fast disappearing group of persons who believed in a holistic approach to individual, science and society.

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