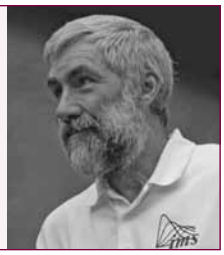
Terence's Stuff: *Statistical Dynasties & Golden Ages*

As he wrote this, Terry Speed was about to revisit Kolkata, which turned his thoughts to the remarkable success of statistics in India, and the 90th birthday of a former IMS president.



The countries that dominated the statistics I learned as an undergraduate were Great Britain, India, and the USA. The presence of India in this list initially puzzled me. Why India, and not China, France, Germany or the Soviet Union, I wondered. A text I used, and liked a lot, at that time was *Advanced Statistical Methods in Biometric Research*, by a young Indian statistician named C. Radhakrishna Rao. It balanced theory and application in a way that I could enjoy: Fisherian, but comprehensible. If it gave the impression that much of statistics concerned skulls, bones and races—anthropometry—that was because in the old days people took measurements on lots of these things, and discussed questions of race. Much important statistics seems to have been inspired by such matters. (I later learned that Rao went from Calcutta to Cambridge, England, in the late 1940s to work on the analysis of a series of human skeletons excavated in Jebel Moya in Sudan.)

In due course I came to understand the answer to"why India?" The reason was P.C. Mahalanobis. During the 1920s he had built up a Statistical Laboratory within his room as Professor of Physics at the Presidency College of Calcutta, and in 1931 he founded the Indian Statistical Institute (ISI). In any area of science, the achievements of individuals, research groups, departments, institutions and countries wax and wane. Almost by definition, the ones we notice are the outliers, and it's hard for outliers to produce new outliers, and for this process to continue, unto the *n*th generation. But the ISI quickly went to the top, and has remained there for a remarkably long time—for a period probably unequalled in our discipline. The first decade of the ISI saw R.C. Bose doing outstanding research on experimental design (working on Galois fields, not in paddy fields), S.N. Roy doing superb multivariate analysis, and many others, doing great work, including Mahalanobis himself, studying his distance. The 1940s were unarguably C.R. Rao's. His famous 1945 paper, which contained the Cramér-Rao inequality, the Rao-Blackwell theorem, and a beginning to the differential geometry of parameter spaces, would guarantee that, even had he done nothing else—but there *was* much else. The 1950s saw D. Basu, Rao's first PhD student, prove his beautiful theorem… and so it has continued.

I've been meeting the ISI all my life. After my exposure to Rao's book, I turned away from statistics to mathematics. Not long into this phase of my life, I stumbled across the amazing quartet: V.S. Varadarajan, K.R. Parthasarathy, S.R.S. Varadhan, and R. Ranga Rao. The first three were students of C.R. Rao at the ISI, while the fourth was at nearby Calcutta University. Probability in physics, on metric spaces, over Lie groups, ergodic theory, group representations, functional analysis, and much more; there seemed to be no limit to what could be done in the name of statistics in Calcutta. There were many other outstanding people, of course, in addition to the four named above. This period of its history has been dubbed the Golden Age of ISI, and that seems right, apart from the fact that this condemns all future ages to lesser metal status. A move from Australia to the UK gave me the opportunity to learn from KRP first-hand, although I didn't manage to get into his research area quickly enough to do independent work before he returned to India. But D. Basu was close by, away from the ISI for a few years, and he led me back into statistics. He also got me invited to give a course at the ISI, so that I had the opportunity to live and work in this unusual place, a truly wonderful experience. That was over 30 years ago, but I'm quite excited to be returning to Kolkata in a couple of weeks.

What is the secret of the ISI's success? In 1961, with help from R.A. Fisher, they adopted the motto "Unity in Diversity," and the banyan tree as a crest. (Buddha is thought to have achieved enlightenment while sitting under this tree.) By then the Institute was a university, with people studying economics, social science, geology, human genetics, crop science, industrial quality control, and much more, with statistics as the connecting theme. Mathematics, theoretical and applied statistics, and sample surveys flourished. It seemed that people could carry out whatever research they wished, though not in all cases, as one distinguished member of our profession found to his disappointment.

These days I'm doing research in cancer genomics, and am involved in the International Cancer Genome Consortium. India is one of the participating nations, with a study of tumors of the oral cavity. Which Indian institution is leading that research? The ISI, of course!

Happy 90th birthday year, C.R. Rao.

The banyan tree, together with the motto Unity in Diversity, *is pictured in the logo for the Indian Statistical Institute. The Great Banyan Tree in the botanic gardens in Kolkata is the largest in Asia, possibly in the world.*