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The Nature of Man: Genetical Aspects

IT seems to be becoming fashionable for biologists to commit themselves on the subject of man. This year's President of the British Association, Sir Wilfred Le Gros Clark, devoted his presidential address to the subject of 'The Humanity of Man'; Medawar delivered the Reith Lectures on 'The Future of Man'; Waddington has recently published a book on ethics; and Sir Julian Huxley has delivered his latest pronouncements on man within the last few weeks. I am therefore in good scientific company in speaking as a biologist on this subject. What I have to say is illustrated by a story told by Canon Raven. When William Temple and he were young dons together at Cambridge they used to discuss the evolutionary interpretation of life. 'It seemed to us (this may have been the arrogance of youth)', he writes, 'that it was evidently the exception for previous generations to think about the world of nature, the universe, as anything more important than a sort of theatre, on the stage of which the drama of man's experience, man's fall and redemption, was enacted. The universe was for them the setting, the stage, the surroundings, the occasion, but it wasn't an integral part of the play. We were prepared to challenge this and insist that it was an impossible position to take up—that the universe was an essential and significant part on the drama of which we were conscious in the world of ours.' Whatever our views on the history of man's thought of the relationship between himself and creation, it is clearly important for us to see man fairly and squarely in the full context of his environment. On a different plane, our Christian calling in this life, although in relation to the whole of creation, is pre-eminently as a part of the Church (1 Cor. xii. 12), which again involves us in an environment of contact, or conflict, with our fellow-Christians and those who are not members of the Church.

Too often in the past the biological view of man has been synonymous with 'Man's Place in Nature' and the anatomical and physiological comparison of man with the rest of the animal kingdom. This exercise means taking man out of his environment and studying him as a machine, using similar techniques to those one might use in the investigation of a motor-mower. The information one obtains in this way is valuable information, but it is only distantly related to the

study of a species in its environment. Until far too recently biologists have occupied themselves with 'classical' studies of form and function: most important advances in our understanding of the life of animals in their natural surroundings have taken place within scientific living memory. This is particularly true of the human species. It is really only since the war that the natural history of man (a term I prefer to that of 'human biology') has come into its own. Nowadays the study of reactions of various groups of people to different stresses are common. I want to concentrate on some of the basic principles underlying such investigations. My reasons for doing this are twofold: comparative studies of the classical type between man and animals have not advanced greatly in recent years (and any conclusions one might try to draw from them tend to arouse considerable emotion among Christians) and, secondly, as ambassadors of the Gospel, it is perhaps more relevant to know the reaction of people to their surroundings, part of which (we hope) is that Gospel, than to know intimately their physical make-up. From the point of view of experimental studies, this seems to involve consideration of two separate subjects: the controlled response of different people to different environments, and thence the reaction between the inborn constitution and the environment or nature and nurture as it is more commonly called.

I hesitate to dwell at length on the first of these two topics, because I am trespassing into the field of psychology, but the evidence of biology is most important here. Tinbergen and Lorenz have given us reasons for believing that many kinds of behaviour which seem to be peculiarly human are part of a very ancient heritage—'showing off' for instance; playing with dolls; sexual rivalry; and many kinds of 'displacement activity', in which a thwarted instinctive impulse vents itself in actions of an apparently quite irrelevant kind. In this year's Eddington Memorial Lecture, W. H. Thorpe (*Biology, Psychology and Belief*, Cambridge, 1961) reviewed some of the mental processes which we think of as being truly human. He concluded that 'in perception, in concept formation and in curiosity and exploration, the human mind seems to be essentially similar to the animal mind; and all these features have, in the animal mind, a vital part to play for the survival and evolution of the stock'. Furthermore, he believes that 'we cannot even make a hard and fast distinction between the animal and human mind on the grounds of artistic sensibility. We find that monkeys and birds (but not fish) prefer patterns with aesthetic character such as symmetry, rhythm and vivid contrast rather than irregular patterns.'

Thorpe finds a definite difference between the minds of animals and men only in what Hobhouse calls the 'Correlation of Governing Principles', which involves 'a recognition of abstract moral law, eternal values which are in themselves good'. If we accept this conclusion, we must also recognise the fact that most men, most of the time, live on a completely sub-human plane, prostituting their humanity to sensual gratification, indistinguishable except perhaps in degree from that experienced by many animals.

C. H. Waddington (*The Ethical Animal*, London, 1960) has made what seems to me an important contribution to this discussion. He envisages the human infant to be born with probably a certain innate capacity to acquire ethical beliefs but without any specific beliefs in particular. During the first few months of life processes go on by which these innate potentialities become realised, and the infant becomes moulded into an 'ethics participant' by a course which Waddington thinks should be thought about in abstraction from any consideration of what particular ethical system is adopted. 'At the same time as a child becomes ethicising it acquires certain definite ethical beliefs; and as it goes on formulating these beliefs in a more and more definite and specific way, it becomes more fully the sort of being that goes in for having ethical feelings. Similarly, at a later stage in life, rationally formulated criteria for criticising ethical systems soon acquire an ethical value of their own in the mental make-up of the person who holds them. In both these early phases, unconscious mental processes play an enormously important role, and they appear to be of a much more peculiar and unexpected nature than might have been guessed. However, it is important to note that they essentially involve interaction between the person under consideration and his external environment, in particular other people. The most important point for our argument is the contention that the moulding of the newborn infant into an ethicising being is not due wholly to intrinsic forces, but requires an interaction between him and his external circumstances.' One of the difficulties when this topic is discussed in Christian literature is the lack of definition of the characteristic of the individual which undergoes reaction with the environment. Medawar has pointed out that the instruments or tools used by man are *functionally* parts of his body, even if they are anatomically separate and distinct. Hence when we speak of the reaction of a man we must include what is variously called his 'socio-genetic' (Waddington) or 'psycho-social' (Huxley) component. This increases the difficulty of analysis

considerably. As Christians we think of the reacting component as being the soul, the 'Inner Light', or 'Divine Spark', or some other rather vague entity. There seems little justification for distinguishing a spiritual part of man reacting apparently in isolation from the rest of his being, except for its use for purely didactic purposes.

R. A. Fisher's discussion of the nature of creation (*Creative Aspects of Natural Law*, Cambridge, 1950) is relevant in this context. He starts from the premise that there seem to be two main reasons why Christians often find it difficult to accept the evolutionary process as evidence of creation. Firstly, mutations, when considered in isolation against a deterministic world, appear to be 'random', and secondly, natural selection, again considered by itself, appears to be nothing more than a blind weeding-out mechanism. Fisher looked at the word 'creative' 'coldly and dryly, divesting it of emotional significance and moral associations, and takes it to qualify effective causation'. Using a closely reasoned argument, he points out that creativeness does not, and cannot, lie in some overall detailed control of mutation (as suggested by the late Bishop of Birmingham), but must reside in the whole inter-relation between organism and environment, animate and inanimate. It is this environment which determines the nature of selection. Thus creativeness lies neither in the one nor the other but in the interaction of both throughout evolutionary time. Consider the components and they appear quite inadequate to explain the course of evolution; consider them together, as Fisher does, and we arrive at a world picture which emphasises the essential unity of creation and avoids the idea of a God who as Coulson satirises, 'controls His universe by intervening only in those parts of the world mechanism which we cannot at present see into or understand'.

This leads us on to the core of the problem: the relation between our inborn constitution and the environment. It is often said that all men are equal—which would minimise this problem—but this is usually a statement of political aspiration or is actually meant to be that all people should have equal rights and opportunities. As a bald statement of fact it is patently not true—either as a theological or a biological proposition. We, as British, are manifestly different from both the Chinese and the Africans, not necessarily inferior or superior, but different. The idea that human races differ in adaptively significant traits is emotionally repugnant to some people. This attitude almost invariably goes hand in hand with a misunderstanding of the nature of biological heredity. I have purposefully chosen rather mundane

examples to illuminate this theme because they are, generally speaking, better known and easier to understand. I do not think that this choice lessens the value of the conclusions that I shall draw which relate to the more specifically human sides of man's nature.

One of the more important results of modern genetical work is the emphasis upon the whole genotype of an organism: from the moment of conception our whole development is the resultant of the interaction between our entire hereditary component and its immediate environment. None of the reactions which a human being displays could occur without a particular environment, which can only vary within certain restricted limits; and no one is born except from particular parents. We tend to think of individual responses to different stimuli as being of relatively minor importance (although discoveries of susceptibilities to neoplasms, such as the lung cancer precipitated by smoking in some people, may have increased the awareness of their importance). In fact many of the world's races are adapted to local conditions to a marked extent. 'Individuals who have a small amount of body fat, great body linearity and brunette skin can probably march for substantially longer distances in a hot desert than their morphological opposites. Individuals with a stocky body build and large deposits of subcutaneous fat, the typical Eskimo build, can sit nude for considerably longer periods in a cool temperature with less loss of body heat and less metabolic disturbance than the desert-adapted thin man. Experimental evidence has even shown that the American Negro who has his extremities exposed to below freezing temperatures is much more likely to suffer from frost-bite than the American white who is exposed to the same condition. On the other hand, American Negroes show less deviation from normal temperatures when they perform work under hot, wet conditions than do American whites, even though matched for body linearity and fats, factors which might affect strain levels. Australian aborigines who sleep nude under cold conditions apparently have mechanisms of vaso-constriction which permit them to conserve body heat and sleep peacefully in a situation where European whites would burn up great quantities of food and shiver, while totally unable to sleep.'[1]

Such adaptations to local situations are determined by many genes, and are not simply analysable. However, there is no reason to think that the inheritance of such traits differs in principle from the genetic

[1] P. T. Baker, *Human Biology*, **32**, 3-16 (1960).

resistance to certain malarial infections, which is more simply inherited. There are three single gene-determined conditions (sickle-cell trait, thallasaemia and glucose-6-phosphate dehydrogenase deficiency) which probably confer some protection against some forms of malaria. They occur with a high frequency where malaria is, or has been, common. In themselves these conditions are harmful to their possessors, but in malarial areas the disadvantage is overridden by the protection that is afforded against the disease. The fact that three distinct traits, controlled by a single gene, appear to give protection against malaria, suggests how different genes might interact to produce a genic system of disease resistance. Most data on genetic resistance to disease in animals suggest that many genes are involved.

One of the easiest of man's characters to study in populations is his blood groups. Populations in many parts of the world have been sampled for their blood, and atlases have been published showing the distribution of the major blood groups of the various systems. Such maps have been of use to anthropologists in tracing the mass movements of people in the past, but the actual meaning of the distributions has, until recently, been far from clear. They were usually considered to be random, or 'non-adaptive' in the language of selection theory. However, it is now known that highly significant correlations exist between some of the blood groups and certain of the common degenerative diseases of modern life. For example, 'persons of blood group O run a markedly greater risk of developing duodenal ulcer than those of groups A, B, or AB, while group A people run a lesser, but still appreciable risk from gastric carcinoma. Furthermore, the blood groups are the manifestation of differences in the antigenic structure of the human organism, and since the antibody-antigen system of the organism is its chief defence against infectious disease, differences in this system may lead to different diseases. For example, cholera vibrios are extremely susceptible to acid conditions, and one of the major mechanisms by which the body is protected against cholera is the inability of the cholera vibrios to survive the acid conditions in the stomach. But there seem to be differences between the ABO blood groups in the amount of stomach acid, and these may indicate different susceptibilities to cholera. Associations have been reported between the blood groups and many diseases, including filariasis, poliomyelitis, diphtheria, scarlet fever, measles, typhoid, whooping cough and tuberculosis.'[1] In other words, the

[1] F. B. Livingstone, *Human Biology*, **32**, 17-27 (1960).

present distribution of blood groups may be a reflection of the diseases and plagues that ravaged mankind in the past. From this it is concluded that different populations of men have their own characteristics, and any one of those populations must exist in a dynamic balance with the environment.

There are two axioms which are at the base of all evangelistic preaching. They are that 'there is no difference, for the whole human species has sinned and come short of the glory of God' and that 'every individual is personally accountable to God for himself'. Without in any way detracting from the absolute truth of these statements, it seems that we must accept the additional proposition that different people respond differently to identical stimuli. I know that I am on dangerous ground in this context where the sovereignty of God and the work of the Holy Spirit is involved, but I do not think that this necessarily negatives the proposition. Take the basic divorce of the human species into male and female: this is a genetically determined dimorphism, maintained by a simple (in the genetic sense) chromosomal switch mechanism. Two brothers may differ from a sister by only a few more genes than they differ from each other, yet the female outlook upon life, and hence on the human level to the claims of Christ, tends to be vastly different to the male one—as is shown by the sex ratio in most of our churches. The male-female divergence is an extreme one, but I think it illustrates fairly the different responses of different hereditary constitutions to the same thing.

We have already seen that the present genetic composition of a race or population is dependent upon its past history. It is widely believed that the forces of selection acting upon man have been abolished by civilisation, hygiene or better medical care. This is not so. What has happened is that the forces have been altered and transferred at certain points from one genotype to another. They now seem to be 'directed towards defects present at birth and leading to failure of development or of function. Even in highly civilised countries, like the United Kingdom or the United States, nearly half of all fertilised ova are unfit in the crude sense of failure to reproduce, and it may be assumed that this failure is, to a significant degree, attributable to the genes carried by them. Penrose has estimated from evidence from many sources that early prenatal loss accounts for at least 15 %; then 3 % of the remainder are stillborn, 2 % are counted as neonatal deaths and 3 % more die before reaching maturity. Of the survivors 20 % do not marry, and of those who do, 10 % remain childless. In view of

the large extent, and the persistence, of this loss and the rarity of observed mutation, it seems probable that selection is, for the most part, acting on homozygotes at both ends of the scale keeping the population in a genetical equilibrium under these conditions.'[1]

One aspect of the genetically dynamic state of the present-day population is shown by the lowering of the age of onset of menstruation in young girls. 'In Sweden in 1840 the average girl began menstruating at the age of 17 or later; nowadays the figure is about 13½. The last two London County Council surveys conducted at an interval of 5 years show a reduction in the age of almost exactly two months. Thus the reduction has been continuous at about four months per decade, or roughly one year per generation. The reasons for this trend are not entirely clear. The earlier maturing is usually put down to better nutrition, and probably with reason. However the acceleration has by no means been confined to the less favoured social classes; indeed it has been only a little more in these classes than in the more favoured ones. An alternative or supplementary explanation was suggested some years ago by Dahlberg, to the effect that the change was the result of hybrid vigour. At the time there was little evidence for this in man, and indeed the evidence is still equivocal, but at least suggestive. If we accept this evidence, then increased outbreeding—that is, an increased tendency for persons to marry outside their own village rather than within it—could have caused the reduction in the age of onset of menstruation. There are indeed data to show that the degree of outbreeding has been steadily increasing in Europe ever since the introduction of the bicycle.'[2]

Another complication of human breeding systems is that human mating is far from being at random. A study of marriage partners reveals that there is a strong correlation between mates for many characters. This is strongest for intellectual capacity, but also applies to physical attributes, social status, colour and so on. This non-random mating of the species maintains a considerable amount of genetical polymorphism, and acts to retard the effect of any altered selective pressures.

One last point about our adaptation to the environment. Mutation rate and the amount of variability in a population is determined by

[1] L. S. Penrose, *Symposia of the Society for the Study of Human Biology*, **2** 1-10, (1959).

[2] *British Medical Journal*, 19 August 1961.

our environment. A certain degree of background radiation has always been part of our environment. The amount of background radiation will certainly increase over the next few years. The biological question is whether genetic change can take place quickly enough so that organism and environment can remain in equilibrium. The rates of change of characters determined by many genes is probably faster than those determined by only a few, but our information about the genetic variance of man is so incomplete that it is virtually useless to make any prophecies on this point.

In the last two centuries, what Whitehead has called 'the invention of modern invention' has produced, and is producing, changes in the material circumstances of man comparable only to those brought about by the invention of urban community life in the Neolithic period. The most obvious sign of the changes that have taken place is the breakdown of community life and the isolation of large sections of the community from direct contact with the forces of Nature. Over the centuries it is reasonable to suppose that man achieved a fair amount of rapprochement with his environment. In particular there must have been selection for primacy and leadership in the rural communities which were the most usual habitat of man. The enormous burst of population increase consequent upon the industrial revolution, the migration into larger assemblies, the disruption of social patterns and allegiances (including those to the local church) must all contribute to a decrease in the adaptation of our species to its environment. This means more 'mis-fits', to use a sociological term, as genetic complexes are broken up and, more important, it means a degree of tension between man and a new environment with a consequent plasticity of behaviour.

I do not know if I am correct in these surmises, but there is one point which directly emerges from the foregoing, and which accords with our Christian knowledge of the nature of man: we cannot shape the future of our species purely by, as we say, 'improving its lot' financially and by education. We have only our individual innate capabilities for realisation as personalities. Whether these are developed to the full depends upon the reaction that takes place with our environment. God has a place for each one of us; in this age of change, we must place ourselves more than ever in the hands of the Holy Spirit to enable us to find that place, and pray that we may always be discontented with a second-best (2 Pet. i. 9-11).