

EDITORIAL

Indian Anthropologists in the Era of Molecular Anthropology

Due to the long historic and prehistoric processes of the peopling of India from diverse cultural, geographic and ethnic backgrounds, Indian subcontinent is bestowed with a mosaic of ethnic groups, contrasting cultural elements and multitude of languages (Kumar and Reddy, 2003; Misra, 2001). Broadly speaking, Indian populations can be assigned to four major linguistic families, viz., Austro-Asiatic, Indo-European, Dravidian and Tibeto-Burman, and two broad kinship systems- Dravidian and Indo-European. The physical features of the Indian population can be put under Australoid, Caucasoid, Mongoloid, Negrito and Negroid ethnic elements, which broadly represent the entire ethnic variety of the globe. One of the most fundamental and unique features of Indian population structure is the division of its population into strictly defined hierarchical endogamous castes, tribes and religious groups, with their subunits, within each of the linguistic and or ethnic categories. It is estimated that the Indian population is composed of about 40,000 endogamous populations of which ~37,000 fall under caste system and 3000 are tribes and religious groups (Malhotra, 1984). This exciting population scenario offered Indian Anthropologists- Biological and Cultural- unlimited possibilities for research into social and biological processes leading to the population structure and genetic composition of the Indian population. Indeed many of the first generation social/cultural anthropologists made immense contributions highlighting the variation and dynamic processes in the socio-cultural fabric of the Indian castes and tribal populations that had implications particularly to marriage patterns and endogamy. On the other hand, biological/physical Anthropologists focused initially on the issues related to the racial elements in the Indian population and subsequently studied the biological/genetic composition of and the affinities among different caste and tribal populations and the micro-evolutionary factors behind the observed patterns of variation among them. The biological anthropologists were analytical in nature and primarily dealt with the relevant quantitative and qualitative data generated from the rich and naturalized field laboratory provided by the complex population scenario. Further, in order to explain the complex Indian society and its socio-cultural patterns and processes,

anthropologists and/or sociologists have come up with certain hypotheses. Some of these socio-cultural processes, particularly those influencing the marriage patterns, can have profound genetic implications and biological anthropologists and others have long been interested in studying how these processes modulate the evolutionary forces. The sociological processes of *sanskritization*, tribe-caste continuum and marriage rules governed by the different kinship systems, the relaxation of strict endogamy by way of hypergamy and the residence patterns of the spouses in the patrilineal and matrilineal societies are all expected to have genetic imprints as well. For example, the process of *sanskritization* (Srinivas 1952, 1962) and the resulting tribe-caste continuum (Bose, 1941; Sinha, 1965) and upward mobility of the lower castes into the higher ranked social groups which appear to be purely sociological processes can lead to profound genetic implications once the tribe achieves the status of a caste and integrates itself into caste society. Over a period of time, there is a possibility for this tribe to develop marital contacts with the neighboring caste groups of similar status as well as with the others that are marginally higher in status which may lead to the process of partial genetic amalgamation of these genetically tribal groups into the genetically intermediate groups, between the castes and tribes. This may result in tribe-caste continuum in the genetic structure as well as genetic amalgamation of differentially ranked caste groups. Some of these interesting research issues could have been best explored jointly by the Cultural and Biological Anthropologists and to the best of my knowledge there has been no worthwhile collaboration between the two broad branches of Anthropology despite almost all Indian universities having the combined departments of Anthropology, represented by both the branches. One gets an impression that the research activity of these two groups of anthropologists appears to be mutually exclusive and non-overlapping, as if there is nothing common for the two streams of anthropologists. I am sure this divide continues to be quite perceptible till today. There have been concerted efforts to see that certain Anthropology departments in the country, particularly in a couple of central universities, to remain as purely cultural/ social and University of Hyderabad is one of those. Strangely, all the faculty members of this department were the products of general Anthropology departments of the country. I for one felt very strongly about it and being in the Indian Statistical Institute (ISI), Kolkata, I wrote to the two successive Vice Chancellors of this university saying that it is not for academic reasons that this department remains to be only cultural and outlining the need for recruiting faculty in Biological/Physical Anthropology. After I shifted to ISI Hyderabad in 2005, I learnt from my friends/classmates in the departments that the Vice Chancellors had forwarded my letters to the department but the outcome of such letters by an individual is anybody's obvious guess. I recall one of my colleagues at ISI Kolkata

used to fondly recount “it is the group that survives, not the individuals” with an apt reference to certain incidents at ISI, Kolkata. I feel very strongly that we the biological anthropologists have failed miserably as a group albeit some of us might have succeeded as individuals. In this context it may not be out of place to narrate an anecdote pertaining to the International conference organized by the Department of Anthropology, Utkal University, as part of its Golden Jubilee Celebrations (16-19 December 2007) for which I was invited as a speaker. Excepting a few relatively young (being in mid-fifties) delegates like me, majority of the invitees were the veteran first generation cultural anthropologists like Professors Gopala Saran, N. S. Reddy and L. K. Mahapatra and a couple of Professors like I. P. Singh and Amitabha Basu from Physical Anthropology. On the first day of the conference during the lunch time I happened to come across an Indian American Professor, who happened to be a cultural anthropologist. Although I have not heard about or met him earlier, to my surprise he asked me if I think there is anything common between Cultural and Biological Anthropology. Coincidentally, I had come prepared to speak on a topic relating to *Molecular Genetic Perspectives of the Indian Social Structure* and therefore told him that I will not answer his question directly but if he is going to be there in the afternoon session he can get answer from my lecture. Unfortunately, he had scheduled sightseeing trip during that afternoon and I do not remember to have seen him again during the remaining days of the conference. But that brief interaction with the Indian American Professor prompted me to begin my lecture by quoting what he asked me and appealing to the veteran cultural anthropologists to judge for themselves whether there is anything common between the two streams of Anthropology from what I present during my lecture. It was gratifying to note that the veteran anthropologists were so excited that they came up to me after the lecture and acknowledged without saying anything that there is indeed a lot in common for the two streams of anthropologists. Alas, none of those veterans are probably not there today to see that the younger generation of anthropologists did not carry forward that momentary conviction shown in their eyes on that eventful day! It is another matter that we have subsequently published a paper based on the theme of my lecture in an international journal (Reddy *et al.*, 2010) and I shall deal further with this in the remaining part of this editorial.

It is in this backdrop that I would like to focus on how impactful were the anthropologists have been in the era of Molecular Anthropology. With the advent of molecular genetic markers and especially after the completion of human genome project in 2003 the research in Human Genetics/Anthropological Genetics has been revolutionized and this has opened up exciting possibilities for research in Molecular Anthropology, particularly to

investigate the genetic implications of the unique Indian population structure and the dynamic sociocultural processes. The discovery of Y-chromosome and mitochondrial DNA markers facilitated defining male and female lineages, respectively, which precisely help in tracing the trails of historic and prehistoric gender specific migrations and peopling of different regions of the globe that was not possible with the help of traditional genetic markers and/or biological variables. These gender specific DNA markers along with the autosomal ones will be handy in determining the genetic implications of the Indian social structure and its dynamic processes discussed above and to test some of the hypotheses proposed earlier by the cultural anthropologists. Could the anthropologists, particularly the biological anthropologists, proactive and grab this opportunity? My answer to this is clearly negative. We have reviewed the Molecular Anthropological studies on the Indian populations till about the year 2008 and based on published results and analyses of the unpublished data of our own assessed the molecular genetic implications of the Indian social structure and as mentioned above published a paper in American Journal of Human Biology (Reddy *et al.*, 2010). Readers may kindly refer to this paper for details and I feel it may not be prudent to reproduce the same here. Nevertheless, based on the review and analyses of molecular anthropological studies till about the year 2010, I shall outline here a critical overview of the outcome of these studies on Indian populations and the role of Indian anthropologists in this. Needless to emphasize that even though a large number of molecular anthropological studies were undertaken after 2010, the marginal nature of the role of Indian anthropologists in those remains unchanged. Nevertheless, one may say that the molecular genetic evidences generally complement the anthropological hypotheses albeit further studies are required with more appropriate framework to reach unequivocal conclusions. As outlined in Reddy *et al.*, (2010), one finds that some of the ill-framed studies merely result from the lack of proper understanding of the Indian population structure. Further, a glaringly disturbing fact that emerges from these studies is that they do not generally furnish population and or sampling details, which are essential prerequisites of the research in Molecular Anthropology. It is not probably the sheer coincidence that the anthropologists were not the authors of such studies. With the advent of molecular genetic technology anthropologists have lost the ground in the resource intensive and laboratory centered milieu, needing to generate 'expensive polymorphisms' to effectively pursue research in Molecular Anthropology. That to the best of my knowledge is because the anthropologists could not get access to and/or establish molecular genetics laboratories. It is indeed a fact but a disturbing one at that. This has naturally proliferated entry of non-anthropologists to pursue this exotic opportunity given the advantages offered by the new technology. However, technology helps only in generating more

refined polymorphisms with improved resolution but the research questions, framework of studies and insights that can be obtained remain essentially anthropological needing focused involvement of anthropologists who are familiar with the concepts and theories in Biological and Cultural Anthropology besides their insights into the intricate Indian population structure.

Anthropologists' experience in the population based approaches to research, especially in sampling appropriate subjects that may truly represent the implicit heterogeneity of a population, ethnography and in obtaining field based insights would not only be unparalleled but crucial as well. Nevertheless, sadly, the involvement of anthropologists is minimal in the molecular anthropological studies hitherto conducted on Indian populations. Since mid 90s a number of papers based on autosomal, mtDNA and Y-chromosome markers appeared on the Indian populations which attempted to examine peopling of India, phylogenetic affinities, origins, history and routes of migrations, and also tested certain other anthropological hypotheses concerning Indian population structure and micro evolution/differentiation (see Reddy *et al.*, 2010 for sources).

To the best of my knowledge, despite involvement of certain Indian anthropologists in some of the above publications as coauthors, their role, with a few exceptions, was restricted to depositing samples about which the core scientific groups, generally non-anthropologists from India as well as from outside had probably no inkling. One is far from certain about the samples being representative of the populations that they deal with and sometimes even the identity of the samples vis-à-vis the specific populations. We also come across bizarre population units like Hindus, Hindi speakers, North Indians, South Indians, etc., all represented by a paltry number of subjects (~ 100), which is far from acceptable from the population genetics perspective. Needless to emphasize the crucial importance of field based insights in interpreting particularly the dynamics of Indian population structure and micro evolution, which are of course not perceptible in most of these studies. Only in a couple of studies we have seen that the Indian anthropologists to form a core scientific group and collaborate with the molecular genetic laboratories. We were fortunate to be one of those and got the precious opportunity of collaborating with Centre for Cellular and Molecular Biology (CCMB), one of the best laboratories in the country then for molecular genetic work and with excellent work culture and round the clock functioning of the centralized laboratory facilities. Our collaboration was initiated during 2000 and lasted effectively for about 10-12 years, as long as Dr. Lalji Singh continued as Director. After initial five years of operation from Kolkata, I had to of course move to ISI, Hyderabad, in 2005 in order to facilitate effective collaboration with CCMB.

Subsequently, we managed to establish minimum laboratory facilities at ISI, Hyderabad, which facilitated DNA isolation and quantification and further processing of our samples till sequencing PCR stage, after which the products were sent to CCMB for sequencing. In collaboration with CCMB we sequenced thousands of samples for Y-chromosome, mtDNA and autosomal markers from 70 different populations, both castes and tribes from different parts of the country covering almost all the groups of Austro-Asiatic tribes including Khasi and about 40 caste and tribal populations of Andhra Pradesh and published a large number of papers in the area of Molecular Anthropology, particularly addressing the issue concerning the role of Austro-Asiatic population in the peopling of India and Southeast Asia besides exploring the genetic implications of the Indian population structure. Based on these data we published nearly 25 papers. Later around 2007 we shifted our focus somewhat and initiated projects related to genetic susceptibility of complex diseases such as (1) recurrent spontaneous abortions, (2) Polycystic Ovary Syndrome, (3) Type 2 diabetes, (4) Coronary artery disease and (5) Chronic Myeloid Leukemia (a collaborative project with Genetics department, Osmania University), which resulted in about 50 biomed publications.

It is high time that the anthropologists get into the business of Molecular Anthropology as the population based approaches are going to be crucial in all aspects of human genetics research including in the arena of pharmacogenomics and/or individualized/population specific medicine. It is true that the anthropologists, having been primarily field oriented, would be better off by joining Molecular Geneticists who are much better equipped to deal with laboratory related issues and in the biochemical nature and dynamics of the genetic markers being employed in understanding evolutionary and anthropological issues. Given enormous research potential that the unique Indian population structure offers, such a partnership is mutually beneficial both to anthropologists and to the practitioners of Molecular Anthropology. This is not to suggest that the Indian anthropologists cannot become self-sufficient in undertaking molecular anthropological and/or human genetics research. However, given the present dismal scenario in different university departments, a lot of concerted efforts are required from the anthropologists as a group. I am given the understanding that the syllabus for postgraduate Anthropology courses in most of the Indian Universities is not updated for a long time, which needs to be done immediately to include training in Molecular Anthropology and Genomics with minimum laboratory facilities established. Similarly, statistical analyses and interpretation of data has become an integral part of any research activity and the scope for reasonable training in basic statistical methods needs

to be imparted as part of M.Sc. dissertation, which should be made mandatory. A broad national level policy is warranted with associated support system by way of budgetary provisions to support appropriate faculty recruitments, establishing laboratories, etc., this could be a Herculean task which can be taken up only by the National Agency like the University Grants Commission, perhaps.

REFERENCES

- Bose N.K. 1941. The Hindu method of tribal absorption. *Science & Culture* 7:188–194
- Kumar V., B.M. Reddy 2003. Status of Austro-Asiatic tribes in the peopling of India: An exploratory study based on available prehistoric, linguistic and biological evidences. *J Biosci* 28:507-522.
- Malhotra K.C. 1984. Population structure among the Dhangar caste- cluster of Maharashtra, India. In: *The People of South Asia*, Lukacs JR., ed., Plenum Press, New York.
- Misra V.N. 2001. Prehistoric human colonization of India. *J Biosci* 26:491-531 (suppl).
- Reddy B.M., V. Tripathi, V. Kumar, A. Nirmala 2010. Molecular genetic perspectives on the Indian social structure. *American J Human Biology* 22:410-417.
- Surajit Sinha 1965. Tribe-Caste and Tribe-Peasant continuum in Central India. *Man in India* 45:57-83.
- Srinivas M.N. 1952. *Religion and Society among the Coorgs of South India*. Oxford, Clarendon Press.
- Srinivas M.N. 1962. *Caste in Modern India and Other Essays*. Bombay, Asia Publishing House.

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