

Biomedical Anthropology in the Service of Mankind in the New Millennium: Are We Ready?

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INTRODUCTION

Recent advancement strides in biotechnology and uses of recombinant DNA technology have revolutionised the applications of molecular genetics for human welfare in terms of population specific gene expression, disease susceptibility, evolution of abnormal genes, migration, spread and admixture of abnormal genes, human ageing, etc. so that the whole emphasis has now tilted towards knowing the mechanisms of gene expression at cellular, developmental and environmental levels.

The central theme of explorations in molecular medicine of human genome is to predict the human fate right from the conception itself. Earlier, the powerful kings or rulers used to have astrological predictions for their future course of action. Now, molecular geneticists are trying to know the predisposition or prediction of DNA molecule so that one can predetermine what is going to happen with a person who is having this or that sort of DNA. Attempt is being made to tamper with human DNA and insertion of primate or human DNA to produce babies with specific qualities. This idea would lead to speeding up cure for dreaded and disabling diseases like breast cancer, Alzheimer's disease, diabetes, etc. including the AIDS. Once, you know about the prediction part of DNA, then the exploitation of the same would be required for desired purpose - beneficial or harmful apprehensions. And, in this way, we can have a baby of choice and the story of human explorations goes on indefinitely.

When we know, how to decipher the human genome and what are the inborn errors (diseases) in the human genome, it has been considered the first and foremost target, how to correct them for normalising the individual or at least the subsequent progeny. This is again an uphill task for human molecular geneticists to tackle the human destiny.

Anthropology is a science which deals with the study of human beings. It tries to understand the socio-cultural and biological aspects of humans in a comprehensive perspective. Strictly speaking in this subject we study about ourselves.

Anthropology is neither dead nor dying as pointed out by earlier scholars (Basu and Biswas, 1980; Danda, 1981; Reddy et al., 1993; Rao, 1998), but is progressively growing and developing with its central theme of study of human origin, evolution, migration and spread, and finding the causes of human variations in space and time. The sluggish or worthless anthropologists who entered the discipline accidentally are, unfortunately, trying to strangle it due to their non-contributive efforts in the discipline !

BIOMEDICAL ANTHROPOLOGY

Biomedical anthropology is a newly emerging discipline which synchronizes the theoretical and methodological concepts of physical anthropology and medical anthropology in the study of human diseases and promotion of health of human populations (Balgir, 1996, 1999). This includes the integral approaches of physical anthropologist with interests in human biology, human genetics, molecular medicine, human growth, development and nutrition, and human being as physical entity, and of a medical anthropologist whose interests are in the areas of health behaviour, medical care (intervention) systems, health planning, psychosomatic illness including mental health, and correlation of demographic variables (Fig. 1). The contention is that a biomedical anthropological approach suits the best when it emphasizes the biological basis of health and disease, while at the same time actively incorporating and understanding the socio-cultural and economical constellations involved in the nature of sickness process in the society.

Biomedical anthropologist should move into the design and provision of health services for intervention in improving the health status of certain at risk population groups, extending their life expectancies, lowering morbidity, mortality, arson, sexually transmitted diseases, excessive drinking, and the other similar public health issues. The entry of such unique expertise is not only welcomed in India, but is imperative also. Thus, the strength of anthro-

pology lies in its analytical potentials, constructive suggestions and practical applications in the society. A biomedical anthropologist has the responsibility to identify himself with the cause and pursue his role and goal with commitment and dedication wherever he is entrusted (Balgir, 1996).

In biomedical anthropology, we use anthropometric measurements, dermatoglyphic traits and, serological and biochemical markers not only in personal identification in forensic science, but also for clinical purposes in prenatal diagnosis of genetic anomalies, genetic counselling, paternity disputes, sports and industry,

physiological experiments, etc. Thus, biomedical anthropology has multifacet applications in diverse fields of science.

In the Indian context, we have to reorganise our priorities for health research and medical care, in the light of technological developments and human welfare, considering the rich and unique human genetic diversity in India, otherwise, our own rich heritage could be stolen and grabbed by the more powerful and technologically much advanced countries in the world. In this context, what is our role as biomedical anthropologists in India ? Whether we would like to loose this opportunity for our self-

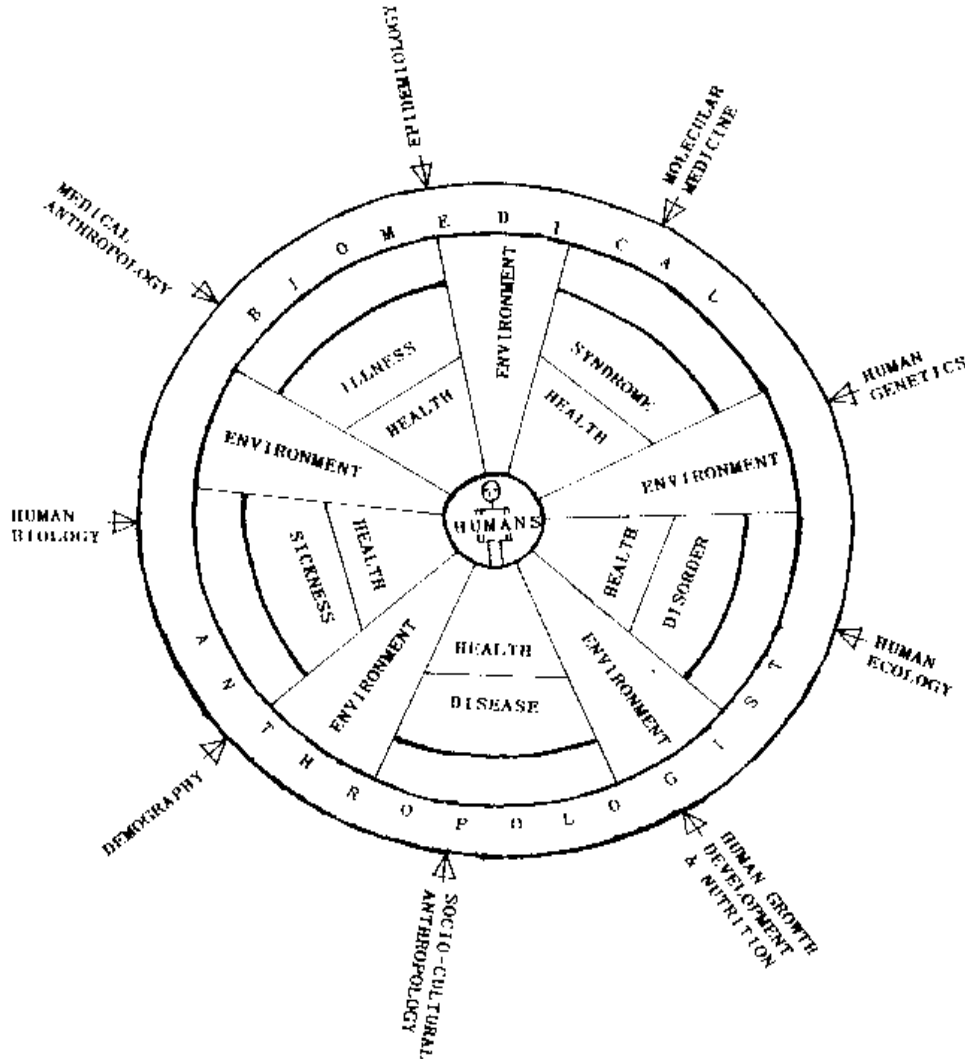


Fig. 1. Status and role of a Biomedical Anthropologist

centred biases towards each other as an expertise in biological or social sciences ? I think, our future is in our hands ! There is an urgent need to combine our efforts to generate a database of genomic diversity of the people in this country.

I think, the study of genetics of various human traits is still a virgin area in anthropology. Deciphering and mapping of genes along with identification of various characters in human genome is a vast unexplored reservoir, with particular reference to Indian lineage.

It is a well known fact that the quality of human life is dependent on the genetic endowment of individuals, inherited from the parents and the interaction between genetic attributes and environmental constraints including various social, cultural, physical and biological factors, which undoubtedly form an integral component of the heritage. Delineation of health hazards due to genetic and genico-environmental interactions is the major task which needs to be undertaken on priority basis. There is a paucity of systematic investigations carried out in India to assess the nature and magnitude of the prevalence of genetic disorders and their management strategies in India.

MOLECULAR EXPLORATIONS

Each human cell contains hundreds of mitochondria and thousands of mitochondrial DNA (mtDNA). The genetics and mtDNA variations are important and unique aspects on various counts. Unlike nuclear DNA (nDNA), mtDNAs are disbursed in cytoplasm, present in thousands of copies per cell and transmitted exclusively through the mother. The mutation rate of mtDNA is 10 to 20 times higher than the nuclear DNA. The significance of each mtDNA mutation to human variability and disease depends on where in the human genome and when in the life cycle, the mutation occurs. Germline mtDNA mutations can be either neutral or deleterious. The deleterious mutations are eliminated by natural selection. Since neutral mutations have accumulated along human female lineage for tens of thousands of years and the mtDNA is uniparently inherited and rarely mixed or recombined. Thus, the differences in number of mtDNA sequence that separate two individuals are directly proportional to the time since they shared a common maternal ances-

tor. Finally, the somatic mutations accumulate in the mtDNAs of post mitotic tissues as we age and, thus, may be important factors in the organ senescence associated with ageing (Wallace, 1995). It may be stressed here that an understanding of the microevolution of the present day human populations at global or atleast continental level can give us clues to the understanding of human macro-evolution. Similarly, the mtDNA variations at global level are also useful in elucidating the role of mtDNA mutation in different disease conditions.

Infact, studies have already come up in this direction regarding the human origin from Africa, Australia or China and the migrational pattern in due course of human history. DNA extracted from the bones of people who lived 4,000 to 5,000 years ago in North-West China have led to the conclusion that Mongolians and Caucasians had lived together long back. Based on the analysis of oldest DNA recovered from human remains, i.e. genetic material from a 60,000 year old skeleton found near Lake Mungo in the Eastern Australian state of New South Wales, it has been claimed that Australia not the Africa was once home to a group of aboriginal people whose genetic line has vanished from the planet. Most primitive forms of DNA known in living humans had been found in Sub-Saharan Africa, leading to the theory that mankind perhaps originated in Africa. The groundbreaking theory that *Homo sapiens* originated in Africa before slowly spreading across the world has now been powerfully backed by new research into variations in the male sex chromosome. It holds that all living people are descended from a group of *Homo sapiens* that left Africa around 100,000 to 150,000 years ago. These studies, although still inconclusive, but certainly a step forward towards knowing human diversity.

On priority basis, there is an urgent need to collect blood or other tissue samples from the most primitive isolated groups in India, representing various biological or racial types to create a DNA bank or cell lines for those populations which are under threat of extinction. Similarly, DNA banks also need to be generated to conserve the oldest human skeletal remains, fossil materials or living primitive people for their molecular analysis if possible now, otherwise, in future without losing them before it would be too late.

We are surprised by the creation of "Dolly" by Wilmut and his team, performing a unique

experiment in the world, we expect too that such experiments eventually be translated into human beings (through genetic engineering) and the failure rate will be reduced by better understanding of mechanisms operating or controlling the technique. There could be many examples available in some communities in India, when we talk of polygamous society, i.e. both polyandrous or polygynous society. "Dev Dasies" was a common practice in various parts of India. How genetic traits are transmitted, when only one husband impregnate many wives and vice versa. This is again a very interesting aspect of human genetic studies along with some ethical issues. Incest breeding, common in some populations, is another aspect of genetic studies in India. How incest breeding leads to excessive congenital malformations, other genetic anomalies and even elimination of some characters in a community, data in this regard are meagre to draw valid conclusions. Sexual exploitation of women by so called religious swamijis or gods is not uncommon even today in India. Only we have to keep a track of such events in the society; and study them thoroughly for human genetic interests which is a unique opportunity or goldmine in India. We have also heard of sororate mothers in the western world, which is now a reality in India also. Social, ethical, biological and genetic implications of all these aspects are not only the concern of psychologists, but equally of a biomedical anthropologist also. Behavioural genetics is an other open field for a biomedical anthropologist in India.

HABITS, HABITATS AND DISEASES

Under a given environmental set, we are accustomed to a particular type of diet and food intake which is locally available. Our body develops accordingly to combat the local conditions of living and survival so much so that our body has almost biologically adapted to local climatic, dietary habits and biological needs. Any sudden change (modern life style for fashion sake only) in our biological behaviour, physiology, dietary habits and human ecology has apparent ill effects. A biomedical anthropologist being interested in the origin, cause and spread of emerging health problems is the most appropriate expertise who can deliver goods and delineate these factors on more logistical grounds.

With the migration to alien country, state or

district or rural/urban mobility due to occupational patterns, etc. we have invited so many diseases of which we never became victim in our previous rural dwelling. This biological adaptability under varied climatic and occupational patterns have drastically changed our life style as a whole and, consequently, human behaviour. Industrial toxicology, radiation pollution and mining operations, etc. have added to the miseries of human life leading to chromosomal aberrations, congenital malformations and so many other unknown effects. Certain diseases have accumulated at one place, leading to a kind of epidemic, which is a concern for human health planners and medical geneticists or biomedical anthropologists. The role of a biomedical anthropologist under such situation is called for in India.

Distribution and spread of various genetic diseases in the world through migrations, admixture and genetic drift, and explaining their concentration in particular geographical and ecological niches is still a challenging task for a biomedical anthropologist in India.

IMPACT OF FLORA AND FAUNA

One of the major gift of nature to man is plants. Man has a symbiotic relationship with plants eversince the life itself came into existence. It is a pity that we are running away from this nature's gift. We are destroying plants, doing ecological imbalance and loosing natural flora and fauna which once had been at our advantage. Now, we have started experiencing adverse effects of climatic changes (including of pollution) and man-made calamity of deforestation. There is a need of sustainable development with sustainable flora and fauna, especially in India, where human population explosion has already done considerable harm to human quality of life.

We are forgetting our heritage of ethno-botanical wealth. We are loosing grounds for folk medicines. In fact, this is a vast potential area of health research and human development for the welfare of humanity and a biomedical anthropologist is the most suitable expertise to develop this field as the most powerful subject matter of study for natural resources development and exploitations.

There is a extensive scope of study of those plants which can be used as pollution monitors, such as *Alstonia macrophyll*, *Dalbergia sissoo*, or *Bougainvillaea*. Places like Delhi, Kolkata

and Mumbai, where most of our obese persons count their days may be benefitted by the use of *Garcinia cambogia* Desr for hydroxy citric acid which is a unique potent metabolic regulator of obesity and commonly used in South India as condiment. Utility of such plant products is worth exploring in India, not only by the botanists alone but also by the anthropologist as a folk medicine-man. Tribal folks are using these natural flora and fauna from the time immemorial for the cure of common human ailments.

For proper human growth and development, the nutrition is utmost necessary component. From health point of view, hygienic and toxin free diet is equally important since infancy onward. Some essential proteins and trace elements are part and parcel of our daily life and their deficiencies cause various kinds of abnormalities, which become health hazards later on. For example, it has been highlighted that a common food nutrient, choline, has been shown to cause permanent brain changes in regions responsible for learning and memory. It has important implications, especially for pregnant women and their children, if choline proves to have the memory enhancing effect in humans.

Choline is a naturally occurring amino acid found in egg yolks, milk, nuts, liver and other meats as well as in human breast milk. It is the essential building block for a memory-forming brain chemical called acetylcholine, and it plays a vital role in the formation of cell membranes throughout the body. Specifically, the research has shown that choline enhances a brain function called long-term potentiation (LTP), in which the act of receiving an electrical stimulus or message actually paves a pathway allowing future messages to reach the nerve cell more easily — similar to the way that rain water creates a furrow through soil upon repeated downpours, enabling even a small trickle to find its way more easily. Choline could potentially be used to ensure normal memory function in the population at large through a modest change in diet. The ramification is that manipulating one single nutrient for a few days during gestation has a lifelong effect on brain function. Thus, we can develop ways to significantly reduce age related memory deficits and other micronutrient deficiencies which are very common in India especially among the vulnerable groups like the pregnant women, children and tribal people.

HUMAN DEVELOPMENT STUDIES

A growing body of evidence suggests that our health in later life is not simply a matter of genes and lifestyle, but is also intimately linked to what happened to us in our mother's womb. Numerous studies around the world confirm that the first nine months of our intra-uterine lives may be the most important period. Retarded growth in the womb is strongly linked with an increased risk of various killer diseases, including heart disease, diabetes and stroke. Those men who were thin at birth with small placentas had high death rates of coronary heart disease.

Babies deprived of nutrients in the last months of pregnancy, for instance, tend to have larger heads and shorter bodies with smaller abdomens, and are more at risk of heart disease. Those experiencing a shortage earlier in their fetal life, on the other hand, are often proportionally smaller with larger placentas, and are more prone to strokes; those affected during the middle months are commonly thin at birth and likely to suffer from diabetes. High blood pressure is associated with retarded growth at any stage of pregnancy. What is clear is that the babies who grow least in the uterus are, subsequently, at risk of these diseases in later life.

Why and what actually happens? When resources are in short supply, the fetus adapts by protecting the essentials, such as the brain or the growth of the placenta, at the expense of other parts of the body. This can reduce the number of cells or produce other physiological alterations in various organs and body parts, i.e. changes, we may not be able to reverse them later in life. If you have a baby who is growing fairly well in the uterus until the last part of gestation, for instance, it makes a number of adaptations directed towards maintaining growth of the brain at the expense of the rest. Hence, we get the larger head in proportion to the rest of the body. It depends not so much on what mothers eat when they are pregnant, but what she has stored before pregnancy and how well the placenta is formed.

SOCIAL IMPACT

We all know how much important is social life, starting from family to any social institution. In fact, we all are bound by social obligations, norms, customs and traditions. The most

pathetic thing is that we are biased towards one sex; preference for male child, negligence of girl child, undernourishment to girls, depressed psychology of fair sex, etc. are issues which are dependent upon religious beliefs, economy and so many other factors. As apparent from the above, the health of a mother is the key factor for the health of future generations, irrespective of any social factors mentioned above. I earnestly and strongly emphasize here the predominant role of female biomedical anthropologists in India.

There is no limit for the expansion of scope of any subject. This article is a humble attempt and gives an outline as an indicator of some of the unexplored avenues and in no way complete in the sense that it has defined some boundaries which may be changed as per the demand with the change of time.

The most important aspect of development of any discipline is the openness, capability and potential for adapting according to the demand, need and requirement of the society and the contributions of elite propellers of the discipline accordingly. It is this very aspect where anthropologists have failed to come up with time and space. Jobs security is one aspect and the development of the discipline is an other one. There is a need to maintain a balance between the two aspects for the sound and healthy growth of the discipline in the contemporary society. We should be ready to accept any challenge for the sake of our dear discipline - Anthropology which is desired in space and time.

CONCLUSIONS

Biomedical anthropology is a newly emerging discipline which combines the theoretical and methodological concepts of physical anthropology and medical anthropology in the study of disease and health of human populations. This includes the integral approaches of physical anthropologist with interests in human biology, human genetics, molecular medicine, human growth and development, nutrition, and human being as physical entity, and of a medical anthropologist whose interests are in the areas of health behaviour, medical care (intervention) systems, health planning, psychosomatic illness including mental health, and correlation of demographic variables. The contention is that a biomedical anthropological approach functions the best when it emphasizes the biological ba-

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I think, the study of genetics of various human traits is still a virgin area in anthropology. Deciphering and mapping of genes along with identification of various characters in human genome is a vast unexplored reservoir, with particular reference to Indian lineage. Distribution and spread of various genetic diseases in the world through migrations, admixture and genetic drift, and explaining their concentration in particular geographical and ecological niches is still a challenging task for a biomedical anthropologist in India.

Further, current status and role of a Biomedical Anthropologist has been emphasized in the light of scope of Anthropology in India.

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KEY WORDS Biomedical Anthropology. Health. Disease. Genetics. Environment. Quality of Life.

ABSTRACT Biomedical Anthropology is one of the prominent advanced health and applied sciences in the world. Biomedical Anthropology is at the crest of development in India regardless its slow pace in space and time and lack of enthusiasm. This article differs from the traditionalism in Anthropology and highlights the dynamism and progressive adaptability to the changing world scenario in the context of advancement in newer technology. The changing human life styles have influenced tremendously the biology, values in society and quality of human life including the susceptibility to diseases in varied environment. Maternal influences, intra-uterine period and nutritional factors, all contribute positively to the out-

come of genotype. However, the social constraints are the most predominant of all the factors. All these aspects of human beings are touched here with a view to revolutionise the discipline of anthropology.

NOTE

This article is dedicated to the pious memories of my mother, Bibi Rakhi Balgir and father, Sri Gurbachan Singh Balgir.

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