# GENETICS AND MAN

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Dobzhansky (1961) has rightly remarked, "The human species, Homo sapiens, mankind, is the unique and most successful product of biological volution, so far." Man has spread and occupied almost all the continents, conquered sea, oceans and deserts, destroyed forests, changed natural ecological conditions and niches of animals and plants and has domesticated many plant and animal species. Together with man took place the evolution of culture which proved instrumental for his adaptation in different environmental conditions. Progress in culture and civilization has brought many comforts to his life but many hazards too. Man is facing now adays the problems of pollution, population explosion, food shortage, energy crisis etc.

Industrial development is a boon, but industrial wastes pollute the atmosphere, rivers and streams and are a good mutagenic agents for producing harmful mutations which either endanger man's life or cripple him for the rest of his life. You cannot dispense with industry but rather would like to find a solution to undermine these effects. Genetics has played a significant role towards the formation of new varieties of plants and animals through the recombination of different genes.

The developing countries are facing problems of food, space, population, child mortality, increasing death rates of pregnant women, the spread of fatal diseases, particularly the hereditary ones. Most of the problems, if not fully, can be solved to a certain extent by the application of genetic principles. Researches have been carried out in this direction in the developed countries, and their results are quite vivid. The successful application of modern genetic concepts in the service of man can be made in the developing countries too.

Man has not only applied modern concepts of genetics in improving the animal breeds and productivity of crops but also in medicine and industry- Of the ever increasing biological problems which the human society is confronting now, and is likely to face in near future, is that of 'population explosion', the rapidly growing disparity between the size of human population and the amount of food available to feed them (Huxley 1956; Simpson1968; Pirie 1967). This may seem rather far removed from anything to do with microorganisms, but in fact, it is apparent that some of the most outstanding successes of applied microbial genetics are in the field of antibiotic production and are directly encouraging increases in human population by producing fall in death rates, particularly in infants who survive to reproduce. Fall in death rates even in the less developed countries is due to safe water, better communication and improvements in agriculture (Huxley 1956; Swaroop 1960). This does not mean that we should ignore the role of antibiotics and the different forms of chemotherapy. Malaria is the example, the eradication of which has resulted in the increase of rate of population in countries like Mauritius and Ceylon. Microbial infections have been controlled through immunological mechanisms involving specific antibody and host cells or by dosing the patients with an antibacterial agent. Poliomyelitis vaccine presents the most successful example of preventive medicine and also shows the largest scale application of medical microbial genetics. Success of poliomyelitis vaccination is also because the naturally occurring virus does not vary from year to year, but this is not the case with influenza. Here the prevention is almost impossible because epidemics are caused by strains which differ from year to year. Vaccination has, however, been less effective in preventing bacterial infections. A good example of an invasive bacterial disease is Typhoid. Vaccination failed to cure this disease. The main defense against bacterial infection, whether typhoid, pneumonia, plague is chemotherapy, notably with antibiotics. Not only those mutants selected for the increased yield, but also others are quite important. There was some difficulty in mass culturing Streptomyces griseus, used for streptomycin production, which gets contamination from extraneous phage. Phage-resistant mutants are now used (Koereber et al., 1950).

The achievements of chemotherapy are enormous but at the same time drug-resistance has become prevalent in bacteria. This has been observed in two of the most important human pathogens, Staphylococci, responsible for wound infection and others ranging from Escherichia coli to the various Salmonella species causing enteric infection. The resistence is not due to chromosomal genes but due to extrachromosomal genetic element called 'Plasmids' (Wolstenholm and O'conner, 1969). Something regarding the genetic factors involved in these resistant forms is known. It is anticipated that some methods of 'curing' bacteria of their plasmids would be discovered. Apart from medicine, microbial genetics has also contributed to the production of protein and essential amino acids by fermentation.
What is the influence of genetics on man? A pertinent question to be asked. Man has applied the genetic principles to reveal the causes of different disorders investigated in the human populations of the world, and at the familial level. We are indebted to Galton (1869) for his remarkable book, 'Hereditary Genius', and Garrod (1908) for his great book on 'Inborn Errors of Metabolism' which paved the way for the study of human genetics.
The discovery of blood groups, their Mendelian inheritance and variation in their distribution has also added to our knowledge as to how they are associated to different diseases, e.g. duodenal ulcer with O group, higher incidence of small pox in A and AB groups, rhesus hemolytic disease and the problem of incompatibility with ABO groups have also been sorted out.\
The human chromosomal study helped finding out X-linked diseases like, hemophilia, ichthyosis (skin disease), colorblindness, muscular dystrophy, G-6-PD deficiency. Huntington's chorea and fibrocystic diseases are the examples of autosomal disorders. The chromosomal disorders arise almost always by non-disjunction, meiotic or mitotic, and kill, sterilise or stupefy on a larger scale than the genie disorder. Down's syndrome (mongolism) caused by the presence of an extra autosome (trisomy 21), Klinefelter's syndrome caused by the presence of an extra X-chro-mosome in male and Turner's syndrome by the lack of one of the two X-chromosomes.
The disorders like hypertension, erratic overwork (mania), epilepsy, depression, morbid dreaminess (schizophrenia), diabetes, coronary thrombosis are not determined at single loci. The selection against these diseases is largely impaired so far as therapy is assisting their fertility. The presence of lunatics, criminals and sudden death in a society could be reduced by breeding the perfect men. Attempts are being made to encourage diabetics, schizophrenics and apparently normal people to moderate or suppress their fertility on medical grounds.
Another factor which plays quite an important role towards enhancing the rate of different disorders is consanguinity. First cousin marriages are either strictly discouraged or are not allowed in United States and United Kingdom. However, in countries like Pakistan, India and Japan first cousin marriages are quite common. Now people have started realizing the harmful effects of such marriages. In such countries what is urgently needed is to educate people in this regard and should be suggested to avoid cousin marriages. Those already engaged in such bonds could be convinced to reduce their fertility.
In view of different genetic disorders the question arises that how the overall condition of the human population can be improved? The different methods suggested include discouraging mutual heterozygotes from marrying. Such methods are difficult to get success because marriages involve psychological, physical and emotional factors. The biochemical courtship will tend to reduce these correlations which are desirable for the society but are difficult to be practised. The other way could be through sexual selection by marrying late or never because fertility after thirty declines rapidly.
Selective abortions, after foetal diagnosis, can also reduce the present increasing problems. Sex-linked diseases can be reduced to mutant level, and their recessives and heterozygotes can be eliminated in conception. The important part of the problem should be the genetic counselling. This will bring some peace of mind to parents who have produced a defective child and who wishes to know the probability of additional defective children. It is necessary to have a detailed medical history of the person and of his family for counselling. Ideally a physician doing counselling should be familiar with the other problems of the person as well (e.g. social, psychological) otherwise a counsellor and physician should

work in association.

The various measures taken in controlling the genetic disorders have been adopted in the developed countries. I would not suggest that an exact replica of those methods be applied on populations in the developing countries. The betterment of the human population depends on socio-economic conditions, climatic conditions, food habits, and their particular genetic constitution. What is essential is that fundamentals like fertility, longevity, life expectancy, birth rate, death rate, sex ratio, age-structure, marriage types, and response to different antibiotics in various populations should be sorted out first. Unless we get the knowledge of these basic things any programme planned for the genetic improvement of human population in a developing country shall prove abortive.

**References**

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