

THE ESSEX HALL LECTURE FOR 1969

EUGENICS
AND
HUMAN HEREDITY

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MA, DM, FRCP

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EUGENICS AND HUMAN HEREDITY

This is the Essex Hall Lecture for 1969, and was delivered in Sheffield on 14 April 1969. Essex Hall is the headquarters of the General Assembly of Unitarian and Free Christian Churches, and stands on the site of the building in which the first avowedly Unitarian congregation met in 1774. The lecture was founded in 1892, and many distinguished men in varied fields have contributed to the series. The delivery of the lecture is one of the leading events during the annual meetings of the Assembly.

A list of the previous lectures still in print will be found in the catalogue of the Lindsey Press.

IT IS A TRUISM that the coming of new scientific knowledge brings with it the responsibility to use that knowledge for the benefit of mankind. Some sciences have no obvious direct applications to human beings, for example astronomy; on the other hand nuclear physics has very direct application to man and Professor Rotblat discussed some of these applications in the 1964 Essex Hall Lecture. All branches of human biology are bound to have applications to men, and this is particularly the case with human genetics, the most fundamental of the branches of human biology. Men and women in many civilisations past and present have been conscious of this. It is only in the last few decades however that three developments—the advent of highly effective methods of family planning, the control of the main causes of death in childhood, and the much more precise knowledge of genetics – have put into our own hands the control of our own biological evolution.

Until recently in almost all societies couples had as many children as resulted naturally in marriage, averaging perhaps as many as six, but there was a very high infant and childhood mortality, such that on average only some two children survived into adult life to become parents. The quality of the next generation depended little on individual parental choices, and any genetic change from generation to generation depended largely on the selective effects of the infection and malnutrition which was responsible for the infant and childhood mortality. The most important genetic changes would have been related to the capacity to develop resistance to infection, though the high death rate also no doubt tended at least to maintain genetic levels for qualities generally important for survival, for example intelligence and perseverance. On the whole the more capable parents would have kept more children alive than the less capable. Now with the planned family of

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usually two or three children almost all of whom survive, any genetic changes that are occurring will come not from selective differences in child mortality, but in genetic differences between those parents who decide to plan families of more than two or three children and those who plan two or less. Each individual couple in planning the size of their family are in fact in some small degree affecting the genetic evolution of the population.

A child's development depends on the interaction of its genetic potential and the environment which he or she experiences. We almost all accept that we should attempt to give our children and our fellow citizens' children an environment which will enable them to realise their full physical and mental growth potential. We must now increasingly accept that we also owe it to our children to see that as far as possible they are born without genetic predisposition to major physical or mental handicap and that as many as possible are born with a genetic potential for growth into healthy, intelligent and socially useful members of the community. The main responsibility for the environmental care of children rests, we are agreed, with the parents, though the community should help with the services that are best provided communally, for example education and medical care. It is accepted however that in exceptional instances when parents are failing badly in their responsibility in bringing up the child the community may well need to take the child into statutory care. The main responsibility for the genetic health of children again, in my opinion, rests with individual parents, though the community as a whole has a duty to see that parents are educated in genetic principles, and a duty to provide services whereby they can get advice on family planning and advice about specific genetic problems that may exist in the particular family. It is I think doubtful whether the community as a whole ever has the right to interfere directly and enforce family limitation. One may envisage hypothetical situations where a couple with a high risk of having handicapped children might wish irresponsibly to have a large family of such handicapped children. However, I know of no examples of such behaviour. Parents behave with good sense and responsibility once the issues are presented to them.

The genetic considerations that should influence parents when planning the size of their families may be conveniently if artificially divided into negative and positive, the field respectively of negative and positive eugenics. The negative considerations are partly medical and partly social. The medical considerations involve the risk of genetically determined malformation and disease. The total load of genetically determined malformation and disease

is a large one and coming into prominence in countries such as our own now that the infectious and nutritional diseases are being brought under control.

One group of conditions which are genetically determined are those due to abnormalities of the chromosomes. These are the structures, 23 pairs that is 46 in all, within the cell nucleus which carry the hereditary factors (the genes). About a third of all patients of school age with severe mental subnormality, what used to be called idiocy and imbecility, have the specific condition, mongolism, which is genetically determined and due to the presence of an extra small chromosome in all their cells. The care and life-expectancy of these children is now greatly improved, but no way of appreciably influencing the mental handicap has been found. Altogether about 1 live-born child in 100 has some form of chromosome abnormality. The least dangerous of these as regards health are the abnormalities of the sex chromosomes; but even these may cause sterility, carry a risk of milder degrees of subnormality and at least one type, those with an extra Y chromosome, carry a substantially increased risk of serious behaviour disorder. These abnormalities can be recognised looking at dividing cells from the patient under the microscope.

Also about 1 child in 100 is born with a genetically determined condition where the underlying abnormality is not of a whole chromosome, but of just one gene. This is a much smaller scale anomaly, not microscopically visible, but some of them nevertheless produce severe handicap. Some familiar examples are muscular dystrophy, haemophilia and cystic fibrosis of the pancreas. Some of these conditions may be present at birth, but others may not cause trouble till middle age, even though the abnormal gene is present from conception. Over a thousand conditions are determined in this way, the most common individual one in the United Kingdom being cystic fibrosis which affects about 1 in 2000 live-born children. Also about two children in 100 are born with one of the major congenital malformations. These are abnormalities of structure where the organ has not completed full development in foetal life. The two most important are congenital heart malformations, which affect about 1 child in 200 live-born children and spina bifida, a congenital malformation of the spinal cord, which affects about 1 child in 500 live-born children. With both these malformations substantial progress has been made in recent years in surgical treatment though the total load of handicap is still a major one.

Genetic counselling, the prevention of these conditions, is essentially a matter for co-operation between parents at risk of having children with these disorders and the medical services, though some quite difficult ethical problems are involved, both for parent and doctor. The decision whether or

not to have children when there is a risk of the child having a genetically determined physical or mental handicap rests, I think, essentially with the parents. It is the duty of the medical profession however to provide the parents with the best information on just what the risks are and to put these risks into perspective for them. This is what has come to be known as 'genetic counselling' and specialist clinics to give advice of this kind have now been established at most of the university medical schools, usually in association with the department of child health. At the Institute of Child Health in London, attached to the Hospital for Sick Children, Great Ormond Street, such a clinic has now been running for twenty years. The commonest reason for enquiry at this clinic is that the parents have already had one child with some major handicap and are concerned about the risks to any further children they may have. In some instances one or other of the parents themselves have an abnormality and are worried about its transmission to their offspring. In some instances one of the parents' near relatives has a genetically determined disorder. In practice it is found that in a number of instances one can be reassuring and tell the parents that the risks to further children are small, perhaps little more than the random risk. Examples are instances where though the child's handicap is genetically determined, the genetic abnormality has arisen as a fresh 'sport', that is a fresh mutation, and so is unlikely to repeat. Most instances of mongolism for example are due to a chance error in formation of the mother's ovum, whereby one small chromosome too many enters the ovum, and this accident is unlikely to repeat in later pregnancies. However, in a minority of instances, particularly when the mother is young, the chromosome abnormality in the mongol child is due to a chromosome anomaly in one or other parent. Here the risk of recurrence may be high. Special tests are now available to pick out these special cases.

In another group of situations in genetic counselling the risks for any children or for further children are substantially greater than the risk of that malformation or disease for parents taken at random, but still not too bad a risk in relation to the total collective risk that the product of any random pregnancy will have some kind of serious handicap. For both the congenital heart malformations and the congenital malformations of the neural tube the recurrence risks are of the order of 1 in 25. This is about ten times the random risk for these specific malformations, but all the same not too bad a risk, and it is the usual practice to suggest to parents that this is not an unreasonable risk for them to take. In another group of situations in genetic counselling the risks for any children or for further children may be high, for example 1 in 4, 1 in 2, or even 1 in 1, though fortunately the last situation,

where the child is certain to be abnormal, is rare. Obviously these high risks, if for seriously handicapping conditions, should make the parents ask themselves whether they should have children, or further children; but morally the final decision rests with the parents. A follow-up after 5 to 10 years of parents who attended the clinic at the Hospital for Sick Children has shown that on the whole parents do take what most of us would regard as sensible decisions. In particular where a high risk was involved, some three quarters of the parents concerned decided to have no more children and one quarter decided they would take the risk. We do not feel critical of those who take the risk. Parents were sometimes prepared to take risks if the subsequent child if affected will die in infancy. Parents will seldom take a high risk if an affected child is likely to survive many years with a major physical or mental handicap, such as severe mental subnormality or one of the serious forms of muscular dystrophy. In addition some of these parents who had planned no more children in fact became pregnant again. Some accepted the pregnancy, and some asked for and were granted a termination of the pregnancy. A few were refused a termination, but this was before the new abortion law was passed and they would probably have had no difficulty now.

The precision of genetic counselling is steadily increasing with the development of new tests for those who, for example, carry mutant genes without themselves being affected. In addition a new technique is on the horizon which will enable foetuses to be screened early in pregnancy for many genetically determined conditions to see if a particular foetus, with say a 1 in 4 risk, is in fact affected or not. This new technique involves aspirating into a syringe a few cubic centimetres of the fluid surrounding the foetus, and growing the cells contained in the fluid, cells which have been derived from the foetus. The chromosomes of the foetus may be examined from this material and also some at least of the biochemical tests diagnostic of genetically determined diseases due to mutant genes may be applied to the cells. If the parent's religion makes it possible for them to accept the offer of a termination of a pregnancy this technique will greatly help. With say a 1 in 5 risk of mongolism because a mother herself has a minor chromosome anomaly parents have in a few instances already been prepared to embark on another pregnancy, knowing that if the foetus is abnormal the pregnancy will be terminated. This technique is also likely to be used, though this is some little way in the future, as a routine for example when pregnant women are over the age of 40 years. At this age it is known there is an increased risk of chromosome anomalies, quite apart from any leads from the family history; for example more than 1 per cent of babies born to mothers over the

age of 40 years have mongolism.

It is not often that there will be social indications strongly suggesting that any particular couple would be wise to plan no more children. There will be occasional instances where the health of the parents, especially the mother, will make it unlikely that they can satisfactorily rear children. There will be occasional instances where one or both parents have character defects such that they are unlikely to be able to provide a home for children. Children need love and those who, and it is no fault of theirs, have no natural fondness for and delight in children should not have children. There are the unfortunately not too rare instances where psychologically disturbed parents are a real danger to their children and all child specialists are familiar with what is called the 'battered baby' syndrome. Social workers too, especially in the big cities, are familiar with 'problem families' in which the children present multiple problems to the medical and social services. The trouble here all too often is that with limited ability and poor social resources the parents who could have managed with one or two children have become overtaxed and then apathetic following the birth of a succession of children. While the genetic issues involved here are not simple and some of the children in these families might do well in another environment, on the whole their potential for development into capable and socially useful citizens is probably less than average. The eugenicist would welcome family limitation in these families on genetic grounds, at least after one or two children, a limitation which in any case is desirable on social grounds.

Experience indicates that in few instances did the parents in these problem families actively wish for a large family. The main need is to help them to limit the size of their families. The new abortion law, with its acceptance of social indications for abortion, should be of great value here, especially when combined with an offer of sterilisation where the mother has already a large family. Aberdeen, under the leadership of the last Professor of Obstetrics, Sir Dugald Baird, has long set a good example of offering sterilisation to women in this group. In addition there is a real need to take the teaching of family planning methods into the homes of these women. It is not easy for them to attend clinics of any kind and it has been shown, for example in Newcastle and Southampton, that a domiciliary family planning service can be most effective in preventing further conceptions in these families. One devoted woman doctor can manage a case-load of about a hundred such families and maintain family planning, where sterilisation is not wanted or inappropriate. Women in this problem family group will be greatly assisted

when some form of long term but reversible method of conception control becomes available. The contraceptive pill is a help, but still demands more intelligent and regular behaviour than that of which many of them are capable.

In relation to negative eugenics we have been asking what are the considerations that should lead parents to decide to have no children or perhaps only one or two children, that is to plan a family well below replacement rate. In thinking about positive eugenics we are asking perhaps the more difficult question as to which parents should, on the grounds that on the whole they have valuable genetic potentialities to transmit to children, aim at a family size of more than replacement rate, that is at three or more children. I use replacement rate as the mean for family size since it is obvious that sooner or later, and it is sooner for the United Kingdom, every population must stabilise its numbers. Replacement rate at present mortality and marriage rates is in Britain about 2.2 children per married couple, and the birth rate is currently close to this.

The questions raised by positive eugenics include: what qualities will be valuable to future generations; to what extent is the development of those qualities under genetic control; how will individual parents know whether they are likely to transmit an above average genetic potential for such qualities?

One quality on which there will be widespread parental agreement is general 'intelligence' in the sense of the quality that enables us to find the right solution to new problems and difficulties as we meet them. Another quality on which there would be equal agreement is that of mental stability in the sense of the quality that enables an individual to meet the 'slings and arrows of outrageous fortune' without mental breakdown. As regards temperamental qualities some that most parents value in their children are the qualities of courage, energy and perseverance. On a more physical plane some, but not all, parents would value the fine neuro-muscular control which makes the good footballer or ballet-dancer. There are other aspects of personality however where there is not a positive and a negative end of the scale, but a variety in a population is desirable. Extroverts are not superior to introverts, though more valued in certain communities. Individuals at the extremes are perhaps unfortunate, but considerable variation in a population is healthy.

The quality about which eugenicists have been most concerned is that of intelligence. The social value of a good general intelligence is undoubted,

and this value is increasing with the technological revolution. In the early days of the industrial revolution, factories required a small proportion of capable managers and designers, and a large proportion of semi-skilled labourers. With advancing technology there is an increasing need of intermediate white-collar skills. The industries of the future, the oil refineries, the atomic energy plants, require a high proportion of highly skilled technicians and scientists with little or no demand for the semi-skilled and only a limited demand even for those with intermediate skills. The need in industry is increasingly not only for individuals who can learn complex skills, but in certain cases the rate of change is such that the need is to be able to learn a new skill more than once in a life-time. It is apparent that the boy of well below average intelligence is going to find it increasingly difficult to make a socially valuable contribution in his work. One task for the future will be to somewhat artificially create jobs for such young men so that they can retain their self-respect, though the fewer individuals for whom this is necessary the better. At the other end of the scale there is no surplus, but a shortage of gifted young men in professions such as physics, engineering and business management.

There is also no doubt that intelligence is in considerable part genetically determined. There is no answer to the question as to how much of a young man or woman's intelligence is due to environment and how much to heredity. There is still no answer if we take intelligence test score as a measure of intelligence. We are all now familiar with intelligence tests; they have their limitations but they are more successful than tests of educational attainment and more successful than teachers' voting in predicting the children who will go on to do well at tackling really difficult academic subjects at universities and colleges of further education. We cannot measure the contribution of heredity and environment to an individual's test score, but it is possible to attempt to answer the question as to how much of the variation in intelligence test score in say fifteen year old school children in London is due to genetic variation and how much is due to environmental variation. One of the most powerful methods of arriving at an answer is by comparing the scores of identical and fraternal twins. Identical twins start life as a single individual, as a single fertilised egg cell which splits early in development to give the two twins. Their chromosomes and genes are the same; with rare exceptions, they are genetically identical. Fraternal twins on the other hand are derived from two separate egg cells which happen to have been released in the same menstrual cycle and have been fertilised by two separate sperm cells. Like ordinary brothers and sisters they have on average

only half their genes in common. I should explain here that while a child cannot, mutations apart, inherit a gene which is not present in either parent there are a great number of genetically different children that any one parent may have. A parent only passes on one member of each chromosome pair to any particular child and it is pure chance which member of the pair is transmitted. With 23 pairs of chromosomes there are an enormous number of different combinations transmissible to the children and a particular pair of brothers, sisters or fraternal twins will only have on average half their genes in common. Considering twin pairs who have been brought up in the same family in the usual way, the differences between identical pairs in the measure for any character will only be due to the environmental differences one may experience within the family. Fraternal twins will be subject to the same within-family environmental differences, but will also show differences due to the genetic differences between them. The greater differences between the fraternal pairs may be used to measure the proportion of the variation between children which is due to genetic variation. Such twin comparisons indicate that well over half of the variation in intelligence test score between London school children is due to genetic variation. This estimate is only valid for similar populations. It might not apply where differences in home background and in educational opportunity are much greater, for example in India or even in the United States of America; but they are valid enough for anywhere in Britain. Substantial confirmation for this estimate comes from those very interesting and valuable individuals identical twins who have been separated in infancy and reared apart in quite different homes. Two considerable series of these twins have been collected, one in the United States and one, more recently, in Britain. The influence of differences in upbringing are apparent in these separated twins, but on the whole the identical twins are surprisingly alike in intelligence test score and in most other characteristics in spite of the different upbringings. Confirmatory evidence also comes from the increasing resemblance of adopted children's intelligence to that of the maternal parents they have never met rather than to the adopting parents who are rearing the children.

There is good evidence that the genetic contribution to intellectual development depends on alternative genetic factors at several sites on several different chromosome pairs. The children within a family should therefore, and in fact do, show considerable variation in intelligence test score depending on which chromosomes their parents have transmitted. Nevertheless the score of the children should and does tend to vary around the average of the two parents. An individual child may be exceptional, but on a statistically

adequate sample the principle works well.

If family size does not vary with parental intelligence there will be no change in average intelligence on the proportion of bright and dull individuals from one generation to the next. There will be change within families owing to the within-family variation that one finds according to which set of chromosomes parents transmit to an individual child. Some intelligent parents will have relatively dull children who regress back towards the population average; some average parents will have an exceptionally bright child.

The constancy from generation to generation for intelligence will no longer be maintained, however, if there are differences in average family size according to the intelligence of the parents. If the duller parents have the largest families and the intelligent ones the smallest, and the intelligence differences correspond to real genetic differences, then there will be a fall in average intelligence in the children as compared with the parents. There will also be a fall in the proportion of the gifted and a rise in the proportion of dull individuals in the population. Conversely if there was a positive relationship between intelligence and fertility, such that the bright parents had more than the average number of children and the duller parents had fewer than the average number and this corresponded to genetic differences, then the average intelligence of the children would be higher than that of the parents.

Over the long history of man's evolution the positive relationship must have been the usual one. The fossil record shows a doubling of man's brain size over the past two million years and, while some of the early increase was due to an overall increase in size, the fifty per cent increase over the past half million years has not been associated with any change in average body size and represents a real increase in relative brain size. Under conditions of high natural fertility and high infant and childhood mortality the relationship between intelligence of parents and number of surviving children is likely to be a positive one, since the more capable parents will on the whole have reared a higher proportion of their children. Before the last war in Britain and many other countries with a western European civilisation there was considerable anxiety lest the relationship between family size and genetic potential for intelligence should be a negative one. There was certainly a negative relationship between a man's social class and the average number of children he had, which dated in Britain at least back into the 1850's. For many years the average family size of manual workers has been some forty per cent higher than that of non-manual workers. A man's occupation is only

a very rough guide to his intelligence, but there is some relationship particularly for the professions to which entry is by difficult examinations. The average intelligence of children of men in the professional and managerial occupations, the Registrar General's social class I, is some twenty points higher than the children of men in the manual working classes, though this difference will not all be due to genetic differences. Overall this negative relationship between social class and family size was an unfortunate one and threw a heavy burden on the educational services. Most children were being born to parents who, though this was no fault of theirs, were themselves relatively uneducated. The reason for these differences was that the practice of family planning naturally enough started at the top of the social scale and indeed among the more capable and farsighted in every social class, while the remainder were still having large natural families.

With the economic depression in the 1930's planned family size was well below replacement rate, and serious fears of depopulation in Britain led to the appointment of the Royal Commission on Population. Since the end of the war however with a change in the economic climate and perhaps the coming of a more robust attitude to life there have been encouraging indications of change. The practice of family planning is spreading further through the community and at the same time planned family size has increased. There are real indications that in so far as family size is planned the more successful a man is, in reaching by education and effort the higher socio-economic occupations, the more children he will plan to have. Similar changes are taking place in America and in western Europe, for example in France and Germany. In the 1961 Census of England and Wales for couples married once only and after 15-19 years duration of marriage the highest average family size was still for the unskilled manual workers, who had an average of 2.3 children. These will have included a substantial number of unplanned children. On the other hand the next largest family size was at the other end of the social scale, an average of 2.2 children for self-employed professionals. Average family size among non-manual occupations in fact fell progressively from the self-employed professional down to a low point of 1.8 among the junior non-manual; it then rose progressively in the manual occupations as one passed down from the foreman and supervisors to the unskilled manual workers. It is not perhaps unreasonable to anticipate that when all children are planned the higher the occupational class of the father the larger the average size of the family.

There is a dearth of more direct studies relating to a man or woman's

intelligence test score and the number of children they have. There are plenty of studies relating to a child's intelligence test score and the number of his brothers and sisters. These at first sight are depressing. For example in the famous 1932 and 1947 surveys of all Scottish 11 year old school children there was a clear negative relationship. The more highly the child scored the fewer on average were his brothers and sisters. This must not be taken at its face value since it is well known that to grow up as one of a large family depresses the development of intelligence, as measured by intelligence tests, for purely environmental reasons. The only child speaks much with its parents and early develops facility in the use of, and good understanding of the meaning of, words and does well on the verbal element in intelligence tests. A sample of the 1932 Scottish eleven year olds have now been followed forward into adult life and show little relationship between the number of children they have had and their intelligence test score. The more intelligent on the whole started their families later, understandably so as they more often went on to higher education, but they had almost caught up with those of lower intelligence at the time of the survey.

On the whole then as regards one measurable, heritable and socially valuable quality, intelligence, there are grounds for being optimistic. After perhaps a century of a trend which may well have been unfortunate genetically and almost certainly unfortunate educationally, while family planning spread through the community, we are perhaps already again in a situation where there is or soon will be improvement in each generation. It is I think likely that this is coming about largely naturally and not as a result of any deliberate decisions by parents based on eugenic considerations. In large part it may simply be due to the fact that in general it is the parent, and particularly the mother, who is capable and energetic who finds that she can take the rearing of her first two children in her stride and so, if she is fond of children, is prepared to plan one or two more. There is however, I think a case for making the eugenic idea more explicit in relation to intelligence, for at least introducing young couples to the idea that if they are lucky enough to be of good intelligence, other things being equal, they should not rest content with just two children. One of the difficulties here is modesty. It is surprising how often people compare themselves with their peers and cannot assess themselves in relation to the whole population. A man or woman who gets only a third class honours degree and compares himself unfavourably with his contemporaries, who get first and second class honours degrees, forgets that only a small majority get to University

to attempt any sort of degree.

Now to come to the community responsibility for eugenics. The main task is to provide information. One would like to see biology taught in all schools and indeed it now is in most. People in agricultural and pastoral communities develop a considerable, if unformulated, understanding of biological principles; their livelihood depends on this. People in urban and industrial communities may lack this understanding and biology must be actively taught. Again, if there is sex education in schools eugenic considerations should be taught as well as the more direct facts about sex and family planning. I have already talked on the need for an expansion of family planning clinics, including a domiciliary service, and the need for genetic counselling clinics. Some local authorities have made good provisions, but others have still only made arrangements to give family planning advice where there are medical indications, and not where there are the often more important social indications. Only a few authorities have yet developed domiciliary family planning services on the lines worked out in Newcastle and Southampton. I have also talked on the place of abortion in relation to genetic counselling. It is also apparent that for some time to come abortion on social grounds will provide a valuable complement to family planning. My own view is that whenever a mother really wants a termination this should be made available to her in the interests of the child. The outlook for an unplanned, unwanted, child is not a hopeful one.

In some areas the new immigrants with a different tradition of marriage and fertility have a special need for domiciliary planning services. Some of those immigrants come from areas where there is still a very high infant mortality and explanations are needed that it is not necessary in Britain to have three sons in order to ensure the survival of one. I should perhaps add that the eugenicist is little concerned with race and colour or with race crossing. There is no evidence that race crossing carries any genetic disadvantages though it may give rise to social difficulties.

A further responsibility that lies with the community is to make it easy for parents to realise their own wishes for the size of their families. Many talk as if the threat of a population explosion in Britain makes it urgent to encourage all parents to plan small families. There is in fact little or no threat of a population explosion in Britain. We are fortunate in having available to us Canada, Australia, New Zealand and to a lesser extent other countries, to which we can emigrate. The present excess of birth over deaths does no more than provide a surplus whose emigration is needed and welcomed by

these Commonwealth countries. It is in fact doubtful, if family planning becomes more complete and fewer unwanted children were born, whether the birth rate would be at all above replacement level. Immigration to Britain has been largely stopped for reasons other than those of population size. There is then no reason why good parents who wish to plan families of three or more children in Britain should not do so, and consideration may be given to the kind of obstacles that now exist and should be removed.

The obstacle of sheer poverty, of being unable to feed the extra children, has largely disappeared with the introduction of family allowances. Parents of large families do spend less per head for food than do parents of small families, but providing the mother is a good manager these children from larger families do not suffer. They do perhaps on average grow more slowly than do those from small families, but this is not necessarily a disadvantage. Housing is a more serious problem for the large family, and we can but hope that the Government's claims that the housing shortage will disappear in three or four years is correct. It is however probably educational considerations which most often lead good parents, who would like more children, to limit their families. In the United States, Canada and Australia as well as France and Germany, parents in general have full confidence in the state educational system. In the United Kingdom there is still a tradition of independent and often expensive private schooling, which in many instances, though in fewer perhaps than the parents realise, gives a better education than that provided in the state schools. The development of comprehensive education is, for a time at least, likely to accentuate these differences between the state and private education. As had been predicted, it is being found most difficult, except in a few large purpose-built schools, to provide adequate sixth form education in comprehensive schools. There are too few graduate teachers particularly in mathematics and science to go round, and too few pupils in individual subjects in the small sixth forms. The eugenicist must therefore welcome the disappearance of the good independent schools. They provide a temptation to good parents, who value education, to limit the size of their families. The number of parents influenced by such considerations is small but they probably include some genetically valuable ones.

In conclusion I would re-emphasize that positive eugenics depends essentially on individual parents and not on the community. Good parents should plan the size of their families with due attention to the qualities they are likely to transmit to their children, as well as to the upbringing they are likely to be able to give them.

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Dr Carter has always been interested in the sociological as well as the medical implications of human genetic studies and is a past secretary and present member of the council of the Eugenic Society. He is on the editorial board of the *Journal of Medical Genetics* and the *Journal of Biosocial Science*.

THREE SHILLINGS
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