RETROSPECTS, REVIEWS, BOOKS, CONFERENCE AND PROFESSIONAL PAPERS

Human Biology in India: Its Possible Role in a Third World Society Under Rapid Transformation

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Introduction

'Physical anthropology' is generally understood in terms of human variation and evolution in relation to space and time, particularly in respect to 'physical' (morphological) and more recently 'biological' (morphological, blood polymorphic, physiological, etc.) traits. Physical anthropology has traditionally been largely concerned with comparison of population groups, contemporary, historical and pre-historical, mainly for the purpose of infra-specific taxonomy. A wide range of statistical tools have been used, from the simple visual comparison of trait frequencies and mean values to sophisticated multivariate methods. While the number of parameters used increased and the methodologies, both biological and statistical, improved, the basic purpose remained virtually unchanged, i.e., population comparison for infra-specific taxonomy, until it was observed that strange results were being obtained. For instance, the number of taxa varied from a few to a few hundred depending on the traits and techniques chosen and the researcher's subjective assessment. It was then realised that there was something wrong in the basic objective of classification below the species level in a species as mobile, environmentally labile and generalised as the Homo sapien. At this juncture, confronted with this state of conceptual wilderness, 'human biology' representing 'a certain attitude of mind towards the most interesting and important of animals'[1] began to replace 'physical anthropology':

> 'Human biology portrays mankind on the canvas that serves also for other living things. It is about men rather than man: about their origin, evolution, and geographical deployment: about the growth of human populations and their structure in space and time: about human development and all that it entails of change of size and shape.'[1]

Obviously human biology is more analytical than descriptive; it emphasises explanation in addition to accuracy of observation: and it encompasses the whole gamut of the human phenomenon, its biology and culture, the most distinctively human trait of communication and non-genetic system of transmitting accumulated knowledge, in short, its strategies for survival in often hostile environments.

Thus human biology may be viewed as a conceptually broadened and methodologically improved successor to physical anthropology. The link between the two disciplines should not however be forgotten; the forefathers of physical anthropology did indeed try to explain population differences in biological traits in terms of what we now call environmental adaptation.

The purpose of this presentation is to show the transformation of physical an-

thropology into human biology in India from the pre-1947 through immediate post-1947 to the present period, indicating the gradual realisation of the scholars of the need for conceptual and methodological sophistication as well as social relevance in their studies. Specifically, (a) the salient characteristics of each period will be described with a few examples; (b) the thrust areas of several projects oriented towards the new realisation undertaken by the Indian Statistical Institute will be described and their interim results summarised, along with a few other relevant ones conducted outside the ISI and/or by non-anthropologists, under broad, socially relevant thematic headings; (c) certain new future lines of research will be suggested keeping in view the major problems of the Indian society. The emphasis will be placed on detecting — and even proposing — broad, general trends of change.

Physical anthropology in India in the pre-1947 period

Physical anthropology may be taken to have started in India at the turn of the century with the publication of Risley's **Peoples of India,**[2] although sporadic studies were made on fossil materials, anthropometry, etc. even earlier[3]. Risley (1915) attempted a racial classification of the Indian people on the basis of anthropometric data collected on a large number of populations. Risley's[2] effort followed the then global trend of classifying the human population into neat pigeon holes of races, subraces, and so on, and was followed by others until recently[4—10], but each of these authors ended up with a different classificatory scheme (Table 1). Following the inconsistencies in the classificatory schemes obtained by different scholars, and following perhaps the trends in the West, two developments occured in the 1930s and 1940s: first, it was realised that the methods of population classification should be made more rigorous, which eventually led to the formulation of the now-famous D^2 statistic[11],and second, it was felt that biological traits other than or in addition to morphological ones should be used, which led to the use of ABO blood groups and eventually other traits, e.g. dermatoglyphics, PTC taste-sensitivity, et.[12—14]. The overwhelming emphasis remained on racial classification and the general trend imitative of the West. Among the few exceptions to this general pattern may be mentioned a study on socioeconomic conditions and body size by Datta[15] which by current terminology may be classed under adaptational studies, a study on the relationship between caste hierarchy, which is typically an Indian phenomenon, and body size[16] and perhaps a few others, but all these constitute an infinitesimally small part of the studies conducted during this period.

Physical anthropology in India in the immediate post-1947 period

1947 has been chosen as the cut-off point considering that a great sociopolitical event, viz., 'political independence' (albeit bifurcation), occurred in that year with all its social, economic, demographic, etc. consequences, which could bring a turning point in the course of anthropological research in the country. For instance, the large scale population movements across the borders between the newly-formed India and Pakistan under an exigent condition involved migration to similar and different physical and sociocultural environments by similar and different ethnic groups, thereby altering population composition generating pressures on food and other resources, leading to social conflicts, and so on. Attempts to quantify all these phenomena and detect their effects on population health and well-being, at macro- and micro-levels, could be rewarding both in academic and practical terms. Unfortunately, no such attempts seem to have been made. A lot of data were generated on morphology, blood groups and other polymorphisms, dermatoglyphics, and so on, but they were treated essentially from the viewpoint of population comparison with a hangover of racial classification.

TABLE I

RACIAL CLASSIFICATION OF THE PEOPLES OF INDIA

Classification by:						
Risley[2]	Giuffrida-Ruggeri[4]	Haddon[5]	Eickstedt[6]	Guha[7]	Sarkar[28]	Malhotra[16]
Turko Iranian	Negritos	Himalayan Indo-Aryan Mongoloid	Weddid group	Negrito	Australoid	Negritos
Indo Aryan	Pre-Dravidian or Australoid Veddaic	Northern Plains or Hindusthan region	Gondid Malid	Proto-Australoid	Indo Aryan	Nishadas or Australoids
Seytho Dravidian	Dravidians	Deccan region	Melanid	Mongoloid	Irano Scythian	Mongoloids
Aryo Dravidian	Tall dolicho-cephalic elements	Negrito	South Melanid	Paleo-Mongoloid	Mundari Speaking	Europoids or Caucasioids
Mongolo Dravidian Mongoloid	Dolichocephalic Aryans	Pre-Dravidian	Kolid	Long-headed	Malayo Polynesian	
Dravidian	Brachycephalic Leucoderms	Dravidian Southern Brachycephals	Indid	Broad-headed	Mongoloid	
		Western Brachycephals	Gracile Indid	Tibeto Mongoloid		
			North Indid	Mediterranean		
			Palaeo Mongoloid	Palaeo-Mediterranean		
				Mediterranean		
				Oriental Western Brachycephals		
				Alpinoid Dinaric Armenoid		
				Nordic		

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A few studies however stand in sharp contrast to this general run of anthropological studies, in methodological rigour, socially meaningful approach, or both. The U.P. anthropometric survey[17], and subsequently the Bengal anthropometric survey[18], brought considerable methodological rigour to the discipline. In addition, the latter led to an inference of considerable social impact: while the Brahmins and Namasudras (highest and lowest castes) of the same region cluster together, the Brahmins of different regions fall in different clusters, indicating that the caste system, a system of socio-economic inequality, has no biological basis/justification. Studies by Karve[19] and Karve and Malhotra[20] also led to similar indications by showing that biologically disparate groups, may, because of historical reasons, get together under a single caste-cluster. Considering that the caste hierarchy generally corresponds to the status-power hierarchy, efforts are likely to be made to preserve the former by providing it scientific legitimacy, as efforts are being made by sociobiologists in the West to provide scientific legitimacy/justification to social class differences in terms of genetic endowment[21] the above mentioned studies refuting the existence of any biological basis of social disparities using rigorous scientific methodology are important. The other methodological advance achieved during the later phase of this period was the use of demographic data — and often its utilisation for population genetical analyses[22—26] which eventually contributed to a new, explanatory, orientation in the field of demography.

While the social implications of studies indicating the non-existence of a biological basis of social disparities are rather far-fetched, Sarkar[27] in much more clear and direct terms showed the potential social role of physical anthropology/human biology in his Presidential Address to the Anthropology and Archaeology Section of the Indian Science Congress entitled 'The place of human biology in anthropology and its utility in the service of the nation'. In this presentation he cited some findings of human biology (e.g., that bottle-feeding may be bad for the baby) suggested certain lines of socially relevant investigation (e.g., on menarcheal age which needs to be known to formulate realistic marriage laws, on differential fertility which is relevant to population planning, on association between physical types and diseases which may help prognosis, etc.) called for a National Commission on Marriage to formulate marriage laws based on biological facts, and recommended adoption of a comprehensive programme of national eugenics (genetic counselling). He further, for the first time in the history of physical anthropology/human biology in India, defined the role of the discipline in concrete terms: 'The final aim of all this is to make an individual healthy in mind and body and thus build a healthy nation'. The same basic conviction about the role of the discipline recurs in his Bijoy Chandra Memorial Lecture, 1967,[28] in which he reiterated some of his earlier propositions and presented a bold view on one of the then crucial national problems by observing (a) compared to certain other countries, India was not overpopulated; (b) India was capable of being self-sufficient in food; and (c) birth control should be left to individual choice. Some of these observations have, in less than two decades, turned out to be extremely realistic.

Indeed, it is difficult to guess the motivation. Possibly some of these new approaches that were being tried by Indian physical anthropologists/human biologists were imitative of efforts of their Western counterparts to enter various socially relevant fields, e.g., demography, nutrition, health, etc. But the pointed observations of Sarkar[28] on the 'population problem' which were quite off-beat given the then dominant Western attitude, for instance, could not have been merely imitative. Perhaps they had their roots in Sarkar's personal acquaintance with the rural society and his gift of independent thinking. Perhaps a new awakening was dawning upon

physical anthropologists/human biologists in India.

Further transformation of physical anthropology into human biology in the context of the major problems of Indian peoples

The major problems affecting the human biology of Indian peoples, i. e., nutrition, health, etc., generate from (a) wide variations of physical environments (e. g., high mountains, deserts, tropical and island niches); (b) wide variations in microbial environments (e.g., pathogens, disease vectors, etc.); (c) inadequate food availability and sociocultural constraints to food intakes; (d) gross socioeconomic disparities and extreme, large scale poverty; (e) lack of transport and communication facilities; (f) unplanned/unbalanced modernisation and urbanisation; (g) disruption of ecologies and pollution (due to influx of outsiders into formerly remote areas, industrial wastes, overcrowding in urban centres, etc.); and so on. The main problem of Indian peoples as of today is rapid transformation of tradition-bound societies into modern ones. While on the one hand some populations or subgroups thereof have remained at the state of backward economy and way of life, on the other modern, Westernised groups have emerged especially in the cities (some agricultural populations have also become modernised in respect of technology), so that disparities have become accentuated between groups at various levels and a large number of populations/subgroups have been placed in a state of transition. In these populations in transition, some components of culture and the total way of life (e. g., religion, marriage patterns, etc.) have changed much less than the others (e. g., occupation, food, dress, etc.); wide gaps have occured between aspirations and achievements, norms and practices; exposure to the outside world has increased suddenly and remarkably; and so on; resulting in disruption of the social equilibrium and generating numerous new problems, social as well as biological.

Confronted with these new problems, as well as perhaps noticing the efforts of professionals from other disciplines of science and technology, the physical anthropologists in India realised the futility of their traditional approach of infraspecific taxonomy and the need for addressing themselves to more down-to-earth problems.

One of the essential features of this new realisation is to comprehend the limits to human adaptation, defined in terms of physical/physiological fitness, well-being and survival at the cellular, tissue, whole body[29] and social aggregate levels, in relation to environmental stresses and genetic make-ups, and to utilise this comprehension to promote the chances of 'complete physical, mental and social well-being',[30] in short health, of the human kind in different situations.

Some examples of the new approach that followed this new realisation are given here, mostly from our own studies on some populations having contrasting environments and ethnic background inhabiting different parts of West Bengal and neighbouring regions in Sikkim and Nepal.

The human adaptability programme of the Indian statistical Institute

The Programme was initiated in early 1976 following in broad outlines recommendations of the Human Adaptability Panel, IBP[31] and Man and the Biosphere Programme, UNESCO.[32] The objectives of the Programe are (a) to evaluate the nutritional and health status of different populations, and identify and measure the roles of physical environmental, biological and sociocultural stresses and/or genetic compositions in determining them; (b) to detect the effects of human health and activity patterns of the environment; and (c) eventually to determine the limits to human adaptation. The adaptive limits are defined as follows: (a) lower limit — the magnitude(s) of stress(es) beyond which survival is not possible; and (b) upper limit — the magnitude(s) of withdrawal of stress(es) and inputs of favourable stimulus(i) beyond

which the chances of survival and well-being does not improve.

Five Projects currently being run under the Human Adaptability Programme and their thrust areas are noted below.

Project 1. Determinants and consequences of human health and activity patterns in the mountain ecosystem: (a) Is high altitude a specialised environment in the human case? (b) What are the relative effects of various physical environmental, biological and sociocultural traits on health? (c) What are the effects of human activity patterns, large scale population influx, deforestation and other forms of environmental destruction, etc., on the environment?

Project 2. Sociocultural characteristics and community health status of the Lepchas of Darjeeling district, West Bengal: (a) Can small scale sociocultural differences make detectable health effects among neighbouring subgroups of a population? (b) Is the Lepcha population declining, if so, why and how to stop this trend? (c) Why does the large scale conversion to Christianity occur? Does such conversion, and consequent identity problem, lead to cultural and/or demographic extinction? (d) How have the growth of Kalimpong town as a business centre during late 1800s-early 1900s, decline after 1950 and emergence as a modern urban centre recently affected the human biological and sociocultural characteristics of the Lepchas inhabiting the vicinity of the town?

Project 3. Effects of micro-socioeconomic factors on health in rural populations: (a) Do micro-economic differences within a single village population lead to detectable health effects (Does economic development automatically lead to improved health status)?

Project 4. Health status and labour productivity: (a) Does the health status of a tea labourer affect his productive output? (b) Does the health-productivity relationship exist in other occupational groups? (c) How much improvement in production can be achieved by improving labourers' health in different occupational groups, practising traditional and modern (urban) industrial occupations?

Project 5. Psychological stress and health of mother and child: (a) What are the psychological stress levels of working vis-á-vis non-working, rural vis-á-vis urban women? (b) Does the difference, if any, affect their and their children's health? (c) Do the stress levels of working versus non-working women, and their health effects, differ between different economic groups?

All these projects are ongoing; further, it is not possible to enumerate here even all the interim results of these projects. Therefore, some results of these and a few 'precursor' studies by us, as well as a few others by-fellow scientists, are summarised below under broad headings to illustrate the emerging new socially relevant trends representing in a microcosm the transformation of physical anthropology into human biology in India.

Interim results of the human adaptability programme and allied studies

Impact of Altitude on Human Populations: The study essentially comprises comparison of a High Altitude Native (HAN) population with its counterpart High Altitude Native — Downward Migrant (↓) following the IBP basic design[31] modified by Baker and Dutt,[32] subgroups of HAN (↓) inhabiting similar altitudes, located spatially close and apart, and practising similar and different occupations and religion; and different ethnic groups inhabiting similar and adjacent habitats and practising similar occupations. The purpose of these comparisons were to detect the effects of altitude, micro-sociocultural factors associated with spatial distance, occupational and religious differences, and ethnicity on human biological traits. Much of our results are already published[34, 36–41] and therefore are briefly recapitulated here: (a) fertility—altitudinal

difference exists but similar differences exist between sociocultural subgroups and ethnic groups holding altitude invariant, so that the altitudinal difference cannot be ascribed to altitude-related physical environmental factors alone (Table 2); (b) mortality--while altitudinal difference does not occur differences between some sociocultural subgroups and ethnic groups do, so that altitude seems to be a factor with relatively little effect (Table 2); (c) body size of adults--body size is bigger in high than in low altitudes (Table 3) contrary to the effect expected under altitude hypoxia; (d) child growth-- it is slower in high than in low altitude Himalayan children (Figures 1a-d) but both are slower than high altitude Peruvian and Ethiopian children, and it is similar between low altitude Sherpa and Lepcha children (Figures 1e & f) so that factors other than or in addition to altitude-hypoxia and ethnicity seem to be involved; and (e) haemoglobin level--it is higher in high than in low altitude Sherpas but not as high as in high altitude Peruvians, so that once again factors other than or in addition to altitude hypoxia is involved in the Himalayan case; and so on. While multivariate analysis of our anthropometric data done recently does show that altitude has relatively greater effect than sociocultural and ethnic factors (Figure 2), altitude as defined in this study includes the latter and therefore its exclusive effects cannot be established from this multivariate analysis.

The lessons learnt from these results are clear: while high altitude does comprise some unique physical environmental stresses (e. g., hypoxia) these stresses do not seem to have any exclusive effects on health so that general health care measures and socioeconomic development may considerably help improving the health status of these populations. Further, the general problems associated with modernisation, e. g., influx of outsiders into remote areas, intrusion of new diseases, disruption of the ecology, etc. may constitute more important stresses for high altitude populations than altitude related physical environmental stresses, to which they may be adapted. Detection of these general problems and formulation of ameliorative measures may constitute the crux of the problem in both high and low altitudes.

Demographic and/or Sociocultural Extinction of Remote Populations: The Indian peoples are divided into numerous castes, tribal religious, etc., groups and subgroups in various regions and stages of socioeconomic development. Some tribal populations inhabiting the remote Andaman Islands are known to have gone extinct between 1850s and 1930s

TABLE 2

FERTILITY AND MORTALITY IN HIGH AND LOW ALTITUDE POPULATION GROUPS/SUBGROUPS

Group/ subgroups	Fertility		Mortality	
	cfr	tfr	imr	amr
HA Sherpa	4.53	5.09	7.21	13.21
LA Sherpa	7.44	6.62	6.58	17.12
Rango Sherpa	8.30	6.16	13.83	24.51
LA Sherpa (Ag)	5.60	5.04	6.08	14.92
LA Sherpa (Pl)	6.85	6.50	6.81	17.92
LA Sherpa (Fo)	7.79	7.12	6.61	17.36
Lepcha	5.65	5.45	6.62	11.59

Source: Gupta et al., 1988.[16]

TABLE 3

ADULT BODY MEASUREMENTS OF THE HA AND LA SHERPAS

Measurements	Type of diff. and level of signif.		Measurements	Type of diff. and level of signif.		Indices/ Ratios	Type of diff. and level of signif.	
	F	M		M	F		M	F
Wt.	H > L*	H > L*	Tric. skf. th. (L)	H > L	H > L	Wt./ht.	H > L*	H > L*
Ht.	H > L*	H > L*	Tric. skf. th. (R)	H > L*	H > L	Wt./ht.^{3}	H > L*	H > L*
Sit. ht.	H > L*	H > L*	Subs. skf. th. (L)	H < L	H > L	Pond. ind.	H < L*	H < L*
Biacr. bdth.	H > L*	H > L*	Subs. skf. th. (R)	H < L	H > L	Cormic ind.	H > L	H > L
Biil. bdth.	H > L*	H > L*	Hd. len.	H > L*	H > L*	Chest/ht.	H > L*	H > L*
Tot. arm len.	H < L	H < L	Hd. bdth.	H > L*	H > L	Surf. area	H > L*	H > L*
Bicond. fem. diam.	H < L*	H < L*	Nose ht.	H > L*	H > L*	Surf. ar./Wt.	H < L*	H < L*
Biceps gir.	H < L*	H > L	Nose bdth.	H < L*	H < L*	Body fat %	H > L*	H > L*
Calf gir.	H > L*	H > L*	Biz. bdth.	H < L*	H < L*	Body wt.		
Chest gir. (exh.)	H > L*	H > L*	Morph. fac. ht.	H < L*	H > L*	Log Σ skf. th.	H = L	H > L
Chest gir. (inh.)	H > L*	H > L*				Hd. ind.	H > L	H < L
						Nose ind.	H < L*	H < L*

* Significant at 5% level.

Source: Gupta and Basu, 1981.[25]

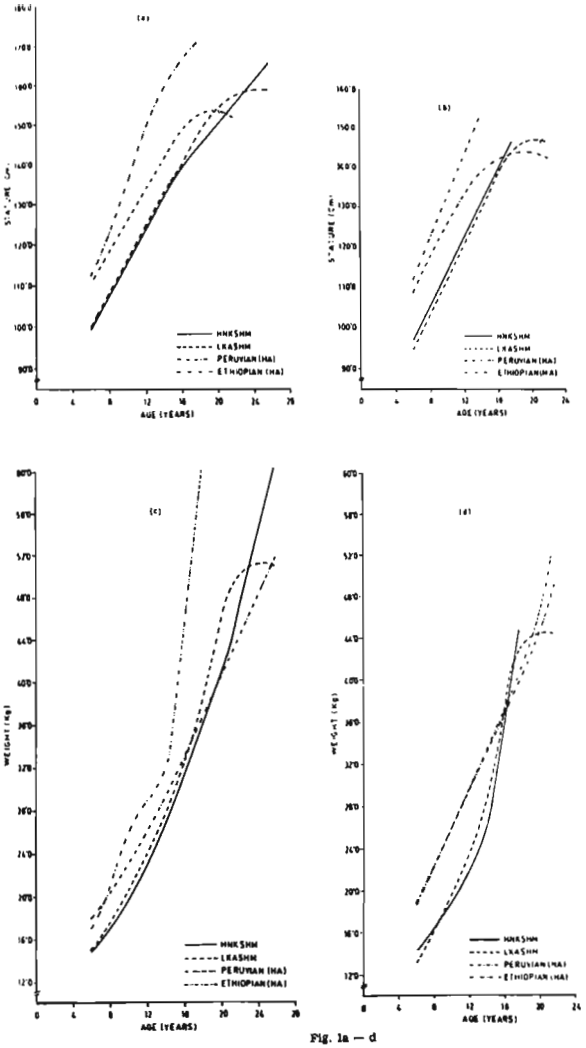
(a)
HNKSHM
LKASHM
PERUVIAN (HA)
ETHIOPIAN (HA)
AGE (YEARS)
(b)
HNKSHM
LKASHM
PERUVIAN (HA)
ETHIOPIAN (HA)
AGE (YEARS)
(c)
HNKSHM
LKASHM
PERUVIAN (HA)
ETHIOPIAN (HA)
AGE (YEARS)
(d)
HNKSHM
LKASHM
PERUVIAN (HA)
ETHIOPIAN (HA)
AGE (YEARS)

Fig. 1a — d

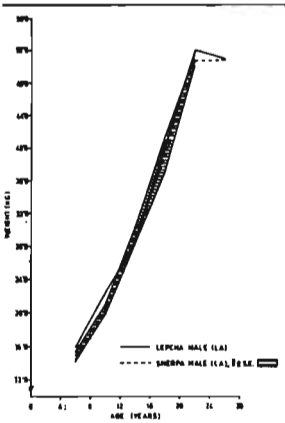

Fig. 1e

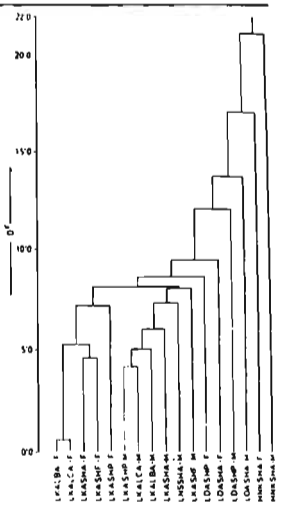

Fig 3.

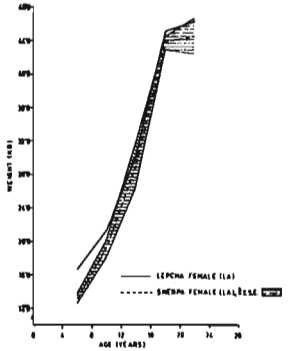

Fig. 1f

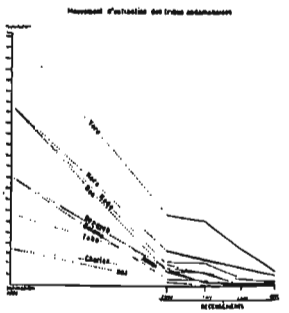

Fig. 3. Source: Cappieri, 1954[10].

(Figure 3);[42] others including some on the mainland are at the risk of extinction even now (Table 4). The magnitudes and causes of demographic decline leading to extinction are not known for most of these groups, but for one an effort was made some years ago to understand the phenomenon.

TABLE 4
THE SIZES OF 10 SMALL INDIAN TRIBES (FROM 1971 CENSUS)

Population	1971	1961
1. Arandan	5	44
2. Kochu Velan	8	47
3. Rona, Rena	12	23
4. Andamanese	24	19
5. Sentinalese*	82	50
6. Shompen*	92	71
7. Onge	112	129
8. Malakkuravan	275	248
9. Jarawa*	275	500
10. Toda	945	716

* Estimated population.
Source: Padmanabha, 1985.[39]

The Pahira is a small tribal population of 1352 individuals, as of mid-1984, inhabiting remote areas of the Dalma and Ajodhya hills in the adjoining areas of West Bengal and Bihar. Our investigations[25] show that the population is divided into three subgroups, the smallest one being of the size of 301 individuals, and that while fertility is quite high (cfs, 6 approx.) mortality is also high (amr, 33—45). Subsequent analysis[28] using a method originally devised for an insect population, modified by Roberts[43] for his study of the Tristan population and further modified under the guidance of Professor Roberts to suit the Pahira data, it was found that the intrinsic rate of natural increase in the three subgroups are lower than that of the Indian population as a whole and that in the smallest one negative (Table 5). This suggests that this population, which is already an infinitesimally small part of the Indian population and is at the risk of extinction due to natural catastrophes which are common in the region and is 'denotified' as a separate entity and likely to be pushed to more backward regions with intrusion of relatively modernised populations into their habitat, is already declining in terms of relative (to the Indian population in general) growth rate with one subgroup having a negative growth rate.

TABLE 5
INTRINSIC RATE OF NATURAL INCREASE (r) FOR THE THREE PAHIRA SUBGROUPS

Subgroup	r
Northern Pahira	—0.0028
Southern Pahira I	+0.0119
Southern Pahira II	+0.0131

Source: Basu, 1971.[28]

While the Pahiras represent a relatively straightforward case of demographic decline with the possibility of aggravation of the problem due to natural catastrophes and/or intrusion of more modernised populations, other cases may be more complex and include a sociocultural component of extinction, i. e., absorption into wider societies.

The population of Mirpur was founded by twelve Portuguese gunmen who came to this area in southern West Bengal in mid late 1700s, married local women and settled down. Initially the population must have remained relatively unmixed because they were hired strongmen of the local feudal landlord as well as because of their atypical origin and absence of Christian populations in the immediate neighbourhood. Even now most of the family names are typically Portuguese, e. g., Tesra, Lobo, Pereira, Nunis, etc. and marriages mostly endogamous. The population reduced to one half between 1891 and 1911 (Table 6), presumably due to some natural catastrophe. The fertility presently is not low and infant mortality about the same as in West Bengal in general (10% approx.), but nutritional level is low, and intestinal parasitic infestation is heavy and the chance of epidemics, droughts, etc. cannot be ruled out, so that the risk of de-

TABLE 6

POPULATION SIZE FLUCTUATION IN MIRPUR

Year	Population
1891	232
1911	129
1921	174
1931	182
1976	320

Source: Basu et al., 1980.[28]

mographic extinction persists. In addition however two phenomena threaten the population's sociocultural survival: (a) improving transport and communication facilitate increasing marital ties with Christian populations across the river covering wider areas, and (b) the relatively new port-cum-industrial town of Haldia has already acquired the Mirpur area under its municipal limits in the immediate future; both of these phenomena may lead to absorption of this tiny atypical population into the wider, dominent communities and loss of their ethnic identity. A more striking case occurs about 35 km down the coast from Mirpur in Khejuri which in the 1600s was a prosperous business town frequented by the Portuguese. The mixed Portuguese--Bengali population there already disown their atypical ethnic identity and claim to be Muslims for fear of reprisal by the neighbouring populations who were ill--treated by their forefathers. A parallel case in the urban area is that of the Anglo-Indians of Calcutta who, with loosening of inter-group marriage restrictions and depletion of their numbers through emigration, are getting absorbed in the wider community and losing ethnic identity.

The examples cited above suggest several important points: (a) a major task of human biologists in India is to enlist population groups/subgroups at the risk of demographic extinction, measure their basic demographic variables and rates of growth/decline, detect the causes thereof and suggest possible ways of saving them; (b) sociocultural extinction due to large scale conversion, absorption into the wider community, etc. and the consequent loss of group identity, may be as detrimental to a population as demographic extinction; and (c) improved transport and communication system, the consequent influx of culturally advanced populations into newly opened-up areas, broadened world view and increased aspirations, etc. which inevitably follow the phenomenon of modernisation may lead to demographic and/or sociocultural extinction.

Food Practices in Contrasting Populations:

Three types of findings are presented here from our recent studies on the indigenously high altitude Sherpas presently inhabiting the middle altitude Kalimpong area, indigenously middle altitude Lepchas inhabiting the same area, the imigrant Oraon tea labourers from Bihar presently inhabiting the foothills in the Birpara area and the indigenous Mahishyas of Chakpota village in deltaic West Bengal.

First, the Chakpota population is divided into three economic subgroups, low, medium and high, using the conventional 'poverty line' of US $ 60.00 and the locally defined 'sufficiency line' of US $ 120.00 per capita per year as cut-off points. The degree of self-sufficiency of food supply is assessed in terms of the number of months in a year for which the staple food for a given household is produced by the household itself. Our data show that households having 0—5 months' self-sufficiency have the lowest calorie and protein intakes, highest total fertility rate and also highest infant mortality rate, as one would intuitively expect. The salient problem here may be formulated in the following manner: as calorie-protein intakes decrease, fertility increases but mortality increases much more, from 12+ months to 0—5 months self-sufficiency category; thus if rural populations are getting increasingly pauperised in general, the 0—5 months category will get increasingly malnourished to the point of starvation and tend towards demographic extinction

and/or destitution in course of time when coping strategies like undereating, selling off land, borrowing, using child labour, etc. will be exhausted. The problem will be most acute in case of the low economic subgroup in which the 0–5 months categories already constitutes about 90% of the total number of households[44].

Second, in all the four ethnic groups except the Sherpas significant differences exist within/among subgroups with respect to intakes of major nutrients, e. g. calorie, animal protein, vegetable protein and fat. The intakes are so characteristic in the case of most subgroups and the differences so clear that a high percentage of the households can be correctly classified into the subgroup to which they actually belong by looking at their nutrient intakes only (Table 7 illustrates the point very clearly for the Mahishyas). The implication of this finding is that any nutritional supplementation programme to be most cost-effective will have to take into account variations within small population aggregates, e. g., village, community, etc. and distribute supplementation differentially according to the differential supplementation needs of these subgroups.

TABLE 7

CLASSIFICATION RESULTS: ACTUAL AND PREDICTED ECONOMIC SUBGROUP MEMBERSHIPS

Actual subgroup	No. of households	Predicted subgroup membership		
		1	2	3
1. Low econ. subgr.)	74	173 (77.9)	49 (22.1)	0 (0.0)
2. (Med. econ. subgr.)	104	84 (26.9)	193 (61.9)	35 (11.2)
3. High econ. subgr.)	63	3 (1.6)	38 (20.1)	148 (78.3)

Note: Figures in parentheses indicate percentages.

Source: Majumder, et al., 1985.[45]

Third, in all the four groups intake differences among individuals within a household were studied, using data on calorie intake estimated from one-day semi-quantitative diet surveys, and standard conversion tables prepared by the Indian Council of Medical Research[45]. Obtained data shows the ranking of individuals within the household in terms of the intake variable defined for this study, i.e., 'Actual-Recommended' intake, where 'actual' intakes as described above and age and sex-specific Recommended Dietary Allowances were presented by Basu et al. (1986) and are briefly recapitulated here[46]. Our results show that in the middle and low economic subgroups of the Mahishyas there is no inequity of food distribution among members within a household, i. e., every member received calories equal or proportional to his/her age-sex specific RDA; the F-values were non-significant. In the other groups/subgroups however the intrahousehold calorie distribution was inequitable, i. e., the F-values were significant (except Lepcha Urban Christian). Regarding the nature of inequity, in all Lepcha subgroups (i. e., Lepcha Urban Buddhist, Lepcha Urban Christian, Lepcha Rural Buddhist, Lepcha Rural Christian) females occupy three of the higher four (and males three of the lower four) intake ranks irrespective of urban/rural habitat indicating a consistent female bias; in the Sherpa subgroups (Agricultural and Plantation Labourers) both husband and wife occupy positions among the four lower ranks indicating that perhaps both of them sacrifice in favour of other members of the household; in the Oraons males and females are evenly distributed in the four higher and lower ranks indicating no sex bias; and only in Mahishya high economic subgroup a male bias with three of the higher four ranks being occupied by males, the highest one by the household head as expected according to the traditional Hindu social norm[47]. Several recent studies have shown micro-level differences, generally a bias against females operating in the Indian subcontinent[48–54]. The study by Sen and Sengupt-

ta[44] conducted in two villages of West Bengal provides 'firm evidence of (1) remarkably high incidence of undernourishment, even of the 'severe' and 'disastrous' types, and (2) systematic sex bias reflected in higher deprivation of girls vis-a-vis boys'. The study goes on to add that 'the village with better overall nutritional record has much sharper sex discrimination'. The implications of our findings are threefold: (a) there is a general trend of deficient calorie intake, i e., the variable 'Actual-RDA', generally has a negative sign in most subgroups and categories of individuals within each; (b) the bias in favour of males, particularly the male household head, does not seem to operate in case of tribal populations; and (c) improvement of the economic condition may not automatically lead to more equitable distribution within the household, but in fact may result in greater discrimination. [Our first and third findings are also corroborated by Sen and Sengupta's[54] study]. Generalising from these results it follows that in applied nutrition programmes efforts should be made not only to provide calorie and other nutrient supplementations to constrained populations, but also to make intra-household distribution of foods equitable especially in populations under the Hindu fold.

Effects of Physical Environmental, Sociocultural and Ethnic factors on Clinical Traits:

Our findings on three types of clinical traits are briefly presented here. First, the results of our data on intestinal parasitic infestations reported in details by Bhattacharya et al.[40] and Bhattacharya et al.[56], show that while significant differences between sub-Himalayan and deltaic zones exist, significant differences also exist within the sub-Himalayan zone between different sections of the same population (but not different ethnic groups inhabiting adjoining villages) and among economic subgroups of the same population inhabiting the same village. This finding indicates that while no exclusive effects of physical environmental factors independent of concomitant sociocultural ones can be established, effects of sociocultural (though not ethnic) factors independent of physical environmental ones is demonstrated.

Second, our data on ophthalmological traits of Sherpas, Lepchas and 'mixed Nepalis' show no significant difference among these groups, indicating also lack of ethnic effects[57]. On the other hand, the data show 'that myopia endemicity found in many populations does not seem to occur in the Kalimpong populations studied', indicating absence of urbanisation effects in these populations living around an urban centre, as myopia is generally regarded to be related to urbanisation.

Third, our data on blood pressures[58] however show that the age-related changes of blood pressures are much steeper in the relatively more urbanised Kalimpong Sherpas than in the remote Upper Khumbu Sherpas, indicating the possible occurence of the commonly believed role of urbanisation in increasing blood pressures (Figure 4).

The lesson learnt from the three abovementioned examples is simple but important: effects of physical environmental, sociocultural and ethnic factors on human biological traits are not straightforward but are group/subgroup as well as trait-specific, so that a large number of traits should be studied in a large number of populations groups and subgroups in relation to a battery of possible factors before any generalisations can be made about causal relationships.

Role of human biology in a third world society

It is not the purpose of this paper to exhaustively review the entire human biological literature on Indian populations. Some examples have been cited to illustrate the changeover from physical anthropology to human biology citing examples mostly from our own studies--which we know best. Further, efforts will be made below to define the role of human biology in a Third World so-

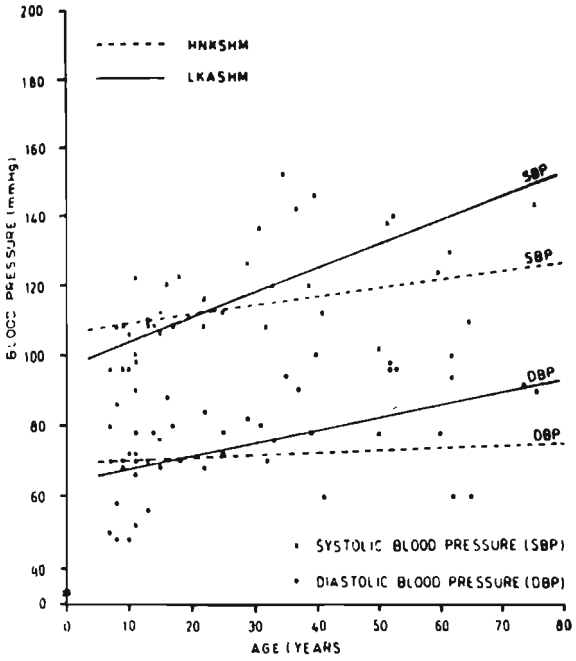

Fig. 4

ciety like India with all its physical, biological, sociocultural and genetic complexities.

As the basic guideline we follow Sarkar's[27] broad, comprehensive definition: 'The final aim of all this (human biological research) is to make an individual healthy in mind and body and thus build a healthy nation'. We define 'health' as complete physical, mental and social well-being[30] and 'well-being' in terms of the degree of harmonious relation with physical and sociocultural environments and the feeling of satisfaction derived out of the same.

But how do we specifically define the role of human biology in promoting population health of Indian populations? The question is an immensely complicated one and no definitive answer can readily be offered, but a possible approach is tentatively suggested below.

First, the people of India live under a wide economic disparity, large scale diff- e. g., deserts, high mountains, tropical zones and sociocultural situations, e. g.,

rigid social segmentation and hierarchy, wide economic disparity, large scale differences in ways of life, and possess varied genetic endowments. Groups should be selected judiciously to represent the myriad of populations for studying their health characteristics as well as physical and sociocultural environmental traits. The assessment of health should be made not only on the basis of presence/absence of diseases but also on such indicators as mortality, child growth, haemoglobin level (not only anaemia), working capacity, etc. The effects of individual environmental factors, their **relative effects** and **interaction effects** on individual health traits as well as a **composite index of health** should be detected and measured. The relative effects of physical environmental vis-á-vis sociocultural factor-complexes should be carefully investigated, using a suitable experimental design, in order to ascertain if adverse effects of the former could not be buffered by suitably manipulating the latter.

Second, in addition to evaluating the effects of various environmental factors on health, it is extremely important to assess the effects of the various kinds of changes of both physical and sociocultural environments on population health for the following reason: large scale changes are occuring in India involving rapid growth and massive influx of populations, urbanisation, industrialisation, environmental destruction, pollution and ecological disruption, breakdown of traditional social norms and values and lack of formulation of new ones, and so on, and understanding the adaptive strategies and limit of individual populations exposed to these situations may help formulating general and population-specific schemes for promoting survival potentials of diverse Indian populations. Some examples of the kind of questions that may be looked into and findings that may be relevant are cited earlier while describing our ongoing projects and interim results, only to indicate the type of researches that should help formulating the schemes mentioned above. No comprehensive review of the researches already done along these lines and the lessons learnt thereof can be given, because hardly any such researches have been done so far in India. As the nature of transformation may be very similar in most Third World countries, at least in its crucial character as represented by a state of flux without a well defined direction, the schemes may have applicability to wider regions than the Indian subcontinent.

But what is the special role of human biology in comprehending and directing this transformation? The most important and special role of human biology, following from the tradition of its precursor discipline, physical anthropology, is to consider at the micro-level, and on the basic of detailed, intensive and first hand information collection, a multitude of human biological traits (not merely disease traits) and the totality of their environmental and genetic backgrounds, in order to detect and measure the intricacies of their interrelations and interactions. This role we presume is most advantageous in view of the immense variability of the human physiological functioning and social behaviour in predicting the course of biological, social and biosocial changes in Third World societies and directing the course, if even to a limited extent, in a meaningful direction.

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