

# EUGENICS AND SOCIETY\*

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## *The Future of Eugenics*

EUGENICS, Dean Inge writes in one of his essays, is capable of becoming the most sacred ideal of the human race, as a race; one of the supreme religious duties. In this I entirely agree with him. Once the full implications of evolutionary biology are grasped, eugenics will inevitably become part of the religion of the future, or of whatever complex of sentiments may in the future take the place of organized religion. It is not merely a sane outlet for human altruism, but is of all outlets for altruism that which is most comprehensive and of longest range.

However, in addition to holding out these emotional possibilities, the eugenic movement must obey practical necessities. If it is to grow into a soul-compelling ideal, it must first achieve precision and efficiency as a branch of applied science.

At the moment, it is idle to pretend that it has advanced very far in either direction. True that to a limited number of men and women, it is already an inspiring ideal: but for the bulk of people, if not a subject for a jest, it remains either mistrusted or wholly neglected. True that, thanks to the genius of Darwin and his cousin Galton, the notion of evolutionary improvement through selection has provided a firm scientific base for eugenics, and that in recent years distinct progress has been made in applying the triumphal discoveries of modern genetics to the human species: yet for the bulk of scientists, eugenics is still hardly reckoned as a science.

It may be that, as a scientist myself, I overrate the importance of the scientific side. At any rate, it is my conviction that eugenics cannot gain power as an ideal and a motive until it has improved its position as a body of knowledge and a potential instrument of control: and in this lecture I shall en-

deavour to point out what, in my opinion, is the next step towards the graduation of eugenics into the dignity of an established science. It will be an inquiry into the methodology of our subject.

## *Social Science and Natural Science*

Eugenics falls within the province of the Social Sciences, not of the Natural Sciences. It shares with the rest of them a suspicion, often very frankly expressed by the pundits of more respectable branches of study, such as physics or pure biology, of being not quite scientifically respectable. Some indeed, go as far as to assert that the social sciences can never be truly scientific, and imply that they have illegitimately used the word *science* in their title in order to exploit the prestige attaching to it in this scientific age.

Personally, I do not think that this criticism is justified. All young sciences are attacked by their elders on the ground of irregularity in their canons of scientific behaviour: but they cannot expect to establish rigorous canons until they are no longer young, any more than an untried adolescent can be expected to possess the assurance and practical skill of a man in the prime of life. In addition, young sciences are not merely young like young human beings owing to the accident of the date of their birth. The date of their birth is no accident: they are young because they are more complex and more difficult. Physics is an older science than biology because in physics it is easier to isolate phenomena and to discover simple but fundamental laws. The social sciences are younger than the natural sciences because of the appalling complexity of variables which make up their subject-matter.

This, however, is not all. The social sciences in certain respects differ radically from the natural sciences; they cannot expect to achieve success by applying the same simple methods as served their elder

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sisters, but must work out new methods of their own. In the natural sciences, we isolate phenomena in order to analyse them. If possible we isolate them in the form of a controlled experiment, as in physics or genetics; if this cannot be achieved, we isolate them in thought, make deductions, and test our conclusions by empirical observations, as in astronomy or stratigraphical geology. By refinements of technique, we can eliminate for practical purposes all irrelevant variables; the geneticist wanting to understand some new type which has appeared in his cultures can eliminate, say, the variable of environment, then the variable of single-gene mutations, then the variable of addition or subtraction of whole chromosomes, and finally pin responsibility for the phenomenon on, for example, the inversion of a particular chromosome section.

But the social scientist cannot do this sort of thing: he can at the best find a correlation between several variables. In terms of causation, the natural scientist can sometimes find a single definite cause for a phenomenon; the social scientist must always be content with several partial causes. He has to work out a system based on the idea of multiple causation. The attractive simplicity of simple and single causation is for him a false simplicity: he needs a different intellectual technique. Anyone who asserts that so-and-so is *the* cause of a social phenomenon is bound to be wrong: it can at best be *a* cause. Let us as eugenicists therefore beware of making such assertions as that the celibacy of the clergy was *the* cause of the decadence of Spain, or that the differential birth-rate is *the* cause of the increase of feeble-mindedness: for by so doing we are being scientifically disreputable.

And, of course, the inevitable obverse of the principle of multiple cause is the principle of multiple effect. I need not labour the point, save to stress the need for the working out of suitable methods, of partial correlation and the like, to deal with this multiple complexity.

Another peculiarity of the social sciences, closely linked with the first, is that we cannot make rigorous and repeatable experiments,

because we cannot isolate our material or control all its variables. Again a different technique from that of the natural sciences has to be worked out—here a different practical technique. Properly planned regional experiments are an example.

But perhaps the most fundamental difference between natural and social science is that the social scientist is himself part of his own material, and that the criteria for judging the outcome of an experiment are partially subjective. Thus the social scientist cannot escape bias, and he cannot hope to check his work against objective criteria that will be accepted by all normal men.

As regards bias, we may compare this with experimental error in natural science. Just as it is possible to reduce experimental error, but never entirely to eliminate it, so it is clearly possible to a large extent to discount and reduce bias. Discovering the technique of reducing bias will be as important in social science as has been in natural science the long and often tiresome process of discovering the technique of reducing experimental error.

The difficulty of finding an objective criterion of truth in social science cuts deeper. But it is based upon an intellectualist philosophy which hankers after abstract truth. It largely disappears if we take the more robust view that science is control as well as knowledge, and that these two aspects cannot be separated. There can be some measure of general agreement on the practical results of social experiments, especially if these are properly planned. Thus in social science, experiment is not the remote preliminary to action that it is in natural science, but is itself partly action—both pure and applied science simultaneously. *Solvitur operando* should be the working principle of the social sciences. It implies that progress in social science and its applications will be slower and more sprinkled with practical mistakes than progress in natural science; but it does not mean that we should deny the possibility of progress.

#### *Eugenics as a Social Science*

These general considerations have many particular applications to our subject.

Eugenics is not, as some of its devotees have perhaps unconsciously assumed, a special branch of natural science: it is a branch of social science. It is not merely human genetics. True that it aims at the improvement of the human race by means of the improvement of its genetic qualities. But any improvement of the sort can only be realized in a certain kind of social environment, so that eugenics is inevitably a particular aspect of the study of man in society.

Up to the present, eugenics has concerned itself primarily with a study of the hereditary constitution, and with deductive reasoning on the effects of selection. It was rightly shocked at the intellectual excesses of the perfectionists and sentimental environmentalists, who adhered to the crudest form of Lamarckism and believed that improvements in education and social conditions would be incorporated in an easy automatic way into human nature itself and so lead to continuous and unlimited evolutionary progress. As a result, it converted the distinction between nature and nurture into a hard antithesis, and deliberately or perhaps subconsciously belittled or neglected the effects of the environment and the efforts of the social reformers—except in so far as their real or alleged dysgenic effects might be used to point a moral or provide a horrid warning.

This was natural, and perhaps necessary; but it was neither scientific nor sufficient. It was an example of the error to which I have already referred, the error of assuming that the methods of the natural sciences will serve for the social sciences. The pure natural science of genetics was able, at least during its early career, to neglect consideration of the environment. It could do this because in its experiments it can and does control the environment in order to deal solely with constitutional factors. By this means it has succeeded (and by no other means could it have succeeded) in making those spectacular discoveries about chromosomes and their doubling and halving, about the existence, number and localization of the genes or hereditary units, their mutation and its effects,

which in a brief quarter-century have raised it to the position of being that branch of biology which in its method and its progress most nearly conforms to the standard set by physics.

But in eugenics this is not possible. The purpose of eugenics is on the one hand to study the presence of different inherited types and traits in a population, and the fact that these can be increased or diminished in the course of generations as the result of selection, unconscious or deliberate, natural or artificial, and on the other, eventually to use the results of this study for control. Eugenics studies the selective implications of human genetic differences.

However, these implications may and often indeed must differ in different environments. Since the social environment is now by far the most important part of the environment of man; and since the social environment differs from one nation to another, one period to another, one class to another, and its differences are outside the control of the eugenicist, he must not neglect it. Its uncontrolled variables bring the eugenicist face to face with the principle of multiple causation, at work here as in all the social sciences.

#### *Need for a Study of Environment*

The study of the environment is necessary for the eugenicist on a number of counts. First, because he cannot equalize it experimentally, he must learn to discount its effects if he is not to mistake their pinchbeck glitter (as he would be apt to think it) for the true gold of genetic influence. If, for instance, the observed lower stature of the so-called lower classes should prove to be due to an inadequate diet, it is eugenically of no significance. Secondly, because by the limited control of social conditions which is open to us already, it is often possible to alter the effect of a genetic factor. Inherited eye-defects, once a grave handicap in almost every walk of life, are now, in most cases, thanks to the progress of the science of optics and the art of spectacle-making, no more than a minor inconvenience.

Thirdly, the environment itself exercises a selective influence. This fundamental truth, long axiomatic in evolutionary biology, has not been properly recognized in human biology so far as the social environment is concerned. A young pioneer civilization, for instance, will both initially attract and later encourage different types from those attracted and encouraged by a civilization that is old and settled.

Fourthly, in planning a eugenic programme, the eugenicist must take account of the social system in which he hopes or expects his improved race to live. Cattle-breeders will set about their work quite differently according to whether they are building up a stock for use in a rich pasture country where winter feed is provided, or one for an undeveloped and semi-arid land, like parts of Africa. Similarly the eugenicist must adopt different aims according as to whether he envisages a world of nationalism and war or one of peace and cultural progress. This is already patent in the crude eugenic efforts of to-day—in the encouragement of high fecundity in Fascist Italy and Nazi Germany, together with the persecution of so-called “non-Aryans” and the glorification of the Nordics in the latter.

Finally, there is the question of bias. It is probably inevitable that most men who come fresh to a problem in social science, however scientifically-minded they may be by nature and training, will have some bias due to their own social environment. This bias in social outlook which besets the pioneers in the social sciences is comparable to the bias in favour of common sense and accepted modes of thought which equally inevitably beset the pioneers in the early stages of the natural sciences. And just as in the natural sciences men had to develop the technique of controlled experiment and verified prophecy and to be willing to follow their findings wherever they might lead, far away from the beaten track of common sense if need be, so in the social sciences a means must be found to detect and discount bias in the observer himself, even though this lead him far from the comfortable road of his preconceived notions.

### *Environment and the Expression of Genetic Traits*

Let me develop these points a little more fully, one by one. In the first place, one and the same genetic outfit will give different effects in different environments. This is so elementary and fundamental a fact that it has often been neglected, by the geneticist as well as the eugenicist. In the early literature of modern genetics, you will often find references to the inheritance of such and such characters. But characters are not and cannot be inherited, in the sense in which inheritance is used by the geneticist. What are inherited are genes, factors, genetic outfit. Any character whatsoever can only be a resultant between genes and environment. A given character expresses the interaction between a particular set of genes and a particular set of environmental conditions. Thus at the outset we see that the old question, whether nature or nurture is the more important, is meaningless. It is like the question “When did you stop beating your wife?” in conveying implications which do not correspond with reality. In general, neither nature nor nurture can be more important, because they are both essential.

You will note that I say “in general.” In particular cases, one or the other may be more important. Do not let us forget that all genetics depends on a study of differences. We take two individuals and strains, and ask what is the cause of the difference between them. By adjusting the conditions of our experiment, we find that this is due either to a difference in their environment or to a difference in their inherited constitution (or, often, to a difference in both). We then proceed further and find out, say, that the genetic difference is due primarily to a difference in a single gene. Let us suppose that the difference was one between red and white flowers in a plant. Then we say, if the white-flowered variety is the aberrant one, that we have discovered “a gene for white flower-colour.” But this is a shorthand notation. Scientifically, we have discovered that the main cause of the difference in flower-colour is a difference in the nature of one unit-section of the chromosome outfit. That is why certain

authors tried at one time to substitute the term *differential* for *gene*.

This rather tedious argument has two corollaries of immediate eugenic importance. The first is this. The more similar are the environments of two human samples, the more likely are the observable differences between the samples to be inheritable. The opposite is also true in theory, that the more similar are their genetic constitutions, the more likely are any differences to be environmental and non-inheritable; but in view of our ignorance of the precise genetic constitution of human populations, this has little applicability save in special cases like that of identical twins.

When on the other hand there are obvious differences in environment between two groups, there is a strong presumption that many of the differences between them will turn out to be mere modifications, which would disappear if the environmental conditions were equalized. This is not, of course, to say that the groups will not differ genetically also: merely that the observed differences in characters are not likely to be wholly inherited.

Genetics can provide interesting examples in which certain conditions of environment may wholly mask the effect of a gene. The classical case is that of *Primula sinensis*. In this plant there is a white-flowered variety and a red-flowered variety, which differ in regard to a single mendelian gene. The white remains white at all temperatures; but the red variety when raised at a high temperature produces white flowers. A hot-house will thus entirely mask the perfectly real genetic difference between the two.

Even more significant for our purpose is the case of the mutant of the fruit-fly *Drosophila* known as *abnormal abdomen*, which depends on a single recessive gene. Flies characteristic of this strain show a bloated and rather abnormal-looking abdomen, with an extremely poor and irregular development of the normal pattern of black bands. However, all gradations from this to normal appearance are found. Analysis has shown that in moist conditions the character manifests itself fully, while in very dry conditions

it does not show at all, and the flies resemble the normal wild type. Environment may thus wholly mask the effect of a pathological gene.

These cases introduce us to the further principle, somewhat paradoxical at first sight, that equalizing the environment may either increase or decrease the amount of visible variation in a group. In a universe containing both dry and moist conditions, a mixture of wild-type and abnormal-abdomen strains of fruit-fly would show a certain range of variation. Equalize the environment by making the universe wholly dry, and the population becomes uniform: but equalize it by making the universe wholly moist, and the variability is increased. Hogben has drawn attention to the importance of this point.\*

In various biometric studies, it has been shown that unfavourable conditions tend to increase the degree of observed variation. But the attempt to erect this into a general principle cannot be correct, since the opposite may in other cases hold good. This is so, for instance, in our fruit-fly example—moist conditions, being associated with abundance and availability of food, are favourable; yet they here increase variability. A human example of the same sort, also cited by Hogben,† concerns education. "The effect of extending to all classes of society the educational opportunities available to a small section of it would presumably be that of increasing variability with respect to educational attainment. The effect of depriving the more favoured of their special advantage would be to diminish variability in educational attainments." Either policy would result in an equalization of environment; but equalizing it by making it more favourable would bring out genetic differences more fully, while the reverse process would mask them.

However, whether equalizing the environment will in this or that case increase or decrease variability, what differences then remain *must* be genetic in their origin. Thus without either equalizing or discounting the

\* Hogben, 1933, p. 115.

† *Op. cit.*, p. 115.

effect of environment, we cannot be sure what differences between groups are due to inheritance.

*Eugenic Bearings of Environmental Influence*

This point is of extreme importance in eugenics. For instance, it is well known that members of different social classes differ in their average of stature, physique and intelligence—all of them characters of the greatest evolutionary importance. I take one or two examples from Carr-Saunders.\* In a sample of fourteen-year-old Liverpool schoolboys, the boys from a secondary school were on the average no less than  $6\frac{1}{2}$  inches (over 10 per cent.) taller than those from a council school in a poor neighbourhood; and differences in weight were equally marked. In a similar investigation in London, the "mental age" (as determined by intelligence tests) of boys from a superior school was far above that of boys from a school in a poor neighbourhood. Twelve-year-olds from the superior school had a mental age nearly a year above their real age, while those from the poor school were a whole year behind their real age—a difference of 15 per cent.

Such differences are usually cited by eugenicists as proof of a real and considerable difference in genetic qualities. For instance, Professor Carr-Saunders, after quoting these facts, concludes that "so far as persons in this country are concerned, the mental differences which we observe, after stripping off the obvious acquirements in the form of knowledge of facts, habits, customs, manners, are due only in very small part to differences in the physical environment, and in a varying though never to a large degree to differences in the social environment, and for the greater part to inherited differences." And he draws the same general conclusion with regard to the physical differences. Yet in the few years since Professor Carr-Saunders' book was written, this conclusion has become extremely unlikely. For recent work has shown that vitamins and other accessory food-factors have physical and mental effects far

transcending what we originally thought possible.

In the early years of vitamin research, attention was concentrated upon the definitely pathological states resulting from total or almost total deprivation. During the last ten years, it has been shown that moderate insufficiency of these accessory food-factors will result in retardation of growth, stunting, lack of physical and mental energy, and reduced resistance to infectious disease. Even boys who by all ordinary canons were regarded as in fine health and well above the average in physique were shown to benefit both in growth and in energy from the addition of extra milk to their diet. Sir John Orr has shown that the diet actually consumed by the poorer classes in Aberdeen, when given in unlimited quantities to rats, results in poor physique, small litters, low expectation of life, and proneness to numerous diseases, while the same diet with the addition of various vitamins and mineral salts kept the animals in tip-top condition.\*

In the face of such facts, it is no longer legitimate to attribute the observed differences in physique and intelligence between social classes mainly to genetic factors. Genetic differences may of course exist; but the strong probability is that most of the differences are dependent on differences in nutrition. Further, the defective nutrition of the poorer classes is in part due to ignorance, but in a large measure to mere poverty. Until we equalize nutrition, or at least nutritional opportunity, we have no scientific or other right to assert the constitutional inferiority of any groups or classes because they are inferior in visible characters.

The extreme importance of applying accurate methods to the problem is shown by the results of recent investigations on twins. As is well known, twins may be identical or monozygotic, always of the same sex and both derived from the same fertilized egg; or they may be fraternal or dizygotic, either of like or unlike sex, and derived from two separate eggs. The former will have identical

\* Carr-Saunders, 1926, pp. 126, 97, 105.

\* Cited in Orr, 1936.

hereditary outfits, the latter will have hereditary outfits as different as those of members of the same family born at different times.

Yet it is true that in regard to intelligence tests, fraternal twins of like sex, though as we would expect they show considerably less resemblance than identical twins, are more alike than pairs of brothers or pairs of sisters born at different times. The additional similarity of their environment, due to their developing pre-natally and post-natally in more similar conditions, has assimilated them.

Writing of these results, Hogben\* says that "the ambiguity of the concept of causation" inherent in classical biometrical method has "completely obscured the basic relativity of nature and nurture." The difficulties inherent in multiple causation are here pithily summed up, and attention also drawn to the practical impossibility of comparing results obtained on material from different environments, and drawing genetic conclusions on their face value.

#### *The Race-Concept and the Social Environment*

The same is true of racial differences. It seems clear that the very idea of race as applied to man is a misnomer under present conditions. Professor Gates has indeed recently asserted† that the major races (colour varieties) of man should be regarded as true species. This appears to me to be a grave error, arising from a failure to recognize the biological peculiarities of the human species, as a species. These are due to man's mobility and his tradition, and result in a unique degree of variability combined with a failure of the usual tendencies to speciation: the incipient species are brought together again by migration and mingled by inter-crossing before any mutual infertility has been established.

While, however, modern genetics has shown that the term *race* only has meaning as a description of somewhat hypothetical past entities or as a goal for even more hypothetical future ideals,‡ yet it is of course clear that different ethnic groups (to use the most

general and non-committal phrase) differ in genetic characters. Ethnic groups obviously differ in regard to the mean values, and also the range and type of variability, of physical characters such as stature, skin-colour, head-and-nose-form, etc.; and these differences are obviously in the main genetic. There is every reason to believe that they will also be proved to differ genetically in intellectual and emotional characters, both quantitatively and qualitatively. But—and this cannot be too strongly emphasized—we at present have on this point no evidence whatever which can claim to be called scientific. Different ethnic groups have different languages and cultures; and the effects of the cultural environment are so powerful as to override and mask any genetic effects.

Most so-called racial traits are in point of fact national traits; and being so, they have no genetic or eugenic significance. In illustration we may think of those chief contributors to our own ancestry, the ancient Britons and the even less civilized Picts and Scots, of the Roman Imperial period. They were truly described by the Romans as barbarians. It is obvious that the difference between their then barbaric state and our present level of relative civilization is due entirely or almost entirely to changes in tradition and culture, material and other. The genetic basis on which this progress has been erected was doubtless a good one; but the only way to see whether other ethnic groups now in the barbaric stage of culture, such as the Bantu, differ in their genetical quality is to give them a similar opportunity. To assert, as is often done, that the present barbarism of, say, the Bantu is proof of their genetic inferiority is a gross error of scientific method.

The dangers of pseudo-science in these matters are being illustrated on a large scale, and with the accompaniment of much individual suffering and political danger, in present-day Germany. The Nazi racial theory is a mere rationalization of Germanic nationalism on the one hand and anti-Semitism on the other. The German nation consists of mendelian recombinations of every sort between Alpine, Nordic, and Mediterranean types.

\* *Op. cit.*, p. 95.

† Gates, 1934.

‡ Huxley and Haddon, 1935, especially Chapter IV.

The theory of Nordic supremacy and initiative is not true even for their own population :\* it is a myth like any other myth, on which they are basing a pseudo-religion of nationalism.

When we come to the distinction between Aryan and non-Aryan, the scientific error is magnified ; for the very term Aryan denotes the speakers of a particular type of language, and can by definition have no genetic significance. As Max Müller himself wrote in a belated recantation :† “ To me an ethnologist who speaks of Aryan race, Aryan blood, Aryan eyes and hair, is as great a sinner as a linguist who speaks of a dolichocephalic dictionary or a brachycephalic grammar.”

And when it comes to anti-Semitic measures, we must remember the elementary fact that the Jews are primarily a pseudo-national group, with a cultural and religious basis, not primarily an ethnic group with a genetic basis. Laws that lay down the amount of Jewish “ blood ” permissible in an “ Aryan ” have no quantitative basis and no real biological meaning.

The alleged inferiority of half-castes between whites and black or browns is another case in point. If the inferiority really exists, it is much more likely to be the product of the unfavourable social atmosphere in which they grow up than to any effect (which would be biologically very unusual) of their mixed heredity.

The results of intelligence tests applied to different ethnic stocks are for the same reason devoid of much value. Intelligence tests are now very efficient when applied to groups with similar social environment ; they become progressively less significant as the difference in social environment increases. Again, we must equalize environment upwards—here mainly by providing better educational opportunity—before we can evaluate genetic difference.

To sum up, in the practical handling of every so-called racial problem, the error seems invariably to have been made of confusing genetic with cultural factors. The former alone could legitimately be called

racial : but indeed the very term race disintegrates when subjected to modern genetic analysis. The net results are, firstly that it would be best to drop the term *race* from our vocabulary, both scientific and popular, as applied to man ; and secondly, and more importantly for our present purpose, that until we equalize environmental opportunity, by making it more favourable for those now less favoured, we cannot make any pronouncements worthy to be called scientific as to genetic differences in mental characters between different ethnic stocks.

In point of fact, so-called racial problems on analysis invariably turn out to be problems of culture-contact. A dominant civilization or class desires to continue its dominance over a civilization or class of different colour or ethnic type, or is afraid that its values will be impaired if it tries to assimilate those of the other group. These are very real problems : but let us tackle them as such, sociologically, not on the basis of a false appeal to genetic science.

#### *Genetic Differences Between Races and Classes*

My hearers must not imagine that I under-rate the extent of the genetic differences between human groups, be they classes or so-called races. Man as an animal organism is unique in several respects : and one of them is his abnormal range of genetic variability. A reminder of the basic nature of this variability is given by the recent work of Blake-lee on taste and smell.\* He finds that a number of substances which have a strong taste to some people, are not tasted at all by others. Thus the perceptive worlds inhabited by different human beings may be different on account of differences in genetic make-up. What far greater differences in conceptual worlds must be due to genetic differences in intelligence and emotion!

It would be most unlikely that this variability should be evenly distributed between different social and ethnic groups. As regards the latter, indeed, the existence of marked genetic differences in physical characters (as between yellow, black, white and brown) make it *prima facie* likely that differences in

\* Huxley and Haddon, *op. cit.*, Chapters III, VI, VII, IX.

† Müller, M., 1888, p. 245.

\* Blakeslee and Fox, 1932.



intelligence and temperament exist also. For instance, I regard it as wholly probable that true negroes have a somewhat lower average intelligence than the whites or yellows. But neither this nor any other eugenically significant point of racial difference has yet been scientifically established.

Further, even were the probability to be established that some "races" and some classes are genetically inferior to others as a fact, it seems certain, on the basis of our present knowledge, that the differences would be small differences in average level, and that the ranges would overlap over most of their extent—in other words that a considerable proportion of the "inferior" group would be actually superior to the lower half of the "superior" group. Thus no really rapid eugenic progress would come of encouraging the reproduction of one class or race against another: striking and rapid eugenic results can be achieved only by a virtual elimination of the few lowest and truly degenerate types and a high multiplication-rate of the few highest and truly gifted types.

Do not let us forget that the over-believers in genetics are not the only ones in error. While the view that the observed differences in achievement and behaviour between class and class, nation and nation, are primarily genetic, is untrue and unscientific, the opposite view that opportunity is all, and that we need only work at reforming the social environment, is precisely as unscientific and untrue. For instance, up to the present, the theoretical foundations of Communism have prevented the Russians, in spite of their great achievements in pure genetics, from paying proper attention to eugenics. It now appears, however, that they are being confronted with problems, such as the rarity of qualities making for leadership and the inherent difference between a born leader and an ordinary man, which are bound to bring them face to face with eugenics. Here we see a social bias operating in the first place, to be checked later by the realities emerging from the social situation.

#### *The Selective Action of the Environment*

But while the enormous differences in

social environment between nation and nation, class and class, normally mask any genetic differences that may exist, and, so far as visible and effective characters are concerned, largely override constitutional influences, it is clear that the social environment itself often exercises a selective influence which may be of great importance.

This selective influence is of two distinct kinds, which we may call pre-selective and post-selective. In simplest terms, pre-selective influences are those which attract certain types into an environment and discourage others. Post-selective influences are those which act on the population subjected to the environment, favouring certain evolutionary trends within it at the expense of others.

As a biological example, think of the assemblage of animals found living in caves. They are characterized broadly by poor eyesight and reliance on touch; the extreme types are eyeless, and pale or even colourless. It seems clear that both pre- and post-selective processes must have here been at work. Animals with somewhat poorly developed eyes, which shun the light and normally live in dark corners, will more frequently find themselves in caves, and will be likely to survive there better than more active and more "normal" types. But once a cave-population is established, selection will be at work to encourage the development of tactile and other organs for use in the dark; it will also cease to operate strongly or at all on the genes responsible for keeping up full pigmentation or perfect eyes, so that these will in many cases degenerate.

A striking example is that concerning the selective influence of the environment provided by fields of cultivated cereals. As Vavilov has shown,\* this favoured certain other plants, which could then flourish as what the farmer calls weeds, in association with the crop. Among these weeds were wild grasses related to the cultivated cereal; and in certain climatic conditions, these weeds flourished relative to the crop, became the dominant species, and were then used by man as the basis for a new crop-plant.

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\* Vavilov, 1926.

Just as cultivation of one crop-plant here provided the basis for the later development of another, so the social environment appropriate to one stage of human culture gives opportunities for the expression of human traits which may be destined to become dominant at a later stage. The eliciting effect of environment is in both cases essential.

The United States furnishes a classical human example. Pre-selection was at work on the pioneers. The human cargo of the *Mayflower* was certainly not a random sample of the English population. Religious zeal, independence of character, perhaps a tendency to fanaticism, together with courage, must have been above the average among the leaders, and probably in the whole band. The early settlers in Virginia and Carolina were pre-selected on other lines, though some of the characters involved were the same. After the first settlements were made, further immigrants until near the end of the nineteenth century were pre-selected for restlessness, initiative, adventurousness, and the qualities making up the pioneer spirit. The easily contented, the unadventurous and the timid, were pre-selected to remain behind. So, too, on the average, must have been those with artistic, philosophic, literary, or mathematical gifts. Even if the mean differences between those who went and those who stayed were not large, they must have been significant.

Once the immigrants were established in the country, selection continued. This post-selection, so long as there was an open physical frontier to the west, and an open economic frontier in the more settled regions, must on the whole have encouraged and discouraged the same qualities favoured by pre-selection: in addition, assertiveness and ambition were encouraged in the acute phase of "rugged individualism," while artistic and literary endowment still were at a discount. Of course the direct moulding effect of the social environment must have acted in the same sense as its selective effect; so that here again genetic differences would be masked. Yet on deductive grounds we can be certain that the selective effect would be

at work, and would produce genetic differences: the only question is the extent of those differences.

Whenever there are mass-movements of population, we are sure to find similar selective effects. The difference between the Southern Irish in America and in Ireland strikes every observer: we can hardly doubt that it is due in part (though doubtless not entirely) to a sifting of more from less adventurous types. And the same holds true of the obvious differences between rural and urban population in a country like our own. Whatever be the effect of country life and labour on a man's temperament, we can be sure that those who stayed behind were not as a group genetically identical with those who ventured away into the new life of the towns.

One of the profoundest selective influences ever brought to bear on the human population of the globe must have been that exerted by the invention and spread of agriculture, as has been well stressed by Ellsworth Huntington.\*

A settled agricultural civilization demands qualities in its members very different from those demanded by a nomadic or a hunting existence. Agriculture demands constant application; the pastoral life is freer, and hunting demands rather occasional outbursts of maximum energy. Agriculture demands foresight and the sacrificing of present comfort to future benefit; in the more primitive modes of life, activity springs more immediately from events. Agriculture demands steady routine in one spot; the nomad and the hunter can profitably indulge the spirit of restlessness.

Inevitably, it would seem, where early agricultural civilizations were growing up, there must have been a considerable drift of the more restless types out of them into the nomad and hunting cultures on their borders; and quite possibly there occurred also a converse movement inwards of more calculating and less restless types.

Further, once the agricultural civilizations were well established, a dominant class

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\* Huntington, 1928, Chapter XIV.

always appeared whose interests were bound up with the success of the group. The members of this class therefore were bound to encourage submissiveness and industry in the cultivators of the soil: and although much was in fact accomplished by purely environmental means, such as religion and law, there must again have been a selective effect, so that the level of inherent docility would tend to rise in the peasant class. Thus in the long run, agriculture must have markedly increased the selective value of tendencies making for the humdrum hard-working human virtues, and in its secondary effects, as in the birth of the merchant class and in other ways, have encouraged foresight and calculation.

Class differences in environment may also be selective. It seems to be established that the inhabitants of our industrial towns are on the average smaller and darker than those of the rural and small-town population.\* It may well be that there is a selection against tall and therefore rapidly-growing types on account of the unfavourable diet and living conditions of the slum dweller, since slow growth makes less demands upon a low supply of vitamins: and that tall stature is on the whole correlated with fair complexion. But whatever the cause, the fact remains, and can only be due to selection of some sort.

A recent report of the Industrial Health Research Board† points out that in the early part of the industrial era, the demand in factories was for men of good physique irrespective of build, while appearance or presence counted for more in shops and offices. This may have laid the basis for the observed fact that manual workers average shorter than blackcoated workers, but are stronger. It is quite likely that with the recent introduction of more automatic machinery, which does not demand strength, the type of selection will alter, and the factory workers come to lose their better physique.

The same report mentions that a fairly large sample of unemployed, contrasted with

a large sample of employed men, were slightly less tall and distinctly less strong. These were mainly men who would be the first to be turned off and the last to be taken on, so that selection seems definitely to have been at work here.

This brings up the large and important question of the selective effect of the class system as a whole in an industrial capitalist society. As many writers have pointed out, in so far as there is any ladder of opportunity by which men may rise or sink in the social scale, there must be some selective action. With the passage of time, more failures will accumulate in the lower strata, while the upper strata will collect a higher percentage of successful types.

This would be good eugenically speaking *if* success were synonymous with ultimate biological and human values, or even partially correlated with them; *and if* the upper strata were reproducing faster than the lower. However, we know that reproduction shows the reverse trend, and it is by no means certain that the equation of success with desirable qualities is anything more than a naïve rationalization.

Before, however, we discuss this further, let us look at some other effects of our pattern of class-system. Once we begin to reflect, we see that certain qualities are more favoured, often much more favoured, in some classes than in others. For instance, initiative and independence have less opportunity among unskilled labourers than elsewhere. Inclinations to art, science, or mathematics will be more favoured in the upper and upper-middle classes than elsewhere. The result may be truly selective, for instance by encouraging types genetically above the average in submissiveness among the proletariat. For the most part, however, it is likely merely to mask genetic differences. The fact that an undue proportion of artists, writers and scientists spring from the upper strata of society would then not mean that these strata were proportionately well endowed by heredity—merely that in the rest of society the Darwins and the Einsteins, like the Miltons, were mute and inglorious.

Two interesting recent studies by Gray and

\* Carr-Saunders, 1926, pp. 195-6.

† Ind. Health Res. Bd. Rept., 1935.

Moshinsky\* confirm and extend this conclusion. They show, on the basis of intelligence tests, and without discounting any of the superior performance of upper-class children as partly due to their superior environment, that our present educational system leaves vast reservoirs of innate intelligence untrained in the children from lower social strata. Contrary to usual belief, only about a third of the children whose performance is in the top thousandth, come from the higher social and the professional classes, while wage-earners contribute 50 per cent. of these children of "exceptional intelligence." Thus our society is not utilizing the innate intelligence of its members as it might, nor does the system give adequate opportunity for intelligence to rise.

Again, highly-strung types are less likely to achieve success in the lower economic strata, more likely to become neurotic or insane. People from the lower-middle and working classes who are apparently mentally deficient or abnormal have often reached their unfortunate condition because they have not had either the care or the opportunities for self-expression which would have been available in a more generous social environment.

Let us also remember that society as a whole can have a similar effect. Those same types which in Siberian tribes would achieve prestige and power as shamans and medicine-men, or in the medieval world would have become candidates for sainthood, would here and to-day often find their way into asylums.

#### *Artificial Selection in Relation to Different Environments*

This brings us on to a biological point whose importance has not always been realized. It is that selection is theoretically meaningless and practically without value except in relation to a particular environment. The practical implications are both the easiest to grasp and the more important for our purpose. In breeding domestic animals, as Hammond of Cambridge has so well stressed,† selection and breeding will not produce the desired results so quickly, and

may not produce them at all, if they are conducted in the unreal environment of an academic breeding station where optimum conditions are provided. They should be conducted in an environment similar to that in which the animals are destined to be used.

An extreme illustration of this is provided by cattle. In various parts of tropical Africa, the semi-arid bush country provides but scanty nutriment, and erosion has led to various mineral deficiencies. The native cattle are scrubby little beasts, no bigger than ponies, yielding not more than two gallons of milk a day, and growing so slowly that they do not breed until four to five years old. Contrasted with cows of a good modern British milking breed, which are double the size, give up to nine gallons of milk daily, and breed at two to three years of age, they are, you would say, very inefficient bits of biological machinery. Yet if we try to introduce European breeds into such areas, they are a complete failure. They make demands which are greater than can be met by the environment. And it is they which suffer; they become stunted, rickety or otherwise diseased, and cannot hold their own in competition with the native breeds. The native stock will stand a little genetic grading up in present conditions; but the only chance for radical improvement is to begin with improvement of the environment—the provision of mineral fertilizers, salt-licks, watering facilities, and so on—and then practice genetic selection to keep pace with the environmental change.

Another example is that of Stapledon's remarkable work on moorland grazings.\* By his methods, rough hill grazings can be converted into real pastures, capable of carrying many more sheep, and carrying them all the year round instead of only in the summer. But this can only be done by the simultaneous transformation of the environment and of the herbage stocks. The environmental transformation consists in breaking up the soil, followed by the application of certain mineral fertilizers. The genetic transformation consists first in the destruction of the original plant covering, brought about by

\* Gray and Moshinsky, 1935, *a* and *b*.

† Hammond, 1932 (pp. 251-2), 1935.

\* Stapledon, 1935.

the breaking-up of the soil, followed by the sowing of more nutritious pasture grasses and clovers. Furthermore, the new plants must be of special strains, previously bred and selected to resist the climatic conditions of the higher altitudes ; the ordinary strains that give good lowland pastures will not maintain themselves.

### *Eugenic Selection in Relation to Different Social Environments*

Precisely the same considerations apply to the improvement of man. Our schemes for improving the genetic qualities of the nation or the species are meaningless except in relation to some particular environment, present or future. Our eugenic ideals will be different according as we relate them to a slave order or a feudal order of things, a primitive industrial or a leisure order, a this-worldly or an other-worldly order, a capitalist or a socialist order, a militarist or a peaceful internationalist order. Even if we imagine we are working to absolute genetic standards, we are in reality thinking of them, albeit unconsciously, in relation to some ideal environment of the future, or to the needs and realities of the present social environment, or, very frequently, to our bias and *a priori* views about this present environment and how in our opinion it ought to be changed. If we were really treating of absolute genetic standards, we should have deserted reality for a metaphysical vacuum, and our reasoning and deductions would have even less value than a discussion of, say, eugenics in heaven. (Even in this latter case, be it noted, the discussion would inevitably be related to the environment which we supposed was awaiting us in the next world!)

Now all such unconscious thinking is inevitably irrational or at best non-rational : if it had been submitted to the light of reason, it would no longer be unconscious. So that a prime task before eugenists is the reasoned formulation of their views on the environment to which their schemes of genetic betterment are to be related.

There are, it seems to me, three possible

courses to be pursued. Either we may accept as given our present type of social environment, and adjust our eugenic programme to it. In practice we shall of course be forced to take a dynamic instead of a purely static point of view, and consider the trends of change within that environment, while assuming that the social system will not be fundamentally altered. Or, going to the opposite extreme, we may assume an ideal social environment—more scientifically, one which is the optimum we can imagine—and plan our eugenic measures in relation to that, piously hoping that in the long run social change will adjust itself to our ideal or to whatever measure of genetic change we may have brought about. Or finally we may envisage, as in Stapledon's grassland work, a joint attack upon environment and germ-plasm. Assuming that we have some measure of control over the social environment, we shall adjust our genetic programme to that programme of environmental change which represents, both in direction and tempo, a happy mean between the ideal and the immediately practical, between what we should like and what we are likely to get.

Let us look at these three alternatives and their implications. First, however, it should be pointed out that they are not wholly alternative to each other. Even if we take the environment for granted, we must face the fact of social change and attempt to meet it eugenically ; and in so doing we shall find it difficult to avoid giving some play to our wishes, fears, and hopes. Even if we assume an optimum environment, our ideal must be based on our conscious or unconscious estimate of what developments are inherently possible to the present system. We shall, in effect, be attempting to forecast social improvement, and we shall prove, we can be sure, as widely out in our forecasts as if we were attempting to prophesy the future of scientific discovery. And the third method, of necessity, must take into account both the hard fact of the present and the ideal of wishes and hopes for the future.

None the less, there are real differences between the three ; and we must consider these more in detail.

*Eugenics in Relation to the Actual and the Ideal*

To accept the continuance of the present type of social environment as essentially given (whether given in reality or in our hopes and fears will make no difference to our eugenic plans) means, I take it, two main things. It means that we must plan for a capitalist class-system, and for a nationalist system. We accept the division of society into economic strata, with large differences in standard of living, outlook, and opportunity between the different classes ; and we accept all the implications of the principle that the earning of a return on capital is the primary aim and duty of business and finance, whatever minor modifications and regulations may be found desirable or opportune. We accept individualist competition, however much toned down in practice, as essential. Further, we accept the division of the world into nationalist states, which, however their sovereignty and independence of action may be modified or curtailed by international agreements, will be competing as well as co-operating with each other, and must in certain eventualities be prepared to resort to war.

Coming down to results, we accept the economic and spiritual frustrations of the system also—that is to say, we accept the necessity of some degree of unemployment, for without that there can be no approach to a free market for labour ; we accept the continuance of trade cycles of boom and slump, even though they may be toned down in amplitude. We accept the need for restriction of output whenever surplus interferes with profit. We accept the existence of a cheap supply of unskilled and semi-skilled workers ; we accept the need for man-power in case of war.

If so, then we must plan our eugenic policy along some such lines as the following :

First comes the prevention of dysgenic effects. The upper economic classes are presumably slightly better endowed with ability—at least with ability to succeed in our social system—yet are not reproducing fast enough to replace themselves, either absolutely or as a percentage of the total

population. We must therefore try to remedy this state of affairs, by pious exhortation and appeals to patriotism, or by the more tangible methods of family allowances, cheaper education, or income-tax rebates for children. The lowest strata, allegedly less well-endowed genetically, are reproducing relatively too fast. Therefore birth-control methods must be taught them ; they must not have too easy access to relief or hospital treatment lest the removal of the last check on natural selection should make it too easy for children to be produced or to survive ; long unemployment should be a ground for sterilization, or at least relief should be contingent upon no further children being brought into the world ; and so on. That is to say, much of our eugenic programme will be curative and remedial merely, instead of preventive and constructive.

Then, in systems like the present, man-power is important, and for man-power, quantity of population above a certain minimum qualitative standard is as essential as raising quality ; and if the two conflict, quantity supply must not be interfered with. For qualitative change, a dual standard is indicated—docility and industrious submissiveness in the lower majority ; intelligence, leadership and strength of character in the upper few. Since a high degree of intellect and imagination, of scientific and artistic ability and other qualities, cannot be adequately expressed or utilized, under any system resembling the present, in the great majority of the lower strata, it is useless to plan for their genetic increase in these strata. Indeed, it is more than useless, it is dangerous ; for the frustration of inherent capacity leads to discontent and revolution in some men, to neurosis and inefficiency in others. The case is strictly analogous to that of cattle in Africa ; in an unfavourable environment, too drastic genetic improvement is worse than none.

Next we come to planning for an ideal or optimum environment. An obvious difficulty here is that the various optima conceived by different minds, or groups of minds, will be so different as to be irreconcilable. Putting this on one side, however, it is I think

possible to state the sort of optimum which would commend itself to the mass of what we may call "men of goodwill." It would, I take it, be a social environment which gave the opportunity, first of work which was not excessive, which was felt to be useful, and whose rewards would provide not only the necessities but a reasonable supply of the comforts and amenities of life: secondly, of a reasonable amount of leisure: thirdly, the opportunity to everyone of expressing whatever gifts of body and mind they might possess, in athletics or sport; in art, science or literature, passive or actively enjoyed; in travel or politics, in individual hobbies or in social service.

If so, then we should plan a eugenic programme with a single and very high standard. We should aim at a high level of inherent physical fitness, endurance and general intelligence; and we should encourage the breeding of special talent of any and every sort, for mathematical as much as for business success, artistic as much as administrative. We should realize that, if we succeeded, our genetic results would over a great range of the population be out of harmony with their social surroundings, and would either be wasted or lead to friction and discontent, or might express themselves in characters such as neurosis or a sense of maladjustment which would represent a lower level than that from which we started. For ultimate success we should rely on creating a demand for changing the environment towards our optimum. The supply of genetic types which could only reach proper expression in such an environment would help to create the demand; the friction and discontent would add themselves to the forces of change.

#### *Simultaneous Control of Heredity and Environment*

It will, however, by now have become clear that neither of these approaches is so satisfactory as the third. Indeed, neither is methodologically sound. If the aim of eugenics be to control the evolution of the human species and guide it in a desirable direction, and if the genetic selection should

always be practised in relation to an appropriate environment, then it is an unscientific and wasteful procedure not to attempt to control environment at the same time as genetic quality. Science is simultaneously both theory and practice, both knowledge and control. For the applied science of eugenics to neglect the environment is a source both of confusion and of practical weakness. I would go farther: I would say that we cannot succeed in achieving anything in the nature of adequate positive eugenics unless we attempt the control of the social environment simultaneously with the control of the human germ-plasm, any more than Stapledon could have improved his rough mountain grazings save by a similar double attack.

Let us then look more in detail into this third or dual method of approach. It has two facets, theoretical and practical. On the theoretical side, we shall only progress in our attempt to disentangle the effects of nature from those of nurture in so far as we follow the footsteps of the geneticist and equalize environment. We shall never be able to do this in the same radical way as the pure scientist, by testing out a whole range of controlled and equalized environments on selected stocks. We must therefore concentrate on producing a single equalized environment; and this clearly should be one as favourable as possible to the expression of the genetic qualities that we think desirable. Equally clearly, this should include the following items. A marked raising of the standard of diet for the great majority of the population, until all should be provided both with adequate calories and adequate accessory factors; provision of facilities for healthy exercise and recreation; and upward equalization of educational opportunity. The further we move in this direction, the more readily shall we be able to distinguish inherent physical and mental defects from environmental stunting and frustration; the higher we raise the average, the more certain shall we be that physical or mental performance above the average is dependent upon genetic endowment and therefore provides the raw material for

positive eugenics. Not only this, but we know from various sources that raising the standard of life among the poorest classes almost invariably results in a lowering of their fertility. In so far, therefore, as differential class-fertility exists, raising the environmental level will reduce any dysgenic effects which it may now have.

Returning, however, to the more important aspect of the eugenic knowledge to be gained by levelling up the social environment, I anticipate that at the bottom, the social problem group, though shrinking in size, will be left, clearly marked out by its inadequate performance in the new and favourable conditions, as a well-defined target for measures of negative eugenics such as segregation and sterilization; and that minor targets of the same nature will emerge out of the present fog, in the shape of nests of defective germ-plasm inspissated by assortative mating and inbreeding, such as have been imaginatively glimpsed by Lidbetter and others. I further anticipate that the professional classes will reveal themselves as a reservoir of superior germ-plasm, of high average level notably in regard to intelligence, and therefore will serve as a foundation-stone for experiments in positive eugenics. And I anticipate that society will tap large resources of high ability that are at present unutilized, thus facilitating the social promotion of at least certain fitter elements; and without social promotion we cannot proceed to reproductive encouragement. This is the scientific ideal at which we should aim. Like many other ideals, we shall not achieve it; but any approach to it will help us towards a more certain knowledge.

Science, however, is control as well as knowledge; and new practice may advance theory as much as new theory lay the basis for practice. This is especially true for the social sciences, where, as we have seen, rigorously controlled experiment, on the pattern of pure physics or physiology, is impossible, and problems must frequently be solved *ambulando*. We make a partial experiment which is simultaneously pure and applied science. The experiment is both an attempt to gain knowledge and an

effort to realize a wish, a desired control. It is planned, like more crucial experiments in the natural sciences, to verify deductions from known facts. In so far as the desired end is attained, the deductions are verified and knowledge is increased: and even if the control is not attained, knowledge is increased, though not to the same extent.

This more empirical mode of attack must also be used in eugenics. We must attempt to control the change of social environment and at the same time to control the change of human germ-plasm, along lines which appear likely to yield tangible and desirable results. It is the results which interest us. Admirable germ-plasm unable to realize itself owing to unfavourable conditions does not interest us: nor do the most alluring social conditions, if they permit or encourage the deterioration of the germ-plasm. Thus the two attacks must be planned in relation to each other, and also in relation to practicability.

#### *The Dysgenic Character of our Present Social System*

When we think along these lines, we shall find, I believe, that a system such as ours, a competitive and individualist system based on private capitalism and public nationalism, is of its nature and essence dysgenic. It is dysgenic both in the immediate respect of failing to utilize existing reservoirs of valuable genes, and also in the long-range tasks of failing to increase them, failing to trap and encourage favourable mutations, and failing to eliminate harmful mutations.

Under our social system, the full stature or physique of the very large majority of the people is not allowed to express itself; neither are the full genetic potentialities of health permitted to appear except in a small fraction of the whole, with a consequent social waste of energy and time, not to mention a waste of individual happiness which is formidable in extent; and finally, innate high ability is encouraged or utilized only with extreme inadequacy. For the first two wastes, ignorance is partly responsible, but in the lower economic strata, poverty



is the chief cause. For the latter, our inadequate educational system is chiefly responsible.

Then R. A. Fisher has brilliantly and devastatingly shown\* the relentless way in which such a system as ours promotes both infertility and certain types of talent, and in so doing ties together the genetic factors responsible. In the course of the generations genes making for small families become increasingly bound up with those making for social and economic success; and conversely those making for social and economic failure become bound up with those making for high reproduction rates. Eugenically speaking our system is characterized by the social promotion of infertility and the excess fertility of social failure.

If this be true, then so long as we cling to a system of this type, the most we can hope to do is to palliate its effects as best we may, by extending birth-control facilities downwards, instituting graded systems of family allowances, providing for sterilization here and financial relief for children there. But even if we thus reduce the distortion we cannot hope to change its sign.

Then, in so far as our system remains nationalist, the demand for man-power and quantity will continue to interfere with the higher aim of quality. Furthermore, modern war itself is dysgenic. This has often been pointed out as regard its direct effects. It appears, however, also to hold for its indirect effects; many among the more imaginative and sensitive types are to-day restricting their families, sometimes to zero, because they feel that they cannot bear to bring children into a world exposed to such a risk of war and chaos.

As eugenists we must therefore aim at transforming the social system. There may of course be those amongst our ranks who prefer the not disagreeable rôle of a Jeremiah darkly prophesying gloom to settling down at the more prosaic job of constructive work. But as a body, we shall wish, I take it, to see at least the possibility of our dreams coming true.

### *The Eugenic Approach to Control of the Social Environment*

What sort of practical changes, then, should we as eugenicists try to encourage in the social and economic system? In the first place—what we have already noted as desirable on theoretical grounds—the equalizing of environment in an upward direction. For this, by permitting of more definite knowledge as to the genetic constitution of different classes and types, will at once give us more certainty in any eugenic selection, negative or positive, upon which we may embark; and secondly, we must aim at the abandonment of the idea of national sovereign states, and the subordination of national disputes to international organization and supernational power.

But we need something more radical than this—we must try to find a pattern of economic and communal life which will not be inherently dysgenic; and we must also try to find a pattern of family and reproductive life which will permit of more rapid and constructive eugenics.

On the first point, it seems clear that the individualist scramble for social and financial promotion should be dethroned from its present position as main incentive in life, and that we must try to raise the power of group incentives. Group incentives are powerful in tribal existence, and have been powerful in many historical civilizations, such as the old Japanese. What interests us chiefly, however, is to find that they have been to a large extent effective in replacing individualist money incentives, or at least diminishing their relative social importance, in several modern States, notably Germany and the U.S.S.R.

It is not for a biologist to discuss the purely social merits of different political philosophies: but he may be allowed to point out that not all group-incentives are equally valuable from the eugenic standpoint. Those of Nazi Germany, for instance, presuppose an intensification of nationalist feeling and activity instead of their diminution: and this, we have concluded, is actually anti-eugenic. It may of course be urged that it is in its immediate effect

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\* Fisher, 1930, Chapter XI.

eugenic ; and there will be many to uphold the value of the eugenic measures recently adopted in Germany under the stimulus of National-Socialist ideas and emotions, even if some of them be crude and unscientific. But if in the long run it leads to overpopulation and war, it is essentially dysgenic, and in matters of evolution we must, I think, take the long view.

Further, if the social environment is such as to give satisfaction to the possessors of social traits such as altruism, readiness to co-operate, sensitiveness, sympathetic enthusiasm, and so forth, instead of, as now, putting a premium on many antisocial traits such as egoism, low cunning, insensitiveness, and ruthless concentration, we could begin to frame eugenic measures for encouraging the spread of genes for such social virtues. At the moment this is hardly possible, for the expression of such genes is so often inhibited or masked by the effects of the environment. This is a human illustration of Hammond's general principle, that breeding and selection for a given type can only be efficiently carried out in an environment favouring the fullest development of the type.

There is no doubt that genetic differences of temperament, including tendencies to social or antisocial action, to co-operation or individualism, do exist, nor that they could be bred for in man as man has bred for tameness in and other temperamental traits in many domestic animals, and it is extremely important to do so. If we do not, society will be continuously in danger from the antisocial tendencies of its members.

Just as the basic structure of our present social system is essentially dysgenic, so we may say that the genetic composition of our present population is largely and perhaps essentially antisocial. Thus both environmentally and genetically the present state of mankind is unstable, at war with itself.

Another important point to remember, especially in these days when the worship of the State is imposing a mass-production ideal of human nature, is the fact and the significance of human variability. The variability of man, due to recombination between divergent types that have failed to become

separated as species, is greater than that of any wild animal. And the extreme variants thrown up by the constant operation of this genetic kaleidoscope have proved to be of the utmost importance for the material and spiritual progress of civilization. Whatever bias or prejudice may beset the individual eugenicist, eugenics as a whole must certainly make the encouragement of diversity one of its main principles. But here again the environment comes in. If extreme types are to be produced, especially gifted for art, science, contemplation, exploration, they must not be wasted. The social system must provide niches for them.

As a special and important special case of providing for variability, there are the needs of the educational profession. At the moment, this social category seems definitely selective in that it attracts and encourages men and women of an intellectualist and academic type. This is partly because there are not sufficient outlets provided elsewhere in our social system for such types, partly because the educational profession as at present constituted does not provide sufficient attraction for contrasted types. This restriction of type among those responsible for the upbringing of the next generation cannot be satisfactory, and an altered status for the educational profession so that its genetic basis is broadened is an important task for social biology, and, since it involves genetics, legitimately part of the eugenic movement.

#### *Eugenics and Reproductive Morality and Practice*

Still more important for the comparatively immediate future is the relation of the dominant group-incentive to reproductive morality, law, and practice. We all know that certain schools of Christian thought to-day are opposed on grounds of religious principle to birth-control, that indispensable tool of eugenics as well as of rational control of population, and even to the very notion of eugenics itself. But even if this opposition could be overcome, there would remain in this field grave obstacles, both to the spread of the eugenic idea and to the rate of its

progress in practice. These are the prevailing individualist attitude to marriage, and the conception, based on this and on the long religious tradition of the West, of the subordination of personal love to procreation. The two influences together prevent us collectively from grasping the implications of the recent advances in science and technique which now make it possible to separate the individual from the social side of sex and reproduction. Yet it is precisely and solely this separation that would make real eugenics practicable, by allowing a rate of progress yielding tangible encouragement in a reasonable time, generation by generation.

The recent invention of efficient methods on the one hand of birth-control and on the other of artificial insemination have brought man to a stage at which the separation of sexual and reproductive functions could be used for eugenic purposes. But it is of real interest to note that these inventions represent merely the last steps in an evolutionary process which started long before man ever existed.

In lower mammals, the existence of limited breeding seasons, and, during these, the restriction of mating to the oestrous phase in the female's reproductive cycle, do in fact link sexual behaviour firmly with reproduction. But in the great primate stock to which we belong, a new trend early becomes apparent. Breeding seasons are less definite, and mating may occur at any time during the female cycle, so that most acts of union are in fact and of necessity infertile, without reproductive consequences. This trend becomes more marked as we ascend the evolutionary scale, and culminates in man. In civilized man, the faint traces of a breeding season apparent in certain primitive ethnic stocks have wholly disappeared, and there is no greater readiness to mate during the short period when alone conception is possible than at most other times of the female cycle.\*

This has already led in point of fact to the widespread separation of the personal function of sexual union from its racial consequences, of love from reproduction. It is true

that some persons and bodies on theological or metaphysical grounds either ostrich-like deny the existence of this separation, or assert that it ought not to be practised; but this does not alter the fact.

The perfection of birth-control technique has made the separation more effective; and the still more recent technique of artificial insemination has opened up new horizons, by making it possible to provide different objects for the two functions. It is now open to man and woman to consummate the sexual function with those they love, but to fulfil the reproductive function with those whom on perhaps quite other grounds they admire.

This consequence is the opportunity of eugenics. But the opportunity cannot yet be grasped. It is first necessary to overcome the bitter opposition to it on dogmatic theological and moral grounds, and the widespread popular shrinking from it, based on vague but powerful feelings, on the ground that it is unnatural.

We need a new attitude to these problems, an attitude which for want of another term we may still call religious. We need to replace the present attitude fostered by established religions by a new but equally potent attitude.

As regards the sense of salvation, we need to substitute social salvation for individual salvation; and as regards the need of some escape-mechanism from the pressure of present difficulty, we need to substitute the real possibility of evolutionary progress for other-worldly phantasies. Once this possibility of true human progress, both social and genetic, is generally apprehended, and the social system remodelled so that individual success does not conflict with communal welfare, and self-expression and personal satisfaction can be largely achieved in serving society, then sex and reproduction can take their due places as individual and social functions respectively. Gone will be many of the conflicts inherent in present-day marriage: any sacrifice involved in parenthood will be made on the altar of the race, and in the knowledge that it will be acceptable. Those who wish to pursue further the possibilities of such a step should consult

\* Zuckerman, 1932, p. 73 f.

Mr. Brewer's recent article on Euteleogenesis\* and Professor Muller's book *Out of the Night*.† Here it must suffice to point out that unless we alter the social framework of law and ideas so as to make possible the divorce between sex and reproduction, or if you prefer it between the individual and the social sides of our sexual functions, our efforts at evolutionary improvement will remain mere tinkering, no more deserving the proud title of eugenics than does the mending of saucepans deserve to be called engineering.

That consummation, you will perhaps say, is impossibly remote from our imperfect present, hardly to be affected by any of our little strivings to-day. That may be so: but I am not so sure. Let us remember that modern science is a mere three centuries old: yet it has already achieved changes in outlook that are of comparable magnitude. Biological science is only now attaining its maturity, and the social sciences are mere infants. Looked at in the long perspective of evolution, the present phase of human activity is one of transition between that of acceptance and that of control of destiny, between magic and science, between unconsciously-nurtured phantasy and consciously-faced reason. It is, in the sense of the word used in physics, a critical phase: and being so it cannot be either stable or long-enduring.

It is to my mind not only permissible but highly desirable to look far ahead. Otherwise we are in danger of mistaking for our eugenic ideal a mere glorification of our prejudices and our subjective wish-fulfillments. It is not eugenics but left-wing politics if we merely talk of favouring the survival and reproduction of the proletariat at the expense of the bourgeoisie. It is not eugenics but right-wing politics if we merely talk of favouring the breeding of the upper classes of our present social system at the expense of the lower. It is not eugenics but nationalist and imperialist politics if we speak in such terms as subject races or miscegenation. Our conclusions in any particular case *may* be on balance eugenically correct

(though the correlation between broad social or ethnic divisions and genetic values can never be high), yet they will not be based primarily upon eugenic considerations, but upon social or national bias. The public-school ideal, or that of the working-class movement, or that of colonial imperialism, may be good ideals; but they are not eugenic ideals.

#### *The Danger of Man's Genetic Degeneration: Conclusion*

Before concluding, I should like to draw attention to one eugenically important consequence of recent progress in pure genetics. In all organisms so far investigated, deleterious mutations far outnumber useful ones. There is an inherent tendency for the hereditary constitution to degrade itself. That man shares this tendency we can be sure, not only from analogy but on the all-too-obvious evidence provided by the high incidence in "civilized" populations of defects, both mental and physical, of genetic origin.

In wild animals and plants, this tendency is either reversed or at least held in check by the operation of natural selection, which here again proves itself to be, in R. A. Fisher's words, a mechanism capable of generating high degrees of improbability. In domestic animals and plants, the same result is achieved by our artificial selection. But in civilized human communities of our present type, the elimination of defect by natural selection is largely (though of course by no means wholly) rendered inoperative by medicine, charity, and the social services; while, as we have seen, there is no selection encouraging favourable variations. The net result is that many deleterious mutations can and do survive, and the tendency to degradation of the germ-plasm can manifest itself.

To-day, thanks to the last fifteen years' work in pure science, we can be sure of this alarming fact, whereas previously it was only a vague surmise.\* Humanity will gradually destroy itself from within, will decay in its very core and essence, if this slow but

\* Brewer, H., 1935.

† Muller, H. J., 1935.

\* Muller, H. J., 1935.

relentless process is not checked. Here again, dealing with defectives in the present system can be at best a palliative. We must be able to pick out the genetically inferior stocks with more certainty, and we must set in motion counter-forces making for faster reproduction of superior stocks, if we are to reverse or even arrest the trend. And neither of these, as we have seen, is possible without an alteration of social system.

Whether or not I have been asking you to accompany me too far into the visionary future, I will end this lecture with a very concrete suggestion for the present, backed by a warning from the immediate past.

Twenty-five years ago, when I had just taken my degree, the field of heredity was still a battle-field. The Mendelians and the Biometricians were disputing for its possession, and in the heat of the struggle little mercy was shown by either side to the other. In the last dozen years or so, however, the apparent conflict of principle has been shown not to exist, and now, thanks to the work of such men as R. A. Fisher and J. B. S. Haldane, we realize that the two methods of approach are complementary, and that certain important problems can only be solved by their simultaneous employment.

The present position of Eugenists appears to me to be closely parallel with the position of the Mendelians a quarter of a century ago. They find themselves in apparent conflict with the environmentalists and the protagonists of social reform. Speaking broadly, the field of human improvement is a battle-field between Eugenists and Sociologists, and the battle is often as violent as that between the Mendelians and Biometricians—or between Swift's Big-endians and Little-endians. In my opinion, it is also as unreal and useless. We eugenists must no longer think of the social environment only in its possible dysgenic or non-eugenic effects, but

must study it as an indispensable ally. Changes in social environment are needed both for the adequate expression of eugenic progress, and as a means for its realization.

The next step for eugenics is, as I urged at the beginning of this address, a methodological one. We eugenists must familiarize ourselves with the outlook and the concepts of sociology, with the technique and practice of social reform; for they are an indispensable part of the machinery we need to realize our aims.

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