1. Singh, K. S., *People of India: An Introduction*, Seagull Books, Calcutta, 1992.
2. Singh, K. S., *Curr. Sci.*, 1993, **64**, 5–10, this issue.
3. Padmanabha, P. (ed.), *Census of India 1981*, Controller of Publications, Delhi, 1981.
4. *Census of India*, 1961, Village Survey Monographs.
5. MacArthur, Robert, H., *Geographical Ecology*, Princeton University Press, Princeton, 1972.
6. Pielou, E. C., *Ecological Diversity*, John Wiley & Sons, New York, 1975.
7. Cody, M. L. and Diamond, J. (eds.), *Ecology and Evolution of Communities*, The Belknap Press of Harvard University Press, Cambridge, 1975.
8. Ranjit Daniels, R. J., Joshi, N. V. and Gadgil, M., *Biol. Conserv.*, 1990, **52**, 37–48.

ACKNOWLEDGEMENTS. We are grateful to Dr K. S. Singh and his colleagues in the Anthropological Survey of India for making this fascinating data set available, and for many stimulating discussions as well as financial and moral support. K. C. Malhotra kindly made available his summary of village survey monograph data to us. Anil Gore and A. V. Kharshikar read an earlier draft of this MS and made a number of useful suggestions. This work has also been supported by a grant from the Ministry of Environment and Forests, Government of India.

Received 27 October 1992; accepted 2 November 1992

Physical anthropology as a science: A commentary

B. M. Reddy, T. S. Vasulu and K. C. Malhotra

Physical anthropology deals with the origin and evolution of man. It studies the role of both culture and biology in shaping the course of human evolution, and the corresponding processes that guided this course.

Variously known as human biology, biological anthropology or simply anthropology, its research and training range from evaluation of comparative biology of primates to studying contemporary biological variations within and between different human populations. The scope of the subject branches out under the following somewhat arbitrary heads:

Human evolution and primatology deals with the description of fossil remains as well as the evaluation of functional significance of traits in the course of evolution. In primatological field, determining man's place in nature is no longer the major issue; it is now more concerned with comparative ethology.

Genetics, particularly population genetics, deals with genetics of traits and their behaviour in populations. A number of genetic systems are used in this field, viz. blood groups, biochemical markers—serum proteins and red cell enzymes, HLA, and DNA polymorphisms. It studies the genetic histories of populations and the processes leading to the present genetic compositions.

Anthropometry, somatology and dermatoglyphics have been the mainstay of the discipline and are studied in assessing growth status, population affinities, typological classification of humans, and in forensic and other applications.

Growth studies of humans and non-human primates are undertaken with an emphasis on the role of socio-economic, cultural and ecological factors on growth.

Population structure and demographic studies are concerned with the role of population attributes like size, distribution, mating patterns and reproductive behaviour in the microevolutionary processes.

Human ecology deals with man–environment interaction as well as the resultant adaptive cultural and biological patterns.

Applied anthropology uses anthropometric measurements, dermatoglyphic traits and serological and biochemical markers in personal and criminal identification, prenatal diagnosis of genetic disorders, genetic counselling, paternity disputes, sports and industry, etc.

History of development of anthropology: An overview

Birth of physical anthropology as a science, followed only after the promulgation of evolutionary theory, by Charles Darwin in 1859, through the publication of *Origin of Species*. The idea that nature selects those which are better adapted to a particular geographical zone and way of life laid basis for understanding the adaptive radiation of the primates. The chief accomplishment till about 1900 lay in the recognition of considerable time depth for man; the joint efforts of geologists, palaeontologists and physical anthropologists finally succeeded in establishing the antiquity of man. Among the important discoveries during this period were the Neanderthal skulls from the Mousterian phase of the old stone age, one each at

Gibraltar (in 1848), North-East Germany (in 1856), and in Iraq, the antiquity of these were estimated to be between 40,000 and 50,000 years. Other discoveries include Java ape man, now popularly known as *Pithecanthropus erectus* by Eugene Dubois in 1891-92, and *Sinanthropus pekinensis* by Pei Wen-Cheng in 1929. These were followed by numerous rich findings of Australopithicines of South Africa. Often referred to as 'man-apes', they may well constitute the first representatives of man.

A large part of the early physical anthropological history thus can be characterized as that of man's attempt to determine his place in nature. Due to lack of knowledge about genetics and the concept of culture, personality traits as well as skin colour were used initially for the classification of human populations into primordial races, even though Blumenbach (1752–1840) observed as early as in 1775 'immense variety of mankind run into each other by insensible degrees', suggesting that there are no pure races.

The turning point

The year 1900 marked a turning point in the development of conceptual approach due to the rediscovery of Mendel's laws of heredity and Landsteiner's discovery of blood groups. The early 20th century was also characterized by development of statistical methods and their wide application to the anthropological data.

Galton (1822–1911), the father of biometry, developed a new measure of variability, correlation and regression based on physical anthropological data. His student Karl Pearson (1857–1936) launched the journal *Biometrika*, perfected correlation, classified distributional types and developed chi-square method, followed by the phenomenal contribution to the modern statistical theory by R. A. Fisher. Fisher's contributions towards design of experiments and field genetics were of immense help for the growth of formal genetics. The statistical methods like ANOVA, multiple regression, discriminant function, generalized distance and factor analysis —all share the criterion of treating multiple variables as a single coherent vector. Some of these methods were further extended, generalized, and perfected by P. C. Mahalanobis and C. R. Rao and applied extensively to anthropological data.

Birth of population genetics

Another breakthrough in the early 20th century came in the form of Hardy–Weinberg equilibrium principle, independently propounded in 1908 by Hardy, a British mathematician and Weinberg, a German medical doctor. This principle illustrates the way in which traits are maintained in a population, under certain assumptions. It was followed by development of the basic principles of population genetics by J. B. S. Haldane and R. A. Fisher in England and Sewall Wright in the United States. These developments influenced the physical anthropologists all over the world and they began examining genetic and morphological variations at the local levels or at the level of endogamous groups within the major racial or geographical groups to understand the processes of microevolution and ultimately to gain insights into evolution of man.

This period can be considered as transitional as the focus of physical anthropology moved from descriptive study of biological parameters to developing analytical mathematical models for understanding the causes of variation. Furthermore, cytogenetic, biochemical and molecular genetic techniques came increasingly into vogue, with remarkable success.

Recent developments and current trends

The advent of molecular biology around the middle of this century had a strong influence on human genetics; the major landmark was the discovery that sickle cell anaemia is due to abnormal haemoglobin molecules. The ever-increasing sophistication of molecular genetic technology, which made the DNA sequencing and gene mapping for various disease markers possible, led to a major endeavour known as 'Human Genome Project' with the objective of capturing the entire range of human genetic variability.

Recent decades have seen the increasing shift in the interests of physical anthropologists, from traditional macroevolutionary problems concerning the origin of man to more of understanding what happens within a local population and between populations in a region, in the background of their sociocultural and ethnic histories. This has led to collection of massive morphological and genetic data on hundreds of human populations from different parts of the world, facilitating better understanding of the role of microevolutionary processes like admixture, mutation, drift and selection. Currently this understanding has become much more fruitful with increasing availability of DNA sequence data. The high substitution rate coupled with a small effective population size, makes maternally inherited mitochondrial DNA (mtDNA) very useful in studying genetic differentiation of human populations. The mtDNA shows a lot of variations revealed by restriction fragment length polymorphism (RFLP); the coefficient of genetic differentiation (GST) is much more (31% on an average) among the human populations so far studied[1], compared to only about 10% captured on the basis of traditional markers[2].

These developments in molecular genetics have also been used to test the two contrasting hypotheses concerning human origin, primarily based on fossil evidence. Those are: i) *the single replacement hypothesis* (Eve Theory), which states that all modern populations of *Homo sapiens* originated in Africa and then replaced all the other then-existing populations of *Homo sapiens* (late *H. erectus*, Neanderthals and other *Homo sapiens*) with little or no hybridization, and ii) the *multiregional transition hypothesis*, which states that *Homo erectus* originated in Africa and spread to temperate regions of Eurasia and evolved independently to produce the modern geographical races.

On the basis of mtDNA analysis of 147 subjects from different continents, it was suggested that the common ancestral mother was an African dating back to about 200,000 years[3,4]. A reinterpretation of mtDNA data challenges the idea of unique origins and suggests evolutionary origins of modern humans in three or more regions. This argument is known as the regional transition hypothesis[5]. The question that naturally struck many was 'Can father Adam be

spatially and temporally far removed?'. To investigate this, studies on Y-chromosome were initiated; although, polymorphism of the Y-chromosome is rather limited, yet the results are compatible with the theory of African origin for modern man.

The Indian scenario

Sir William Jones in 1774 in his inaugural address to the Asiatic Society of Bengal defined the scope of its enquiries as comprising an entire field of studies concerning 'man' and 'nature'. This may well be regarded as the beginning of Anthropology in India. Many anthropological investigations were initiated under the auspices of this society and, throughout the 19th century, lot of ethnographic information on Indian tribes was gathered.

Although Shortt, who took anthropometric measurements of Kotas and Todas in 1868, was a pioneer in biological anthropology of Indian populations, and launched the journal *Indian Antiquity* in 1874, the real impetus to such studies came only after Risley[6] published his classical work on 'People of India', wherein he attempted a seven-fold racial classification of the Indian population on the basis of anthropometric measurements: (1) Dravidian, (2) Mongoloid, (3) Mongolo-Dravidian (4) Aryo-Dravidian, (5) Indo-Aryan, (6) Scytho-Dravidian and (7) Turko-Iranian. Risley was also the first to claim racial basis for the caste system on anthropometric evidence. This heralded the beginning of scientific approach to the problem of caste origins. Earlier (in 1870) T. H. Huxley classified Indian population on the basis of skin colour, while Emile Schmidt (1889–90) observed that the linguistic groups in India do not coincide with uniform racial groups, and instead tackled the classification purely from the morphological point of view.

During early decades of the 20th century, several efforts were made in establishing the racial composition of the Indian populations. Risley's racial theories were subjected to criticism. For example, Chanda's[7] study of historic and prehistoric sources lined him up against Risley's 7-fold classification. While resuscitating the *Nishadic* hypothesis, he also brought strong evidence in support of Indo-Alpine elements in Indian populations, a hypothesis indicated by A. C. Haddon which also gained support from the racial survey of India by B. S. Guha. Furthermore, while Ruggeri[8] arrived at a six-fold ethnic classification for India, Eickstedt, who led an anthropological expedition to India during 1926–29, classified the somatic types as Veddid, Melanid, and Indid groups, with two sub-types in each of these categories. This was followed by a systematic anthropometric survey of Indian populations by B. S. Guha as part of 1931 census. Guha[9] proposed a different classification leading to the revision of Risley's conclusions. Applying Karl Pearson's coefficient of racial likeness, he classified the Indian people into six major races and nine sub-races. The initial stimulation for organized research in India, however, came only with the introduction of Anthropology in the curriculum of Calcutta University in 1921. During the same year, Sarat Chandra Roy launched the Journal *Man in India.*

Most of the studies that followed Guha's publication of 'Racial Affinities of People of India', ended with either examining Guha's classification for various unstudied populations or describing same populations with added morphological or genetic traits. During this period blood groups and dermatoglyphic traits gained importance. The works of Biswas[10] and Sarkar[11] deserve special mention for their attempts at popularizing dermatoglyphics and genetic studies respectively. In addition, a few regional anthropometric studies covering a large number of endogamous groups were also conducted; Lido Cipriani measured 2000 adults (during 1934–35) belonging to 36 groups in the Travancore–Cochin–Coorg area, while Bowles and Mrs. Bowles measured 6000 people from Kashmir to Burma.

Blood group investigations in India were initiated by Herzfield who examined soldiers of all nationalities, including Indians, during the 1st World War (1910–11). Since then, attention has been focused on the distribution of blood groups in Indian populations. The contributions of Mrs. Macfarlane were outstanding during the formative stages (1936–1942). She along with her colleagues studied caste-wise distribution of blood groups[12,13]. The credit for introducing the newly discovered blood groups goes to E. C. Buchi during his stay in India in 1953. Among other early workers, contributions of Malone and Lahiri[14], Majumder[15] and Sanghvi and Khanolkar[16] deserve special attention.

The search for prehistoric and paleontological evidence

The search for evidence of plio-pleistocene evolution in India started with the palaeontological investigations in the Siwaliks by Lydekker[17] and Pilgrim[18,19]. These were followed by several other excavations at different parts of the country: Guha and Sewell studied human remains excavated at Nal (1929), at Makran and Mahanjodaro (1931, 37), while Sankalia and Karve[20] reported human skeletons from Gujarat with Negroid features.

The excavations from other parts of India, viz. Piklihal, Nevasa, Rupkund and Lothal, and Ujjain skeletons of the Gupta era threw considerable light on the ancient people of India. Excavations in the Sind and Punjab provinces gave promise of India's claim to be regarded as the cradle of civilization dating back to 3100 BC; human remains from these sites belonged to four ethnic types: (1) Proto-Australoids, (2) Mediterranean, (3) Mongolian branch of Alpine and, (4) Alpines.

It was Bruce Foote who discovered the first palaeolithic tool at Pallavaram around 1860, and became pioneer in the discovery of Stone Age in India. Subsequently, several other Stone-Age cultures were unearthed from different parts of India. H. D. Sankalia from Deccan College, Pune, in particular, had broken new grounds in the search of early man through his discoveries of the remains of Palaeolithic and Neolithic man. This generated new interest in pre- and-protohistoric research in India.

Between 1940 and 1960

Indian physical anthropology between 1940 and 1960, although continued in its traditional mould with the typological approaches, widened the scope not only by employing new parameters like blood groups and dermatoglyphics for the purpose of studying racial composition, but also by pursuing non-typolo-

gical problems. The anthropometric and serological surveys of UP, Gujarat, and Bengal by D. N. Majumder in collaboration with the pioneering statisticians, P. C. Mahalanobis and C. R. Rao, from the Indian Statistical Institute, belong to this category. This period was also characterized by designing and increasing use of statistical tools in anthropological studies[21-23].

Another significant event during this period was the establishment of Anthropological Survey of India in 1946 under the Directorship of B. S. Guha, and launching of a new journal *Eastern Anthropologist* under the editorship of D. N. Majumder. Ten more university departments of anthropology were also established to teach anthropology as a regular course; the first among those being Delhi University (which started anthropology in 1947), with a greater emphasis on physical anthropology. This period was also distinguished by studies by S. S. Sarkar from Calcutta and Irawati Karve from Maharashtra. Sarkar classified Indian people on the basis of cephalic index and concluded that India is predominantly dolichocephalic. Sarkar also reviewed all the data on dermatoglyphics in India and observed striking differences in finger prints between Australoids and other groups of people, and proposed that the whorl–loop ratio of 60:40 is a characteristic feature of Veddid or Australoids.

The last three decades of physical anthropology

The sixties represent an important period, where a definite shift in the focus of physical anthropology occurred. The traditional typological approaches were gradually replaced by more problem-oriented, microevolutionary, regional and ethnic approaches. For example, Karve with the help of her students, examined a sociological hypothesis which states that the several subcastes under a single generic name in any particular region may not have a common genetic origin, but in fact different castes that have assumed the generic name due to Sanskritization process. Two of her students collected both morphological and genetic data on Brahmins and Potters caste-clusters and found substantial evidence in support of her hypothesis that 'varna' is not a biological category, rather it is sociological construct[24]. This was followed by a multidisciplinary study among Dhangar caste-cluster by her in 1969, which was led by K. C. Malhotra after her death in 1971; all the 23 endogamous groups of Dhangars covering the 24 districts of Maharashtra were studied.

The importance of castes or breeding populations as analytical units, and the relevance of understanding population structure of the groups in terms of mating patterns and reproductive behaviour was also realized, leading to a large number of studies in these areas. Numerous contributions in the field of consanguineous marriages and inbreeding[25-28] and matrimonial distance[29] were made.

Several microevolutionary studies were also conducted from many other regions and occupational groups (for example, Malhotra's studies among Nandiwallas, Gavadas, etc.). Basu's[30] work among the Pahiras of Ayodhya hills is another pioneering effort in this direction, for he tried to establish breeding isolates within a tribe and treated them as units for biological investigation. This shift can typically be described as physical anthropologists assuming the role of full-time population-geneticists; the palaeoanthropological studies by the anthropologists having taken a backseat.

The unique social structure of India, with the well-defined castes, particularly suited this direction and India has been rightly regarded as a suitable field laboratory of population geneticists. In these efforts of data generation, Anthropological Survey of India through its all-India infrastructure played a pivotal role through several all India projects such as All India Bioanthropological Survey, and All India Anthropometric Survey. The Anthropology Department of the Indian Statistical Institute, and the twenty and odd anthropology departments in different parts of the country have also contributed significantly towards this goal in generating anthropometric, genetic marker, and dermatoglyphic data. Several small-scale studies were also oriented towards obtaining demographic data towards portraying population structure and reproductive processes of different Indian populations.

With some exceptions, most of these studies can be considered purely descriptive. These data were nevertheless fruitfully used in examining the geographical, ethnic and racial patterns in serological and biochemical markers[31-34], anthropometry[35,36] and dermatoglyphics[37]. The other genetic markers like PTC and colour blindness were also subjected to periodic reviews.

The research activities in physical anthropology in recent decades were also well-portrayed in the form of periodic analytical reviews in different areas: Bowles[38] and Kennedy[39] in palaeoanthropology; Mukherjee[40] in dermatoglyphics, and Gupta and Dutta[41] in anthropometry, conference proceedings[42-45] and special numbers of journals like *Journal of Human Evolution* (1978) and *Anthropologischer Anzeiger* (1983) and in the form of a special volume concerning the people of South Asian region[46]. These volumes brought to light various facets of research activity in biological anthropology of the subcontinent. If there is anything in which the Indian anthropologist is found wanting, it is the field of human molecular genetics.

Nevertheless, it is heartening that in a fitting tribute to Risley, the pioneer of Indian Physical Anthropology, whose *People of India* as a first milestone in Indian physical anthropology, Anthropological Survey of India has successfully completed a mammoth project again named as *People of India Project* under the able guidance of its Director-General, K. S. Singh. These data have already been subjected to some comprehensive analysis in collaboration with Indian Institute of Science at Bangalore.

We also gather that many such projects of all India nature, covering different aspects of physical anthropology, viz. genetic structure of Indian populations, anthropometry of Indian women, nutritional survey, and a search for human origins in India, have already been initiated by Anthropological Survey of India. We can hopefully look forward for some more exciting findings in the near future which will enrich the knowledge on biological variation of man in India, and contribute to the understanding of the processes that led to such a rich genetic, biological and cultural diversity.

1. Stoneking, N., Jorde, L. B., Bhatia, K.

and Wilson, A. C., *Genetics*, 1990, **124**, 717–733.
2. Nei, M. and Livshits, G., in *Population Biology of Genes and Molecules* (eds. Takahata, N. and Crow, J. F.), Bifukan, Tokyo, 1990, pp. 251–265.
3. Cann, R. L., Brown, W. M. and Wilson, A. C., *Genetics*, 1984, **106**, 479–499.
4. Wilson, A. C., Stoneking, M., Cann, R. L., Preger, E. M., Ferris, S. D., Wrischnik, L. A. and Kiguchi, R. G., in *Human Genetics* (eds. Vogel, F. and Sperling, K.), Springer-Verlag, Berlin, 1987, pp. 158–164.
5. Levin, M. D., in *Encyclopaedia of Human Biology* (ed. Dulbecco, R.), Academic Press, New York, 1991, vol. 6, pp. 99–105.
6. Risley, H. H., *People of India*, 2nd edn., Oriental Book Reprint Corporation, Delhi, 1915.
7. Chanda, R. P., *Indo-Aryan Races: A Study of the Origin of Indo-Aryan People and Institutions*, Rajashahi, Varendra Research Society, Calcutta, 1916.
8. Ruggeri, G., *The First Outlines of the Systematic Anthropology of Asia*, translation from Italian by H. N. C. Chaklandar, Calcutta University Press, Calcutta, 1921.
9. Guha, B. S., in *Census of India*, 1931, vol. 1, part 3a, Government of India, Simla, 1931.
10. Biswas, P. C., *Z. Morphol. Anthropol.*, *19 35, 519–550.*
11. Sarkar, S. S., *Trans. Bose Res. Inst.*, 1937, **12**, 89–101.
12. Macfarlane, E. J. W., *Curr. Sci.*, 1936, **4**, 653–654.
13. Macfarlane, E. J. W., *J. Roy. Asiatic Soc. Bengal*, 1940, **6**, 39–49.
14. Malone, R. H. and Lahiri, M. N., *J. Med. Res.*, 1929, **16**, 963–972.
15. Majumder, D. N., *J. R. Asiatic Soc. Bengal*, 1943, **11**, 81–94.
16. Sanghvi, L. D. and Khanolkar, V. R. *Ann. Eugen.*, 1949, **15**, 52–76.
17. Lydekker, R., *Palaeontol. Indica Mem. Geol. Surv. India*, 1886, **4**, 23–58.
18. Pilgrim, G. E., *Rec. Geol. Surv. India*, 1915, **45**, 1–74.
19. Pilgrim, G. E., *Palaeontol. Indica (N.S.)*, 1927, **14**, 1–26.
20. Sankalia, H. D. and Karve, I., *New Indian Antiquary*, 1944, **7**(1), 1–6.
21. Mahalanobis, P. C., *Proc. Natl. Inst. Sci. India*, 1936, **12**, 49–55.
22. Rao, C. R., *Advanced Statistical Methods in Biometric Research*, John Wiley and Sons, New York, 1952.
23. Sanghvi, L. D., *Am. J. Phys. Anthropol.*, 1953, **11**, 385–404.
24. Karve, I. and Malhotra, K. C., *Curr. Anthropol.*, 1968, **9**, 109–124.
25. Karve, I., *Hindu Society: An Interpretation*, Deshmukh Co., Pune 1961.
26. Sanghvi, L. D., *Eugen. Q.*, 1966, **13**, 291–301.
27. Roy Choudhury, A. K., *Trans. Bose Res. Inst.*, 1976, **39**, 65–76.
28. Reddy, B. M., *Hum. Biol.*, 1992, **64**, 659–682.
29. Malhotra, K. C., *Curr. Anthropol.*, 1980, **21**, 135–136.
30. Basu, A., *Am. J. Phys. Anthropol.*, 1969, **31**, 399–416.
31. Balakrishnan, V., in *Human Genetics* (eds. Malhotra, K. C. and Basu, A.), Eka Press, Indian Statistical Institute, Calcutta, 1984, pp. 103–145.
32. Roy Choudhury, A. K., in *Human Genetics* (eds. Malhotra, K. C. and Basu, A.), Eka Press, Indian Statistical Institute, Calcutta, 1984.
33. Majumder, P. P. and Roy, J., *Curr. Anthropol.*, 1982, **23**, 539–568.
34. Cassero, C., Montana, R., Arena, M. and Modiano, S., *AH1 Della Academia Nazionale Del Lincei Memoire*, 1986, **18**, 67–252.
35. Malhotra, K. C., *J. Hum. Evol.*, 1978, **7**, 45–54.
36. Majumder, P. P., Uma Shankar, B., Basu, A., Malhotra, K. C., Gupta, R., Mukhopadhay, B., Vijayakumar, M. and Roy, S. K., *Curr. Anthropol.*, 1990, **31**, 94–103.
37. Krishnan, T. and Reddy, B. M., *Ann. Hum. Biol.*, 1992, (communicated).
38. Bowles, G. T., *The People of Asia*, Charles Scribners's, New York, 1977.
39. Kennedy, K. A. R., *Annu. Rev. Anthropol.*, 1980, **9**, 391–432.
40. Mukherjee, D. P., in *Trends of Research in Anthropology in India* (ed. Rakshit, H. K.), Anthropological Survey of India, Calcutta, 1975, pp. 25–44.
41. Datta, P. C. and Gupta, P., *Anthropometry in India*, Anthropological Survey of India, Calcutta, 1966.
42. Rakshit, H. K. (ed.), *Anthropology in India: Physical Anthropology*, Anthropological Survey of India, Calcutta, 1976, vol. 2.
43. Sanghvi, L. D., Balakrishnan, V., Bhatia, H. M., Sukumaran, P. K. and Undevia, J. V. (eds.), *Human Population Genetics in India*, Orient Longman, New Delhi, 1974.
44. Bansal, I. J. S. (ed.), *Human Biology: Recent Advances*, Today and Tomorrow's Printers and Publishers, New Delhi, 1983, vol. 2.
45. Reddy, B. M., Roy, S. B. and Sarkar, B. N. (eds.), *Dermatoglyphics Today*, IBRAD, Anthropological Survey of India and Indian Statistical Institute, Calcutta, 1991.
46. Lukacs, J. R. (ed.), *The People of South Asia*, Plenum., New York, 1984.

ACKNOWLEDGEMENTS. We thank Mrs. Susmita Bharati for help in compiling references.

Received 1 September 1992; accepted 30 September 1992

The authors are in the Indian Statistical Institute, Calcutta 700 035, India