"Natural Inheritance." My subject will be the possible improvement of the human race under the existing conditions of law and sentiment. It has not hitherto been approached along the ways that recent knowledge has laid open, and it occupies in consequence a less dignified position in scientific thought than it might. It is smiled at as most desirable in itself and possibly worthy of academic discussion, but absolutely out of the question as a practical problem. My aim in this lecture is to show cause for a different opinion. Indeed I hope to induce anthropologists to regard human improvement as a subject that should be kept openly and squarely in view, not only on account of its transcendent importance, but also because it affords excellent but neglected fields for investigation. I shall show that our knowledge is already sufficient to justify the pursuit of this perhaps the grandest of all objects, but that we know less of some estimations upon which success depends than we might and ought to ascertain. The limits of our knowledge and of our ignorance will become clearer as we proceed.

Human Variety.—The natural character and faculties of human beings differ at least as widely as those of the domesticated animals, such as dogs and horses, with whom we are familiar. In disposition some are more gentle and good-tempered, others surly and vicious; some are courageous, others timid; some are eager, others sluggish; some have large powers of endurance, others are quickly fatigued; some are numerous, others are weak; some are intelligent, others stupid; some have tenacious memories of places and persons, others frequently stray and are slow at recognising. The number and variety of aptitudes, especially in dogs, is truly remarkable; among the most notable being the tendency to herd and to retrieve. So it is with the various natural qualities that go towards the making of civic worth in man. Whether it be in character, disposition, energy, intellect, or physical power, we each receive at birth a definite endowment, characterised by the parable related in St. Matthew, some receiving many talents, others few; but each person being responsible for the profitable use of that which has been entrusted to him.

Distribution of Qualities in a Nation.—Experience shows that while talents are distributed in endless different degrees, the frequency of these different degrees follows certain statistical laws, of which the best known is the Normal Law of Frequency. This is the result whenever variations are due to the combined action of many small and different causes, whatever may be the causes and whatever the object in which the variations occur, just as twice a always makes 4, whatever the objects may be. It therefore holds true with approximate precision for variables of totally different sorts, as, for instance, stature of man, errors made by astronomers in judging minute intervals of time, bullet marks around the bull's-eye in target practice, and differences of marks gained by candidates at competitive examinations. There is no mystery about the fundamental principles of this abstract law; it rests on such simple fundamental conceptions as, that if we toss two pence in the air they will, in the long run, come down one head and one tail twice as often as both heads or both tails, that the ten throws we shall select, so to speak, that go to the formation of civic worth are distributed with rough approximation according to this familiar law. In doing so, I in no way disregard the admirable work of Prof. Karl Pearson on the distribution of qualities, for which he was adjudged the Darwin Medal of the Royal Society a few years ago. He has amply proved that we must not blindly trust the Normal Law of Frequency; in fact, that when variations are minutely studied they rarely fall into that perfect symmetry about the mean value which is one of its consequences. Nevertheless, my conscience is clear in using this law in the scientific calculations of the data that are found, whenever they have been tested, to vary normally to a fair degree of approximation, and consequently we may infer that our results are trustworthy indications of real facts.

The possible improvement of the human race under the existing conditions of law and sentiment!

In fulfilling the honourable charge that has been entrusted to me of delivering the Huxley lecture, I shall endeavour to carry out what I understand to have been the wish of its founders, namely, to treat broadly some new topic belonging to a class in which Huxley himself would have felt a keen interest, rather than to expatiate on his character and the work of his noble life. Of the which I have selected for to-night is one which has occupied my thoughts for many years, and to which a large part of my published inquiries have borne a direct though silent reference. Indeed, the remarks I am about to make would serve as an additional chapter to my books on "Hereditary Genius" and on

I The second Huxley Lecture of the Anthropological Institute, delivered by Francis Galton, D.C.L., D.Sc., F.R.S., on October 29, 1900.

NO. 1670, VOL. 64]
whole of the following table starts into life, evolved from that of the "probability integral." It expresses the distribution of

Table I.—Normal Distribution (to the nearest per ten-thousand
and to the nearest per hundred).

<table>
<thead>
<tr>
<th>$\mu$ and below</th>
<th>$u$</th>
<th>$t$</th>
<th>$r$</th>
<th>$R$</th>
<th>$S$</th>
<th>$T$</th>
<th>$U$</th>
<th>$V$ and above</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>180</td>
<td>672</td>
<td>1613</td>
<td>2500</td>
<td>2500</td>
<td>1613</td>
<td>672</td>
<td>180</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>16</td>
<td>25</td>
<td>16</td>
<td>7</td>
<td>2</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

any normal quality, or any group of normal qualities, among 10,000 persons in terms of the normal-talent. The M in the
upper line occupies the position of Mediocrity, or that of the
average of what all have received: the $+ 1^2$, $+ 2^2$, etc., and
the $- 1^2$, $- 2^2$, etc., refer to normal talents. These numerals stand as gradations at the heads of the vertical lines by which
the table is divided. The entries between the divisions are the
numbers per 10,000 of those who receive sums between the
amounts specified by those divisions. Thus, by the hypothesis,
2500 receive more than $M$ but less than $M + 1^2$, 1613 receive
more than $M + 1^2$ but less than $M + 2^2$, and so on. The
terminals have only an inner limit, thus 35 receive more than 4,
some to perhaps a very large but indefinite amount.
The divisions might have been carried much farther, but the numbers
in the classes between them would become less and less
trustworthy. The left half of the series exactly reflects the right
half. As it will be useful henceforth to distinguish these classes,
I have used the capital or large letters R, S, T, U, V, for those
above mediocrity and corresponding italic or small letters, r, s,
t, u, v, for those below mediocrity, r being the counterpart of
R, T of S, and so on.

In the lowest line the same values are given, but more
roughly, to the nearest whole percentage.

It will assist in comprehending the values of different grades
of civic worth to compare them with the corresponding grades
of adult male stature in our nation. I will take the figures
from my "Natural Inheritance," premising that the distribution
of stature in various peoples has been well investigated and
shown to be closely normal. The average height of the adult
males, to whom my figures refer, was nearly 5 feet 8 inches,
and the value of their "normal-talent" (which is a measure of
the spread of distribution) was very nearly 13 inches. From
these data it is easily reckoned that Class U would contain men
whose heights exceed 6 feet 13 inches. Even they are tall enough
to overlook a hatless mob, while the higher classes, such as
V, W and X, tower above it in an increasingly marked degree.
So the civic worth (however that term may be defined) of
U-class men, and still more of V-class, are notably superior to
the crowd, though they are far below the heroic order. The
rarity of a V-class man in each specified quality or group of
qualities is as 35 in 10,000, or say, for the convenience of
using round numbers, as 1 to 300. A man of the W class
is ten times rarer, and of the X class rarer still; but I shall
avoid giving any more exact definition of X than as a value
considerably rarer than V. This gives a general but just
idea of the distribution throughout a population of each and
every quality taken separately so far as it is normally
distributed. As already mentioned, it does the same for any
group of normal qualities; thus, if marks for classics and for
mathematics were severally normal in their distribution, the
combined marks gained by each candidate in both those subjects
would be distributed normally also, this being one of the
many interesting properties of the law of frequencies.

Comparison of the Normal Classes with those of Mr. Booth.—
Let us now compare the normal classes with those into which
Mr. Charles Booth has divided the population of all London, in
such a way that corresponds not unfairly with the ordinary conception
of grades of civic worth. He reckons them from the lowest
upwards, and gives the numbers in each class for East London.
Afterwards he treats all London in a similar manner, except
that sometimes he combines two classes into one and gives the
joint result. For my present purpose, I had to couple them
somewhat differently, first disentangling them as I best could.
There seemed no better way of doing this than by assigning to
the members of each couple the same proportions that they had
in East London. Though this was certainly not accurate, it is
probably not far wrong. Mr. Booth has taken unheard-of pains
in this great work of his to arrive at accurate results, but he
emphatically says that his classes cannot be separated sharply
from one another. On the contrary, their frontiers blend, and
this justifies me in taking slight liberties with his figures. His
class A consists of criminals, semi-criminals, loafers and some
others, who are in number at the rate of 1 per cent. in all
London—that is 100 per 10,000, or nearly three times as many
as the $t$ class: they therefore include the whole of $u$ and spread
upwards into the $t$. His class B consists of very poor persons
who subsist on casual earnings, many of whom are inevitably
poor from shiftlessness, idleness or drink. The numbers in this
and the class combined closely correspond with those in $t$
and all below $t$.

Table II.—Comparison of Mr. Booth's Classification of All London with the Normal Classes.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>97</td>
<td>H. All above G ......</td>
<td>......</td>
<td>....</td>
<td>100</td>
<td>100</td>
<td>100 89 S</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>T and above</td>
</tr>
<tr>
<td>200</td>
<td>(G. Lower middle ...</td>
<td>......</td>
<td>....</td>
<td>200</td>
<td>150</td>
<td>150 161 R</td>
</tr>
<tr>
<td></td>
<td>(F. High-class labour above 30s. per week ... ...</td>
<td>....</td>
<td>200</td>
<td>250</td>
<td>250 161 S</td>
<td></td>
</tr>
<tr>
<td>382</td>
<td>E. Regular standard earnings from 22s. to 30s. per week ... ...</td>
<td>....</td>
<td>400</td>
<td>250</td>
<td>250 161 S</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(C. Intermittent earnings, improvident, poor ... ...</td>
<td>....</td>
<td>200</td>
<td>150</td>
<td>150 161 S</td>
<td></td>
</tr>
<tr>
<td>227</td>
<td>D. Regular earnings under 22s. per week ... ...</td>
<td>....</td>
<td>100</td>
<td>100</td>
<td>100 89 T</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(A. Criminals, loafers &amp;c. ... ...</td>
<td>....</td>
<td>1000</td>
<td>1000</td>
<td>1000 1000</td>
<td></td>
</tr>
</tbody>
</table>

The two columns headed "Nos." give respectively the numbers per thousand in Mr. Booth's and in the normal classes.

N. O. 1670, Vol. 64]
Class C are supported by intermittent earnings; they are a hard-working people, but have a very bad character for providence and shiftlessness. In Class D the earnings are regular, but at the low rate of twenty-one shillings or less a week, so none of them rise above poverty, though none are very poor. D and C together correspond to the whole of $s$ combined with the lower fifth of $r$. The next class, E, is the largest of any, and comprises all those with regular standard earnings of twenty-two to thirty shillings a week. This class is the recognised field for all forms of cooperation and combination; in short for trades unions. It corresponds to the upper four-fifths of $r$ and the lower four-fifths of $R$. It is therefore essentially the middle class, standing as far below the highest in civic worth as it stands above the lowest class with its criminals and semi-criminals. Next above this large mass of mediocrity comes the honourable class $F$, which consists of better paid artisans and foremen. These are able to provide adequately for old age, and their sons become clerks and so forth. $G$ is the lower middle class of shopkeepers, small employers, clerks and subordinate professional men, who as a rule are hard-working, energetic and sober. $F$ and $G$ combined correspond to the upper fifth of $R$ and the whole of $S$, and are, therefore, a counterpart to D and C. All above $G$ are put together by Mr. Booth into one class $H$, which corresponds to our $T$, $U$, $V$, and above, and is the counterpart of his two lowermost classes, A and B. So far, then, as these figures go, civic worth is distributed in fair approximation to the normal law of frequency. We also see that the classes $t$, $u$, $v$ and below are undesirable.

**Worth of Children.**—The brains of the nation lie in the higher of our classes. If such people as would be classed W or X could be distinguishable as children and procurable by money in order to be reared as Englishmen, it would be a cheap bargain for the nation to buy them at that rate of somewhat of the several thousands of pounds per head. Dr. Farr, the eminent statistician, endeavoured to estimate the money worth of an average baby born to the wife of an Essex labourer and thenceforward living during the usual time and in the ordinary way of his class. Dr. Farr, with accomplished actuarial skill, capitalised the value at the child's birth of two classes of events, that is the cost of maintenance while a child and when helpless through old age, the other its earnings as boy and man. On balancing the two sides of the account the value of the baby was found to be five pounds. On a similar principle, the worth of an X-class baby would be reckoned in thousands of pounds. Some such 'talented' folk fail, but most succeed, and many succeed greatly. They find great industries, establish vast undertakings, increase the wealth of multitudes and amass large fortunes for themselves. Others, whether they be rich or poor, are the guides and light of the nation, raising its tone, enlightening its difficulties and imposing its ideals. The great gain that England received through the immigration of the Huguenots would be insignificant to what she would derive from an annual addition of a few hundred children of the classes W and X. I have tried, but not yet succeeded to my satisfaction, to make an approximate estimate of the worth of a child at birth according to the class he is destined to occupy when adult. It is an eminently important subject for future investigators, for the amount of care and cost that might profitably be expended in improving the race clearly depends on its result.

**Descent of Qualities in a Population.**—Let us now endeavour to obtain a correct understanding of the way in which the varying qualities of each generation are derived from those of its predecessor. How many, for example, of the V class in the offspring come respectively from the $V$, $U$, $T$, $S$ and other classes of parentage? The means of calculating this question for a normal population are given fully in my "Natural Inheritance." There are three main senses in which the word parentage might be used. They differ widely, so the calculations must be modified accordingly. (1) The amount of the quality or faculty of the parent may be known in each parent. (2) It may be known in only one parent. (3) The two parents may belong to the same class, a V-class father in the scale of male classification always marrying a V-class mother, occupying identically the same position in the scale of female classification.

I select this last case to work out as being the one with which we shall here be chiefly concerned. It has the further merit of escaping some tedious preliminary details about converting female facilities into their corresponding male equivalents, before men and women can be treated statistically on equal terms. I shall assume in what follows that we are dealing with an ideal population, in which all marriages are equally fertile, and which is statistically the same in successive generations both in numbers and in qualities, so many per cent, being always this, so many always that, and so on. Further, it shall take no notice of offspring who die before they reach the age of marriage, nor shall I regard the slight numerical inequality of the sexes, but will simply suppose that each parentage produces one couplet of grown-up filiads, an adult man and an adult woman.

The result is shown to the nearest whole per thousand in the diagram up to "U and above" and in the table up to "V and above.

| Table III. —Descent of Qualities in a Population. (The difference between the sexes only affects the value of the Unit of the Scale of Distribution). |
|---|---|---|---|---|---|---|---|---|
| Per 100 Fathers (or Mothers). | 2 | 7 | 16 | 25 | 25 | 16 | 2 | 100 |
| Per 10,000 | 35 | 180 | 671 | 1614 | 2900 | 2500 | 1614 | 672 | 180 | 35 |
| Names of classes | v | u | t | i | r | S | R | T | U | V |

<table>
<thead>
<tr>
<th>Sons of Fathers</th>
<th>35</th>
<th>180</th>
<th>671</th>
<th>1614</th>
<th>2500</th>
<th>1614</th>
<th>672</th>
<th>180</th>
<th>35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sons of Mothers</td>
<td>180</td>
<td>7</td>
<td>4</td>
<td>20</td>
<td>52</td>
<td>61</td>
<td>13</td>
<td>10</td>
<td>35</td>
</tr>
<tr>
<td>Total 10,000 Fathers (or Mothers)</td>
<td>34168</td>
<td>655</td>
<td>1623</td>
<td>2522</td>
<td>2522</td>
<td>1623</td>
<td>655</td>
<td>1658</td>
<td>34</td>
</tr>
</tbody>
</table>

| Note. —The agreement in distribution between fathers (or mothers) and sons (or daughters) is exact to the nearest whole per centage. The slight discrepancy in the ten-thousands is mainly due to the classes being too few and too wide, theoretically they should be extremely numerous and narrow. |

| NO. 1670, VOL. 64 |
above," to the nearest ten-thousandth. They may be read either as applying to fathers and their sons when adult, or to mothers and their daughters when adult, or, again, to parentages and filial couples. It will not now attempt to explain the details of the calculation to those to whom these methods are new. Those who are familiar with them will easily understand the exact process from what follows. There are three points of reference in a scheme of descent which may be respectively named "mid-parental," "genetic," and "filial" centres. In the present case of both parents being alike, the position of the mid-parental centre is identical with that of either parent separately. The position of the filial centre is that from which the children disperse. The genetic centre occupies the same position in the parental series that the filial centre does in the filial series. "Natural Inheritance" contains abundant proof, both observational and theoretical, that the genetic centre is not and cannot be identical with the parental centre, but is always more mediocre, owing to the combination of ancestral influences—which are generally mediocre—with the purely parental ones. It also shows that the regression from the parental to the genetic centre, in the case of stature at least, would amount to two-thirds under the conditions we are now supposing. The regression is indicated in the diagram by converging lines which

Consequently the richness in produce of V-class parentages is to that of the R-class in an inverse ratio, or as 14:3 to 1. Similarly, the richness in produce of V-class children from parentages of the classes U, T, S, respectively, is as 3, 11:4 and 55:10 to 1. Moreover, nearly one-half of the produce of V-class parentages are V or U, and taken together, and nearly three-quarters of them are either V, U or T. If then we desire to increase the output of V-class offspring, by far the most profitable parents to work upon would be those of the V class, and in a threefold less degree those of the U class.

When both parents are of the V class the quality of parentages is greatly superior to those in which only one parent is a

<table>
<thead>
<tr>
<th>STANDARD SCHEME OF DESCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARENTAL GRADES NUMBER IN EACH</td>
</tr>
<tr>
<td>1000 COUPLES BOTH PARENTS OF SAME GRADE AND ONE ADULT CHILD TO EACH</td>
</tr>
<tr>
<td>REGRESSION OF PARENTAL TO FILIAL CENTRES</td>
</tr>
<tr>
<td>22 CHILDREN OF U</td>
</tr>
<tr>
<td>67 or t</td>
</tr>
<tr>
<td>5 or a</td>
</tr>
<tr>
<td>250 or T</td>
</tr>
<tr>
<td>250 or R</td>
</tr>
<tr>
<td>161 or S</td>
</tr>
<tr>
<td>67 or T</td>
</tr>
<tr>
<td>22 or U</td>
</tr>
</tbody>
</table>

| SUMS |
| 20 | 06 | 162 | 252 | 252 | 162 | 66 | 20 |

[NO. 1670, VOL. 64]
The limited number who had not been automatically weeded away by this condition might be submitted in some appropriate way to the independent votes of fellow-students on the one hand, and of tutors on the other, whose ideals of character and merit necessarily differ. This ordeal would reduce the possible list to a very small number, out of which an impartial committee might be trusted to make the ultimate selection. They would be guided by personal interviews. They would take into consideration all favourable points in the family histories of the candidates, giving appropriate hereditary weight to each. Probably they would agree to pass over unattractive, unless they were notorious and flagrant, owing to the great difficulty of ascertaining the real truths about them. Ample experience in making selections has been acquired even by scientific societies, most of which work well, including perhaps the award of their medals, of which the foundation at least are tempted to consider judicious. The opportunities for selecting women in this way are unfortunately fewer, owing to the smaller number of female students between whom comparisons might be made on equal terms. In the selection of women, when nothing is known of their athletic proficiency, it would be especially necessary to pass a high and careful medical examination; and as their personal qualities do not usually admit of being tested so thoroughly as those of men, it would be necessary to lay all the more stress on hereditary family qualities, including those of fertility and progenitiveness.

Correlation between Promise in Youth and subsequent Performance.—No serious difficulty seems to stand in the way of classifying and giving satisfactory diplomas to youths of either sex, supposing there were a strong demand for it. But some real difficulties would be in the question. Could such a scheme be worth the heavy cost of forecast of qualities in later life? The scheme of descent of qualities may hold good between the parents and the offspring at similar ages, but that is not the information we really want. It is the descent of qualities from men to men, not from youths to youths. The accidents that make a career do not enter into the scope of this difficulty. It resides entirely in the fact that the development does not cease at the time of youth, especially in the higher natures, but that faculties and capabilities which were then latent subsequently unfold and become prominent. Putting aside the effects of serious illness, I do not suppose there is any risk of retrogression in capacity before old age comes on. The mental powers that a youth possesses continue with him as a man; but other faculties and new dispositions may arise and alter the balance of his character. He may cease to be efficient in the way of which he gave promise, and he may perhaps become efficient in unexpected directions.

The correlation between youthful promise and performance in mature life has never been properly investigated. Its measurement presents no greater difficulty, so far as I can see, than the problems which have been successfully attacked. It is one of those alluded to in the beginning of this lecture as bearing on race-improvement, and being on its own merits suitable for anthropological inquiry. Let me add that I think its neglect by the vast army of highly educated persons who are connected with the present huge system of competitive examinations to be gross and unpardonable. Neither schoolmasters, tutors, officials of the Universities, nor of the State department of education, have ever to my knowledge taken any serious step to solve this important problem, though the value of the present elaborate system of examinations cannot be rightly estimated until it is solved. When the value of the correlation between youthful promise and adult performance shall have been determined, the figures given in the table of descent will have to be reconsidered.

Augmentation of Favourable Stock.—The possibility of improving the race of a nation depends on the power of increasing the productivity of the best stock. This is far more important than that of repressing the productivity of the worst. They both raise the average, the latter by reducing the undesirables, the former by selecting those who will become the lights of the nation. It is therefore all important to prove that favour to selected individuals might so increase their productivity as to warrant the expenditure in money and care that would be necessitated. An enthusiasm to improve the race would probably itself be fostered by granting diplomas to a select class of young men and women, by encouraging their intermarriages, by hastening the time of marriage of women of that high class, and by provision for rearing children healthily. The means that might
be employed to compass these ends are doubtful, especially for those to whom moderate sums are important, assured help in emergencies during the early years of married life, healthy home, the presence of public opinion, honours, and above all the introduction of motives of religious or anti-religious character. Indeed, an enthusiasm to improve the race is so noble in its aim that it might well give rise to the sense of a religious obligation. In other lands there are abundant instances in which religious motives make early marriage a matter of custom, and continued celibacy to be regarded as so disgraceful as to prevent its occurrence. The customs of the Hindoos, also of the Jews, especially in ancient times, bear this out. In all costly civilisations there is a tendency to shrink from marriage on prudential grounds. It would, however, be possible to alter the conditions of life that the most prudent course for an X class person should lie exactly opposite to its present direction, for he or she might find that there were advantages and not disadvantages in early marriage, and that the most prudent course was to follow their natural instincts.

We have now to consider the probable gain in the number and worth of adult offspring to these favoured couples. First as regards the effect of reducing the age at marriage. There is unquestionably a tendency among cultured women to delay or to abstain from marriage; they dislike the sacrifice of freedom and leisure, of opportunities for study and of a cultured companionship. This has to be reckoned with. I heard of the reply of a lady official of a College for Women to a visitor who inquired as to the after life of the students. She answered that one-third profited and another third little good; one third were failures. "But what becomes of the failures?" "Oh, they marry." There appears to be a considerable difference between the earliest age at which it is physiologically desirable that a woman should marry and that at which the ablest, or at least the most cultured, women usually do. Acceleration in the time of marriage, often amounting to 7 years, as from 28 or 29 to 21 or 22, under influences such as those mentioned above, is by no means improbable. What would be its effect on productivity? It might be expected to act in two ways:—

1. By shortening each generation by an amount roughly proportionate to the diminution in age at which marriage occurs. Suppose the span of each generation to be shortened by one-sixth, so that six take the place of five, and that the productivity of each marriage is unaltered, it follows that one-sixth more children will be brought into the world during the same time, which is, roughly, equivalent to increasing the productivity of an unshortened generation by that amount.

2. By saving from certain barrenness the earlier part of the child-bearing period of the woman. Authorities differ as to the direct gain of fertility due to early marriage that it is dangerous to express an opinion. The large and thriving families that I have known were the offspring of mothers who married very young.

The next influence to be considered is that of healthy homes. These and a simple life certainly conduce to fertility. They also act indirectly by preserving lives that would otherwise fail to reach adult age. It is not necessarily the weakest who perish in this way, for instance, yzomer disease falls indiscriminately on the weak and the strong.

Again, the children would be healthier and therefore more likely in their turn to become parents of a healthy stock. The great danger to high civilisations, and remarkably so to our own, is the deplorable drain upon the rural districts to supply large towns. Those who come up to the towns may produce large families, but there is much reason to believe that these dwindle away in subsequent generations. In short, the towns sterilise rural vigour.

As one of the reasons for choosing the selected class would be that of hereditary fertility, it follows that the selected class would respond more than other classes to the above influences. I do not attempt to appraise the strength of the combined six influences just described. If each added one-sixth to the product of the number of offspring would be doubled. This does not seem impossible considering the families of colonists, and of those in many rural districts; but it is a high estimate. Perhaps the fairest approximation may be that these influences would cause the X women to bring into the world an average of one adult son and one adult daughter in addition to what they would otherwise have produced. The table of descent applies to one son or to one daughter per couple; it may now be read as specifying the net gain and showing its distribution. Should this estimate be thought too high, the results may be diminished accordingly.

It is no absurd idea that outside influences should hasten the age of marrying, nor need it be for the best to marry the best. A superficial objection is sure to be urged that the fancies of young people are so incalculable and so irresistible that they cannot be guided. No doubt they are in some exceptional cases. I lately heard from a lady who belonged to a county family and position that a great aunt of hers had scandalised her own domestic circle two generations ago by falling in love with the undertaker at her father's funerai and insisting on marrying him. Strange vagaries occur, but considerations of social position and of fortune, with frequent opportunities of intercourse, tell much more than rarer than sudden fancies that want roots. In a community deeply impressed with the desire of encouraging marriages between persons of equally high ability, the social pressure directed to produce the desired end would be so great as to ensure a notable amount of success.

Existing Activities.—Leaving aside profitable expenditure from a purely monetary existence should be borne in mind of immense voluntary activities that took no forms. The total value of the productive process of the 100 parents can then be estimated by an actuary, and consequently the sum that it is legitimate to spend in favouring an X parentage. The clear and distinct statement of a case is often more than half way towards its solution. There seems no reason why this one should not be solved between limiting values that are not too wide apart to be useful.

Profit and Loss.—The problem to be solved now assumes a clear shape. A child of the X class (what we shall call the signified) would have been worth so and so at its birth, and one of each of the other grades respectively would have been worth so and so; 100 X parentages can be made to produce a net gain of 100 adult sons and 100 adult daughters. The total value of the productive process of the 100 parentages then be estimated by an actuary, and consequently the sum that it is legitimate to spend in favouring an X parentage. The clear and distinct statement of a case is often more than half way towards its solution. There seems no reason why this one should not be solved between limiting values that are not too wide apart to be useful.

"Hospitals and Charities," 1898, p. 85).

There are other activities long since existing which might well be extended. I will not dwell, as I am tempted to do, on the endowments of scholarships and the like, aim at finding and educating the fittest youths for the work of the nation; but I will refer to that wholesome practice during all ages of wealthy persons interesting themselves in and befriending poor but promising lads. The number of men who have owed their start in a successful life to help of this kind must have struck every reader of biography. Befriended and befriender is hardly to be expressed in English by a single word that does not connote more than is intended. The word "patron" is odious. Recollecting Dr. Johnson's abhorrence of the patrons of his day, I turned to an early edition of his dictionary in hope of deriving some antonym as well as instruction from his definition of the word, and I was not disappointed. He defines "patron" as "a wretch who supports with insolence and is repaid with flattery," that is totally opposed to what I would advocate, namely a kindly and honourable relation between a wealthy patron and his position in the world and a youth who is avowedly his equal in natural gifts, but who has yet to make it. It is one in which each party may well take pride, and I feel sure that if its value were more widely understood it would become commoner than it is.

Many degrees may be imagined that lie between mere befriended and actual adoption, and which would be more or less effective in freeing capable youths from the hindrances of narrow circumstances, not including girls to marry early and suitably, and in securing favour to their subsequent offspring. The advantage of being connected with a great and liberally managed estate being widely appreciated, the practice already existing and usually more extensive, so selection can be exercised. The consequence is that the class of men found upon these properties is markedly superior to those in similar positions elsewhere. It might well become a point of honour, and as much an avowed object, for noble families to gather fine specimens of humanity around them, as it is to

NO. 1670, VOL. 64]
procure and maintain fine breeds of cattle and so forth, which are costly, but repay in satisfaction.

There is yet another existing form of princely benevolence which might be so extended as to exercise a large effect on race improvement. I mean the provision to exceptionally promising young couples of healthy and convenient houses at low rents. A continual supply of such settlement and care could be hereby imagined, free from the taint of patronage, and analogous to colleges with their self-elected fellowships and rooms for residence, that should become an exceedingly desirable residence for a specified time. It would be so in the same way that a good club by its own social advantages attracts desirable candidates. The tone of the place would be higher than elsewhere, on account of the high quality of the inmates, and it would be distinguished by an air of energy, intelligence, health and self-respect and by mutual helpfulness.

Prospects—It is pleasant to contrive Utopias, and I have indulged in many, of which a great society is one, publishing intelligence and memoirs, holding yearly elections, administering large funds, establishing personal relations like a missionary society with its missionaries, keeping elaborate registers and discussing them statistically with honest precision. But the first and pressing point is to thoroughly justify any crusade at all in favour of race improvement. More is wanted in the way of unbiased scientific inquiry along the many roads I have hurried over, to make every stepping-stone safe and secure, and to make it certain that the forms are really what they handle. All I dare hope to effect by this lecture is to prove that in seeking for the improvement of the race we aim at what is apparently possible to accomplish, and that we are justified in following every path in a resolute and hopeful spirit that seems to lead towards that end. That is the important point, and it is still the object of the highest man can accomplish. The faculties of future generations will necessarily be distributed according to laws of heredity, whose statistical effects are no longer vague, for they are measured and expressed in formulae. We cannot doubt the existence of a great power ready to be directed with vast benefit as soon as we shall have learnt to understand and to apply it. To no nation is a high human breed more necessary than to our own, for we plant our stock all over the world and lay the foundation of the dispositions and capacities of future millions of the human race.

OCEAN CIRCULATION

The investigation carried on by Mr. H. N. Dickson into the distribution of temperature and salinity in the surface water of the North Atlantic is one of great importance. It promises, if continued, to be of considerable value, not only to those who are especially interested in studying the circulation of the surface water of the ocean, but also to meteorologists generally, and particularly to those who see, in a comparison of the varying yearly temperatures of the North Atlantic with that of a mean for the season, the key to a clearer knowledge of the causes which combine to influence the climate of western Europe, and especially of our Islands, and who look hopefully in that direction for information whereby future modifications in the conditions of climate may be foretold for periods some time in advance.

The treatise before us, setting forth the author’s method of conducting the research and the results at which he arrived, was contributed to the Royal Society in March, 1900.

In introducing his subject the author says: “The history of our knowledge of the currents of the North Atlantic Ocean up to the year 1870 has been written once for all by Petermann, whom he quotes at some length, remarking “that the conclusions, then arrived at, were not modified by the observations of the next twenty years.”

During the years 1896 and 1897 materials were collected for preparing the charts of temperature and salinity, the parallel of 46° N. being near the southern boundary of the area for investigation. The observations of temperature were furnished by the Meteorological Office, the Danish Meteorological Department, the United States Hydrographical Department, and the Bureau Central Météorologique de France, and by Prof. Petersson of the Norwegian Hydrographic Office. The observations of salinity were obtained from the captains of vessels keeping logs for the Meteorological Office and for the Danish Hydrographical Department, specially made bottles being supplied to them for the purpose, and no care being spared in guarding against impurity or the introduction of any matter that could give rise to error in the analytical determinations.

The accuracy of the method adopted in estimating the salinity of the samples was subjected to severe scrutiny. The author states the results of his observations, demonstrating the distribution of temperature and salinity for each month during the year 1896 as shown in the charts prepared by him, in which the isotherms and isolahlines are supplemented by a scale of colouring denoting areas having the same range of temperature and the same range of salinity. He calls attention to the general agreement between the distribution of salinity as shown on the one set of charts and that of temperature as shown on the other set when apparent, and notes departures and irregularities when necessary occur. He then deals in the same manner with the observations of 1897 and compares results.

Taking the means of each month respectively for the two years, the distribution of temperature, as shown on these charts, corresponds fairly well with the distribution of sea-surface temperature given on the quarterly sea-surface charts on the North Atlantic, issued by the Meteorological Office in 1884.

For the purpose of defining the limits of ocean currents and of arriving at some estimate as to its relative velocity in different localities, the information to be gained by the thermometer is invaluable, for over areas of little current, such as by shipping where current observations are necessarily sparse, a comparatively insignificant number of sea-surface observations will suffice to indicate the existence or failure of an ocean stream; and if to these detective signs be added observations of salinity, the evidence acquired becomes complete.

The effects of the cold water from the north in deflecting the warm stream from the westward are clearly shown on these charts, which, when seasonal variation in temperature has been made allowance for, appear in good agreement (speaking generally) with the monthly current charts of the North Atlantic, published by the Admiralty, as regards the area over which the warm water of the Gulf Stream is distributed, each month, and the northern and western limits to which it reaches. The indications of the existence of Gulf Stream water, stated roughly, may be traced on the Admiralty Chart to the following limits in the given months:

January.—The stream does not reach to the eastward of 20° W., and a south-easterly set is apparent off Ireland.

February.—In 35° N. it reaches 15° W.; a south-easterly set is found to the westward of Ireland, and a south-westerly to the south-westward of the Fastnet Rock.

March.—It has advanced to the coast of Ireland.

April.—In 35° N. its limit has receded to 20° W., and the Iceland south-going current begins to show itself north of 50° N.

May.—The Gulf Stream and Davies Strait cold current coalesce in 47° N. 27° W., the Icealand current sets S. and S.W. to 45° N. 30° W.

June.—Gulf Stream to 15° W. in 52° N. Iceland and Denmark Strait cold currents to Irish coast.

July.—At the S. of 50° N. it joins the Iceland and Denmark Strait current in about 48° N. off the Bay of Biscay.

August.—It extends to the north of Ireland but is modified in about 20° W. by a south-going set.

September.—It extends to the north of Scotland.

October.—It is found in 10° W. in 59° N.

November.—The data are insufficient, but the Stream is traceable to 19° W. in 59° N.

December.—It is difficult to trace the Stream eastward of 40° N. in 45° W. A south-going cold current is shown to the north-westward and westward of Iceland; there is a persistent southerly (S. E. to S.W.) movement of water in the eastern half of the Atlantic.

Mr. Dickson’s charts show the existence of Gulf Stream water to the north of 50° N. and the limits given above for several months, notably on the January chart, and the explanation doubtless is that the value of the current being small, it has been inappreciable in navigation.

There exists, during the greater part of the year, a movement of water from eastward, as at a warmer western shore of the English Channel. One arm branches towards the Bay of Biscay, the other northward (Kennell’s Current). The latter is well known to the captains of the large

1 Phil. Trans. of the Royal Society:—‘The Circulation of the Surface Waters of the North Atlantic Ocean.’ By H. N. Dickson.

NO. 1670, VOL. 64]