

Chandra Sinha. After carefully reading the book titled “History of the Calcutta School of Physical Sciences” [Purabi Mukherji and Atri Mukhopadhyay; Springer Nature: 2018], he profusely praised the book and advised me to write such books on Mathematical Sciences in modern India. I did listen to him and he always encouraged and inspired me in my venture.

As all human beings have to leave this world some day, Prof. Bikash Chandra Sinha too left for the unknown journey a few weeks back. After a prolonged illness, he passed away on the 11th August, 2023 in Kolkata leaving thousands of heartbroken students and admirers in India and abroad. Along with all the members of the

Institute of Science, Education and Culture, I too offer my deepest respects to the departed scientist.

He brought immense glory to the state of West Bengal and India through his tireless, dynamic and excellent scientific research. But life is so fragile. So he had to go and the void will remain.

In the words of our iconic poet Rabindra Nath Tagore: “All things rush on, they stop not, they look not behind, no power can hold them back, they rush on.”

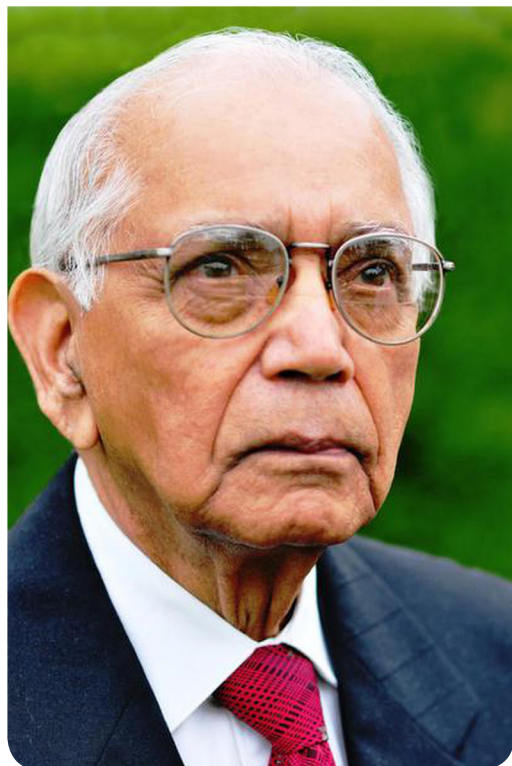
His demise is a great loss to India. We pray that may the departed soul rest in eternal peace.

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Obituary



Late Prof. C. R. Rao, F.R.S
(1920 – 2023)

Just a few months back I wrote a salutatory article on Prof. C. R. Rao to pay our sincere tribute on behalf of all the members of the ‘Institute of Science Education and Culture’ (ISEC), when it was announced that the outstanding mathematician and statistician will be awarded the ‘2023 International Prize in Statistics’, the highest and a very prestigious award in the said discipline. Some compare the award equivalent to a ‘Nobel Prize’ in Statistics.

What an irony of fate that on the day the Indian scientists of ISRO (Indian Space Research Organization) were successful in landing the Chandrayan – 3 on the South side of the moon, India lost her star statistician Prof. C. R. Rao. He passed away in USA on the dawn of the 23rd August, 2023.

My earlier article titled “Salutations to Prof. C. R. Rao F.R.S.” was published in ‘Indian Science Cruiser’ [Volume 36, No. 6, November 2022]. Now within a few months, with deep sorrow and a sad heart I am writing an ‘Obituary’ of the departed scientist on behalf of all the members of the ISEC family.

C. R. Rao was a brilliant student right from his childhood. The details of his earlier career are available in my earlier article. Here, in this article, I shall highlight a few important events that helped C. R. Rao to become a world-renowned scientist.

His parents C. N. Naidu and A. Lakshmikanthamma instilled in C. R. Rao the admirable qualities of discipline, simplicity, modesty, loyalty, kindness and hard work. These helped him to achieve excellence in the fields of Mathematics and Statistics and also made him a legend in his lifetime.

C. R. Rao with very frugal financial help from his middle class family joined the Indian Statistical Institute (ISI) in Calcutta in 1941. That was a watershed in his life. Prof. P. C. Mahalanobis, F. R. S. (1893-1972) took charge of the young man and became his mentor. Throughout his life C. R. Rao was grateful to Prof. Mahalanobis, who was unique in a way. He was a teacher who gave opportunities to his students to bring out the best in them. In the case of C. R. Rao at his tender age of 23, Prof. Mahalanobis encouraged him to write research papers instead of asking him to solve routine problems. C. R. Rao made fullest use of this and in 1945 he published a research paper titled "Information and accuracy attainable in the estimation of statistical parameters" [Bulletin of the Calcutta Mathematical Society, 37(3), (1945), 81-91]. This gained him world-wide acclaim and paved the way for international recognition.

As discussed in my earlier article, Prof. Mahalanobis directed C. R. Rao to join the newly established Post-Graduate Department of Statistics at Calcutta University as a student of the first batch. In 1943, C. R. Rao passed the M. A. Examination in Statistics with flying colours standing First with a First class and scoring 83% of the total marks. This record is unbroken till date. Earlier in 1941, C. R. Rao had stood first with a first class in the M. A. Examination in Mathematics from the Andhra University (Waltair), Vishakapatnam.

In 1943, Prof. Mahalanobis recommended and arranged to send C. R. Rao to the University of Cambridge. There along with a job at the University Museum, C. R. Rao joined the King's

College and started doing research under the guidance of Prof. R. A. Fisher. Prof. Fisher, one of the legends of modern day Statistics became the second mentor of C. R. Rao and taught his young Indian student the mathematical foundations of Statistics. This enabled C. R. Rao to carry out brilliant research in the fields of Likelihood Function, Information and Orthogonal arrays.

Just to mention some of his outstanding contributions, in 1944, C. R. Rao derived a famous result which is known as "Cramer-Rao bound". In 1945 he proved a result now widely known as "Rao-Blackwell Theorem". During his Ph. D. Research, he discovered a method now known as "Rao's Score Test". This method is widely used in all scientific disciplines. He obtained his Ph. D. Degree from the University of Cambridge in 1948 under the joint guidance of Prof. R. A. Fisher and Prof. P. C. Mahalanobis. Dr. C. R. Rao remained grateful to both his mentors throughout his life.

As already discussed in my earlier article published in 'Indian Science Cruiser', Dr. C. R. Rao on his return to Calcutta from England, was immediately recruited as a Professor at the Indian Statistical Institute in 1948 and put in charge of the ongoing "Research and Training School" there. This reflects Prof. Mahalanobis's immense confidence on his young protégé. Prof. C. R. Rao fully justified the responsibility vested on him. He revamped the school, research and training programmes were reorganized. Prof. C. R. Rao became a pillar of ISI. He inspired generations of students and research scholars who in turn themselves became iconic figures. To name a few, Debabrata Basu (1924-2001) the first student who obtained his Ph.D. degree under the supervision of Prof. C. R. Rao, the 'famous four' comprising R. Ranga Rao (1935-2021), K. R. Parthasarathy (1936-2022), V. S. Varadarajan (1937-2019) and S. R. S. Varadhan FRS (1940) are all internationally acclaimed statisticians of the highest order. They were all nurtured, inspired and supervised by Prof. C. R. Rao.

Prof. C. R. Rao was instrumental in establishing several branches of ISI in several other Indian states. They are all under the administrative control of ISI, Kolkata. The 'Asian Statistical Institute', which is now known as 'Statistical Institute of Asia and Pacific' situated in Tokyo,

Japan was also the brainchild of Prof. C. R. Rao. This particular institute trains up people working as statisticians in government and private agencies in various Asian countries. Apart from being a mathematician and statistician of the highest class he was also a great administrator and academic institution builder.

In ISI, Prof. C. R. Rao spent close to 40 years and did most of his path-breaking research work during his long tenure there. After retiring from ISI, in 1979, he migrated to USA and served as prestigious Professors in various important Universities of USA. Initially he was a Professor at the University of Pittsburgh. In 1982 he established and also took charge as the Director of 'Center for Multivariate Analysis' at the same University. In 1988 he moved to the Pennsylvania State University as the 'Eberly Chair Professor' and the Head of the Department of Statistics. After official retirement, he continued to serve the University as 'Professor Emeritus'. Later in life Prof. C. R. Rao became a Research Professor at the University of Buffalo, New York.

In his more than eight decades long academic career, Prof. C. R. Rao has made memorable contributions to both theoretical and applied Statistics as well as Mathematics. His work has influenced not only Statistics and Mathematics, but has left valuable implications for disciplines as diverse as Economics, Anthropology, Genetics, Geology, National Planning, Demography, Biometry and even Medicine. He has authored nearly 400 research papers which have been published in famous peer-reviewed journals. On his 100th birthday, he wrote his last research paper. He has also written and published 14 books, many of which are used by students and researchers the world over on a regular basis. His book titled "Advanced Statistical Methods in Biometric Research" published in 1952 has influenced and helped generations of research workers in Statistics. Many of his other books are equally notable. Prof. C. R. Rao was a priceless presence in the arena of modern day Statistics.

During his almost 40 year long tenure at ISI, apart from the prestigious posts he held there, Prof. C. R. Rao served his motherland India in various important capacities. He was the

Chairman of the Committee of Statistics (1962 – 1969), Chairman of the Demographic Committee for Population Control (1968 – 1969), Chairman of the Committee in Mathematics, Atomic Energy Commission (AEC) (1969 – 1978) and Member of the Committee on Science and Technology (COST) (1969 – 1971).

Prof. C. R. Rao is perhaps the most decorated scientist from India. He was given 38 'honorary Doctorate' degrees from 19 different countries. A man, who received medals from his school days, standing first in almost every examination, in later life received some of the most prestigious medals in the world for his outstanding scientific contributions. To name a few important ones in his kitty, the Calcutta University Gold Medal, 'S. S. Wilk's Memorial Medal' from 'American Statistical Association', Army Medal of USA, 'Guy Medal in Silver' from the 'Royal Statistical Society, London', 'Meghnad Saha Medal' and 'Ramanujan Medal' from the Indian National Science Academy, 'J. C. Bose Gold Medal' from the Bose Institute, Kolkata, 'Mahalanobis Birth Centenary Gold Medal Award' from the Indian Science Congress Association and the 'University of Zelona Gold Medal' from Poland.

The Government of India honoured Prof. C. R. Rao by conferring the 'Padma Bhushan' Award on him in 1968 and the 'Padma Vibhushan' Award in 2001.

For his pioneering contributions in various branches of Statistics, in 2002 President G. W. Bush of USA felicitated Prof. C. R. Rao at the 'White House' and honoured him with the 'National Medal of Science, USA', the highest award in the domain of science. The award was given to Prof. Rao for his path-breaking contributions to the foundations of statistical theory and multivariate statistical methodology and their applications which enriched the physical, biological, mathematical, economical and engineering sciences.

In 2010, the then Indian Prime Minister Dr. Manmohan Singh on behalf of the Government of India conferred on Prof. C. R. Rao the 'Indian Science Award'. This award is the most prestigious and highest award given by the Indian Government in the area of science. The award was

in recognition of his outstanding contributions to the field of statistical science. He was the recipient of the “2023 International Prize in Statistics”, which is considered to be equivalent to the Nobel Prize in Statistics.

‘Times of India’, a noted News paper of India had listed Prof. C. R. Rao as one of the top 10 Indian scientists of all times.

As a mark of respect to the outstanding scientist:

- The Pennsylvania State University has initiated the “C. R. And Bhargavi Rao Prize’ in Statistics. Incidentally Prof. Bhargavi Rao is the spouse of Late Prof. C. R. Rao.
- In Hyderabad “C. R. Rao Advanced Institute of Mathematics, Statistics and Computer Sciences” was established in
- The ‘Ministry of Statistics and Programme Implementation’ of the Government of India has established an award in Statistics in the name of Prof. C. R. Rao for excellence in the discipline.
- The road from IIT, Hyderabad passing along the ‘Central University’ of Hyderabad is named after Prof. C. R. Rao.

One of the greatest statisticians of all times, Prof. C. R. Rao became a legend during his own life time. In the early hours of the 23rd of August, 2023, this great son of India (Indian-American) breathed his last in Buffalo, New York, USA. It is an irreparable loss to the world scientific community and to the citizens of his motherland India. The void will remain forever.

A quote from Tagore which he wrote for another great son of India may be used for this sad occasion too. The poet wrote:

*“Death’s law can give us no sense of his loss,
He who has been taken away
From the bosom of the earth
Has been held in the heart of this country.”*

I along with all the members of the ‘Institute of Science, Education and Culture (ISEC)’ pay our respectful homage and obeisance to Late Prof. Calyampudi Radhakrishna Rao (Prof. C. R. Rao). We pray that may his departed soul rest in eternal peace.

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