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Penrose's Work and Views in Relation to Anthropology

By N. A. BARNICOT

Lionel Penrose's work was essentially concerned with medical genetics and, as this audience is well aware, especially with mental defect. He very seldom published in an anthropological journal, and on the few occasions when he mentioned anthropologists in his writings his remarks were not very complimentary. However, those of us who are in the business can take comfort from the fact that these remarks were generally aimed at an earlier generation of anthropologists who had failed to benefit from what human genetics already had to offer in the years before World War II.

It may therefore seem that I have chosen an unpromising theme for my talk. But when I remember how much I learned from Penrose during a happy association lasting some twenty years, I feel glad to make the attempt. I shall mention various instances in which his studies impinged on anthropology, but perhaps the main point is to be found firstly in the nature of his approach to his own work, and secondly in the changes that have come about in anthropology through the influence of population geneticists like himself. He saw the problems of inherited disease in an evolutionary perspective and as part of the wider problem of human variation in general. This immediately points to the connections I have in mind. Traditionally, anthropology has been concerned with the remote evolutionary history of man and with the differences between present-day populations, many of which are the terminal products of this evolutionary process. It is true that anthropologists were not as a rule interested in disease, feeling that 'normal' man was their province; though a few inherited aberrations, such as albinism, excited their attention in the eighteenth century when the subject began to develop, and in those days medicine was the normal route into the biological sciences. In the light of population genetics the distinction between normal and abnormal has become, in a sense, more blurred. We realize, for instance, that some genes which produce severe defects when present in double dose may be harmless or even beneficial when the individual carries only one of them. So it can be confusing to think of genes as unconditionally 'good' or 'bad'. This is a theme to which Penrose often returned, particularly in his criticism of overconfident eugenic proposals.

Perhaps I ought to explain that when I speak of anthropology I mean the biological side of the subject. Most people are vaguely aware that there are two kinds of anthropologist, one of whom is believed to measure skulls and the other to describe the curious habits of exotic peoples. This characterization may have been apt fifty years ago, but it is inadequate today. Nevertheless, some such occupational division does exist and demands different professional training and skills. Clearly the division is not absolute, since both branches study the human organism. The way people behave can affect the genetical constitution of populations; for example, mating customs influence the flow and distribution of genes. Conversely, the possession of certain genes can have repercussions in social life, as most black-skinned migrants have reason to know.

I do not think Penrose had much taste for the more erudite writings of social anthropologists, but he was sometimes delighted by popular accounts of the way primitive peoples live, such as Bridges' story of his experiences among the Indians of Tierra del Fuego (1) and Jenness on the Eskimos of Hudson Bay (2). Perhaps he felt, as many of us may at times, that scholars often excel in making fascinating material tedious. His pleasure in these glimpses of unsophisticated peoples was one facet of his interest in human oddity in general and of the

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wide sympathy that illuminated his dealings with mentally deranged and retarded patients. He was always wary of rigid and overconfident attitudes of mind, and he may have enjoyed the discovery that other cultures do not always share our assumptions and can jolt us out of complacency if we are receptive.

To return to my main theme: anthropologists who work on the biology of living populations have first to describe the differences between them. They have to consider whether these differences are due to genes, to the effects of environment during a lifetime, or, as may often be the case, to some interaction between the two. From an evolutionary point of view the genes are of paramount importance, since it is the genes that are transmitted from one generation to the next; so anthropologists must try to explain how the observed patterns of gene distribution in the world came about. Unless they are dealing with skeletal variations they are less fortunate than the palaeontologists, since they lack direct fossil evidence of what earlier populations were like. Since relevant historical records are usually meagre, they have to proceed more deductively, using their knowledge of what genes do today and applying theoretical concepts worked out by geneticists skilled at algebra.

Inherited differences between populations are generally a matter of degree. They can be summarized as averages of various measurements or as frequencies of discrete traits such as blood groups. Populations are not composed of identical individuals; all are very variable. Many populations are large, so that we can only characterize them by taking a relatively small and, hopefully, random sample. It is therefore evident that in the collection, description and comparison of data we are obliged to use statistical methods. The development of these methods owes much to Galton and later to Karl Pearson and R. A. Fisher. Galton's name is commemorated in the chair at University College which Penrose occupied as Fisher's successor. Penrose had a strong sense of the history of his subject (3) and of the traditions of the Galton laboratory (4), and he found it easy to carry on the biometric tradition because he had an outstanding flair for the analysis of numerical data. Even today it is probably unusual for a student with mathematical leanings to take up medicine, and especially psychiatric medicine. I imagine it was even rarer when Penrose was a young man. For a long time the biological sciences have tended to be the refuge of the innumerate, but genetics is a branch of biology with obvious scope for mathematical skill. This is particularly true of some aspects of human genetics, because breeding experiments are not possible and the analysis of gene segregation in pedigrees and the detection of gene-linkage require statistical reasoning. The need for such statistical analysis and the dangers of being deceived by artefacts of sampling were clearly appreciated by Penrose in his Buckston Brown Prize Essay of 1933 (5).

Penrose did on occasion turn his mathematical ingenuity to problems that arise in anthropology. One example has to do with classification. If, say, a skull is unearthed, we may ask whether it should be assigned to one or other of certain known populations. This question can best be answered if we take into account not merely one measurement but several. Fisher had devised the method of discriminant analysis to cope with this situation, but in the days of mechanical calculating machines the computational labour was heavy. Characteristically, Penrose sought a simpler procedure (6), believing that biological data are often not accurate enough to justify rigorous but lengthy methods. He followed this up by considering the related problem of measuring the degree of difference between a number of populations each of which has been described by a battery of measurements or of gene frequencies. Mahalanobis and Rao had already tackled this problem, but again the computational difficulties were formidable. Penrose showed, using examples from anthropological data, that closely similar results could be achieved much more rapidly (7). These excursions into mathematical taxonomy were probably not stimulated by anthropology but by the fact that similar problems arise in classifying diseases. Indeed the methods of factor analysis, which were so dear to some schools of psychology, have much the same aim. When Penrose did this work we were on

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the threshold of the era of electronic computers which can handle the more complex methods at amazing speed and are now asked to do so almost as a routine. The value of these moronic monsters is not in doubt, but they are not a substitute for thought. For this reason Penrose viewed them with some suspicion, though he made use of them in some of his later work. He preferred simple methods which enabled him to see what he was doing.

I have mentioned classification. Anthropologists, following the lead of botany and zoology, have often tried to classify mankind into races. In these latter sciences the word is more or less coterminous with subspecies, and although the subspecies concept has been criticized the term race is not disreputable. In the human context it has been a source of endlesss misunderstanding and bitter controversies. The populations of various geographical regions obviously differ to varying degrees in visible features and in the frequencies of many genes; but the pattern of this variation is complex and does not lend itself to a useful subdivision into discrete groups. Penrose disliked the term race and even more the opinions of racists who assert the superiority of certain populations, usually their own. In his comments (8) on the Statement on Race, issued by Unesco in 1951, he made the sensible suggestion that it would be better to substitute the more neutral term population. A population could then be described by geographical location, political affiliation, religion or whatever might be appropriate for the work in hand. The erroneous implications that have grown round the word race would thus be avoided.

Some inherited diseases, such as sickle cell anaemia, Tay-Sachs disease and Down's syndrome, show curious geographical or ethnic variations of incidence. Penrose was fully alert to the interest of these facts and urged anthropologists and others to collect more information; but he also liked to view genetical change as a process involving the whole human species (9), especially today when communication technology has swept away so many barriers. This led him to the idea of working out the frequencies of genes for the world as a whole, taking into account the sizes of different populations. He did this for the ABO blood groups, for which the data are sufficiently abundant, and he suggested that the peculiarities of particular populations could best be expressed by comparing them with these world frequency values (10). He felt, with some justification, that anthropologists had often paid too much attention to small, specialized populations to the point of neglecting the bulk of mankind.

In the early part of this century workers like Garrod and Bateson were busy seeking examples of clear mendelian gene segregation in man. They found them in certain rare diseases which anthropologists tended to ignore because they were so infrequent. Meanwhile Galton and his followers were studying the inheritance of metrical traits, such as stature, that do not show segregation and were at that time held to refute Mendel's theories. This biometric school had natural affinities with anthropology, which had long relied on body measurements for comparing populations. Perhaps this is one reason why mendelian genetics was slow to penetrate anthropology and made little progress before the ABO blood groups were introduced to the subject in 1914. Today the position is very different, and thanks to the advances in biochemical genetics we can study a whole host of simply inherited variations of enzymes and other proteins. Penrose was quick to appreciate the value of Garrod's work on inborn errors of metabolism and Fölling's discovery of a biochemical defect in phenylketonuric imbecility, and he enthusiastically promoted biochemical studies at the Galton laboratory. Nevertheless, there are many medically and socially important human qualities that cannot yet be described in terms of particular genes with specific biochemical effects; and so Penrose continued to pursue various lines of biometric work in the Galtonian tradition, using methods of correlation analysis on twins and other relatives. His work on the causes of variation in birth weight (11) is perhaps the best known of several examples. He was a great believer in the value of measurement, and he himself measured the heads (12), hair colour (13) and palm (dermatoglyphic) patterns (14) of mentally defective patients. Later on, when cytogenetics

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became so important in the study of mental defect, he was active in measuring chromosomes with the aim of identifying each member of the human set (15).

The size and shape of the head, hair colour and dermatoglyphic patterns are classical anthropological characters, but Penrose's interest in them did not come from this source but from their relevance to certain kinds of mental defect. However, as he emphasized, the study of the abnormal is only meaningful against the background of variation in the general population. In investigating hereditary influences the incidence of a condition in relatives must be compared with that in the population at large; or again, in studying whether a particular gene affects susceptibility to certain environmentally induced diseases the frequency of the gene in a sample of patients must be compared with that in the normal population from which the sample was derived.

So Penrose's absorption in the problems of inherited disease naturally led him to consider the causes of variation in the normal population, and this interest he shared with genetically orientated anthropologists. His work on the dermatoglyphic patterns on the hands and feet is a case in point. It is well known that these show characteristic deviations in Down's syndrome and in various other conditions due to chromosome misbehaviour. He encouraged work on the inheritance of the normal patterns and in his last years devised a new method of classifying them (16). He came to it by considering how these patterns are formed in the embryo and reached typically ingenious conclusions based on topology, a branch of mathematics well-suited to the study of how parallel lines can cover complex surfaces (17).

Penrose's mathematical bent must have made it easy and congenial for him to assimilate the work of Fisher, Haldane and Wright who were laying the foundations of the genetical theory of evolution in the 1920s and 30s. Evolution can be regarded as a process of gene frequency change in populations. Gene variants are continually being injected into the population by mutation. Many of these mutations lower fitness in the darwinian sense and are rapidly eliminated or lurk around at low frequencies in the heterozygous state. In some instances these heterozygotes, who carry a single copy of the gene in question, enjoy a selective advantage in certain environments. The frequency of the gene then becomes stabilized at an equilibrium level. In very small populations unfavourable genes may reach quite high frequencies and favourable ones may be lost merely by chance. In terms of the human life-span the action of natural selection is very slow, often taking tens or hundreds of generations to produce appreciable changes. These, in very crude outline, are some of the principles which emerged from this important mathematical work and which influenced Penrose's thinking profoundly. In the course of time they also influenced anthropology, so that today the boundaries between much of this subject and population genetics are nebulous or non-existent.

Penrose, working on the disease epiloia (18), was one of the first to measure the mutation rate of a human gene, and later on he was involved in discussions about the likely effects of mutagenic atomic radiation on the incidence of genetic defects (19).

The picture of the present human condition, with its ills and imperfections, as a product of natural selection recurred in many of his papers (20), whether on mental defect (21), congenital malformations (22) or chromosome anomalies (23). The idea that genes involved in the production of disease might be held in approximate equilibrium, due to past or present selective advantages of the heterozygotes, was one that he found particularly attractive (24). In arguing against eugenists he constantly emphasized that human populations, in their genetical structure, are more like wild species than like farmyard animals. Their genetical structure had been achieved very slowly by natural selection, and in our present stage of ignorance it was foolish to advocate wholesale interference with it. A notable example was his idea that variation in intelligence, in so far as it is due to genes, is a balanced situation in which the subnormal is a natural and necessary component (25). It was therefore no surprise to him when the decline of national intelligence which had been predicted from the observation that the less intelligent are apt to be more fertile

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was found not to have occurred (26). In any case he himself was too intelligent to suppose that intelligence tests are an accurate measure of genetical endowment. He pointed out the analogous case of stature, which might also have been predicted to decline but had in fact increased in many countries, due no doubt to a more favourable environment. Nor was he satisfied with the view that civilization is leading to genetical decay because natural selection has ceased to act and weaklings are thus being preserved. Civilization, he thought, had changed the direction of selection, often in unexpected ways, as we see when new drugs reveal previously hidden inherited susceptibilities. As Professor Fraser has shown in his paper in this symposium, eugenics poses some quite complicated scientific and ethical problems. Penrose's attitude to these was always cautious and humane. He liked to cite the sample of the severe inherited disease, sickle cell anaemia, which may be expected to decline slowly in frequency as malaria is eradicated. The reason is that malaria seems to be the major selective factor keeping the gene at high frequencies in some parts of the tropics. This is a good illustration of how a public health measure, taken for quite different reasons, can have unforeseen, and in this case beneficial, genetical consequences, without anyone having to be sterilized. Admittedly, in such a case the rate of decline of the gene frequency would be too slow to satisfy impatient eugenists, and, as Penrose realized, other methods such as direct treatment that could circumvent the bad effects of such a gene might offer preferable solutions.

His remarks on these and other matters of social importance show that he was never one to be attracted by superficial or fashionable explanations or to respect opinions merely because they were authoritative. He knew that only by the patient collection of evidence and critical analysis of it could some insight into the complexities of human biology be achieved.

In concluding this inadequate survey of the ways in which Penrose's work had a bearing on anthropology, I should like to thank the Royal College of Psychiatrists for giving me the chance to pay tribute to a deeply thoughtful and original scientist and a very good friend.

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