STERILIZATION POLICY, ECONOMIC EXPEDIENCY AND FUNDAMENTAL INHERITANCE, WITH ESPECIAL REFERENCE TO THE INHERITANCE OF THE INTELLIGENCE QUOTIENT.

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INTRODUCTORY.

IN a social system where responsibility for the care and support of children rests with the parents, society is justified in imposing restrictions designed to prevent the births of children to a socially incompetent person who is unable to assume such responsibility. Owing to the overcrowded conditions of state institutions for the care of the mentally defective, it is certain that patients committed to such institutions are scarcely able to provide satisfactory care and support for themselves, and would not be able to provide adequately for any children that they might produce. On this basis, society is quite justified in enacting the regulation, as, according to Popenoe (1, 2), has been done in one State, that no patient who has been committed to a state institution for the care of the feeble-minded shall be allowed to leave the institution without having first been sterilized.

Such a sociological reason for terminating the existence of a portion of the germplasm of any society, however, though economically expedient, and sociologically consistent with the established societal structure as already explained, is nevertheless quite irrelevant to the real issues involved. That it is not impossible for a society, based upon the family system, to develop a means whereby children produced by economically or socially inadequate parents can receive adequate support, care, training, education and supervision, is clearly demonstrated by the *fact* that in such societies, agencies devoted to such purposes actually have developed, and have been supported to an ever-increasing extent by other members. Such children do not receive the direct and individual care that can be provided by loving and devoted parents, but the care and opportunities provided by the socially supported institutions, or in the supervised foster or boarding homes, are in no way inferior to that provided by many of the parents in the borderline socio-economic, though more or less self-supporting families.

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It is important that when the home environment is unfavourable, children can be removed from the care of their parents and placed in a foster, or other form of boarding-home. Termination of the existence of any portion of the germ-plasm in any given society can be justified only when it can be clearly demonstrated that any such portion of the germ-plasm is deleterious to the welfare of such a society. Up to the present time this has been done only in the cases of a few conditions, such as in the cases of persons with amaurotic family idiocy, as shown by Sjögren (3) and Slome (4), or with phenyl-pyruvic oligophrenia, as shown by Penrose (5), Munro (6), and Jervis (7), or with Huntington's chorea, as stated by Penrose (8), and though in these cases the completely helpless nature of such patients has clearly been demonstrated to be due to a defective germ-plasm, such cases are comparatively few, and there has been provided no clear-cut and unquestionable evidence which concerns the value to society of the germplasm of patients committed to an institution for reasons of an " undifferentiated mental deficiency ".

A few attempts have been made to make this determination. Thus, Popenoe (1) found that success on parole of patients at a custodial institution was quite independent of family background, in that there was essentially the same number of successes and of failures from families which contained other defectives. It is questionable, however, if the difference in the patients, which entail success or failure on parole, among the comparatively small portion of suitable cases to justify one in expecting any statistically noticeable differences among the parents. He found an incidence of defective family background among the total parole group of approximately 75%, but this figure is of uncertain significance, for, as he (9) has stated, " the population of the institution does not constitute a fair sample of the feeble-minded, not even of the low-grade feeble-minded, of this State. It comprises to a marked degree only the most acute and troublesome cases that come before the juvenile courts. . . . The patients tend to fall roughly into two groups: first, a group of low-grade individuals (predominantly males), who are homeless and helpless and are sent primarily for their own protection; secondly, a group of somewhat higher grade individuals (predominantly females) who have intellect enough to get along in the community, but whose behaviour is so bad that, after every other course has been tried, they are as a last resort sent to the institution primarily for the protection of society ". In such a population it is probable that the causes of the institutionalization may vary widely, and that in some cases the causes would be due to heredity, while in other cases they would be due essentially to environmental factors.

The heterogeneous nature of the population of that institution may also be expected to reduce the significance of the observation of Popenoe (10) that " nothing can be inferred regarding the parentage of a deficient individual from his presence in the institution ". He found that the occupational ratings of the fathers of the sterilized feeble-minded did not deviate in any distinctive

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way from those of the population as a whole, and that the patients at that institution represented all grades of the population. On the other hand, Terman (11) has found that the fathers of 560 of the brightest children in the public schools of a State were predominantly of the professional or semi-professional and business classes, and Cox (12) has found a similar condition in regard to the fathers of 300 of the world's greatest geniuses.

The significance of the lack of correlation which Popenoe (10) found between the I.Q. of the patient and the Barr occupational rating of the father has significance only in relation to the degree that the Barr occupational rating is correlated with I.Q., and this has not been satisfactorily determined. Popenoe, however, interprets this lack of correlation to indicate that " strains producing mental defect are scattered throughout the entire population—with the exception of the superior intellectual stratum at the top ". Though there was no correlation between the I.Q. of a sterilized paroled girl and the Barr rating of her husband, there was a correlation of ·34 between the Barr rating of the girl's husband and her father. Clearly the relation between the I.Q. and the Barr rating should be carefully determined before one may draw reliable conclusions from a correlation or a lack of correlation between I.Q. and Barr rating.

As has been frequently mentioned by Popenoe (10), and as is also indicated by Blackburn (13), the social maladjustment that frequently leads to institutionalization may be of a very complex nature, and may vary widely among different patients, and of these, the intelligence quotient is but one factor. In vocational guidance, as stated by Oakley and Macrae (14), and others, tests are given for intelligence *and* for special abilities, thus implying that there is a significant difference in the influence of the two factors in the matter of vocational adjustment.

A low intelligence quotient, though not the sole factor in institutionalization of those who are socially maladjusted, is especially in the case of the feeble-minded very important. It is a factor, as has been shown by Terman and Merrill (15), Blackburn (13) and others, unlike many of the factors that might bear a causal relationship to social maladjustment, is essentially uninfluenced by environment in the early development of the patient.

For these reasons, a study designed to demonstrate the degree to which the intelligence quotient might be considered to depend upon hereditary factors, though not of a nature such as would provide an understanding of the complete situation with regard to the causes of the development of social maladjustments that lead to institutionalization, would nevertheless provide some very helpful information in relation to an understanding of such a condition. Studies of this nature have been made by several workers. Thus, Bernstein (16) found, among 312 children of feeble-minded women in state institutions for the care of the feeble-minded, that " at 2 years old, 10% were adjudged to be defective (though not definitely of low grade), 60% appeared to be normal

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children, and 30% were on the borderline". Martz (17), with 25 children born in an institution for the care of the feeble-minded, found that 10 could be rated as normal, while the rest showed varying degrees of mental deficiency, and none of the children was above average. Vanuxem (18) found that, among a group of 410 children, 106 had an I.Q. above that of the mother, 46 had an I.Q. below that of the mother, 61 had an I.Q. within 5 points of that of the mother, while with 197 the relationship was not known. Woodall (19), basing his study on all of the offspring of mothers who had been patients at a custodial institution from January 1, 1923, to January 1, 1931, obtained a total of 385 children, only 119 of whom, however, could be examined. The children averaged 16·3 points of I.Q. superior to their mothers, but even so, showed a positive correlation between the I.Q. of the mothers and of the children.

The reliability of these studies, however, is subject to a certain amount of question. In some cases the size of the group was small. In many cases the I.Q. determinations were made while the children were young, i.e., under 10 years of age, and such determinations, unless corrected with the revised scale of Terman and Merrill (15), show, as described by Woodall (19), a progressive augmentation as the chronological age decreases.

Material and Analysis.

By means of a study of the social history records that had been filed by the social service department of a custodial institution, a group of patients were selected, each of whom had had one or more children before commitment, while on parole, or after discharge. In many cases, data concerning the early environmental conditions, school attainments and intelligence quotients of these children and the intelligence quotients of the parents were recorded on these records, and all such data were transcribed on to work sheets. It was possible to locate, in this way, a group of 488 children.

Of these, there were records concerning the early environmental conditions in the cases of 441. So far as the records showed, only 35 of these were cared for entirely by the parents or by the mother, while 23 were cared for entirely by the grandmother, and 10 were cared for by other relatives. This gives a total of 68, or 15·42% of these children for whom care and support could be provided by the parents, grandparents, or other relatives, while the remaining 84·58% became dependent upon public or extra-familial agencies.

Of these, 119 were cared for entirely in boarding homes, while 9 were cared for by the mother, 6 by the grandmother, 2 by other relatives, and 38 by orphanages, later to be transferred to boarding-homes. 45 were cared for entirely in orphanages, while 4 were cared for by the mother, 5 by the grandmother and 1 by other relatives, later to be transferred to orphanages. 37 were adopted, and of these, so far as the records showed, 20 were cared for entirely by the family that adopted them, while the remaining 17 had also

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been cared for by the grandmother, an orphanage, or a boarding-home. This gives a total of 266, or 60·32% of these children, who were eventually and finally cared for by orphanages, boarding-homes, or adoption, while the remaining 107, or 24·26%, had to be cared for eventually at a custodial institution.

Of the group of 107 children, 2 had been adopted, 26 had been in boarding-homes, 12 had been in orphanages, and 11 in both. This indicates that, even though facilities have been provided by society for the care and support of children of parents who are unable or incapable, themselves, adequately to provide such care and support, approximately 25% were so defective that custodial care in an institution had become necessary.

This condition is even more apparent when the school records of these children are considered. There were records, in 114 cases, concerning the school attainments, or mention of residence in a custodial institution for the feeble-minded, during a school age of from 5 to 15 years. Of these, 52, or 45·61%, were patients at an institution for the care of the feeble-minded. On the other hand, of the remaining 62, or 54·38%, but 20, or 17·54%, were found to have attained a grade that would be normal for their age, none had attained a grade that would be in advance of that normal for their age, while 42, or 36·84%, were definitely retarded in their school attainments. Of these, 12 were 1 year retarded, 12 were 2, 13 were 3, 3 were 4, and 2 were 5 years retarded.

These conditions have been presented graphically in Fig. 1, where the number of children that occurred in each class of retardation or advancement is represented by means of the solid line. On this figure, in order to provide a basis of comparison between the school group and the institutional group, the frequency of occurrence of children in the various I.Q. classes has also been recorded, and though the I.Q. that is indicated by the amount of retardation varies within limits in accordance with the ages of the children, and though the limited amount of data has made it impossible to treat each group separately, an attempt has been made, nevertheless, to adjust the two scales so as to provide reasonably reliable comparisons.

A study of this figure shows that the curve for the distribution of children in accordance with the amount of retardation in school, and the curve for the distribution of the same children in accordance with the I.Q. rating, except for a few omissions where the I.Q. determination was not available, correspond quite well (1) in the general location on the graph, (2) in the general range of variability, and (3) except for a certain massing in the " normal " class of the advancement-retardation curve, in the location of the modal class. On the other hand, the markedly greater irregularity in the advancement-retardation curve, when it is compared with the I.Q. distribution curve for the same group of children, indicates, to an extent, the difference which occurs in the distribution of a population on the basis, on the one hand, of an artificial factor, such

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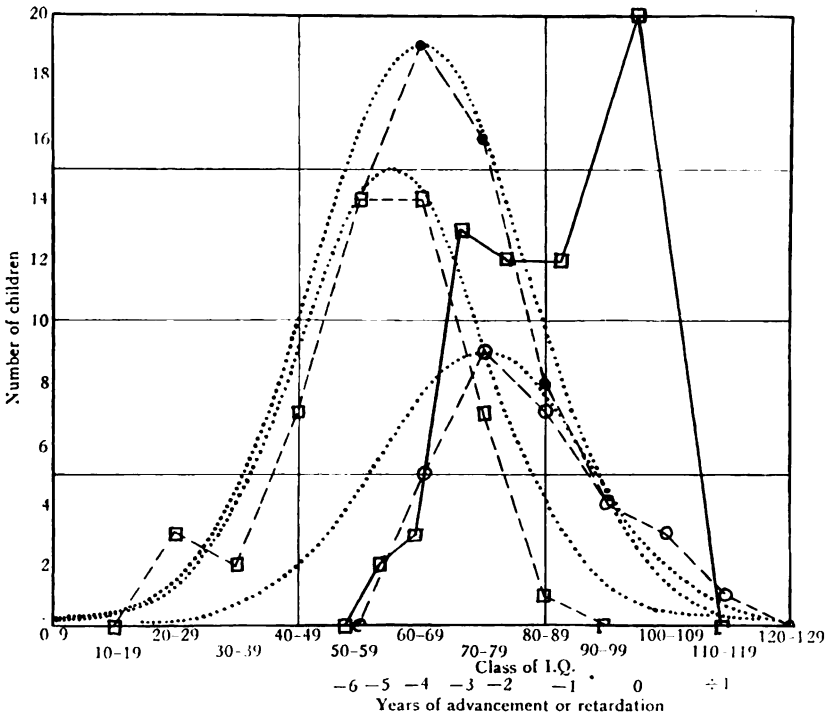

—□— Distribution curve to show the amount of advancement or retardation among the children of the institutionalized persons who attended school.

– –○– – Distribution curve to show the distribution of the same group of children in accordance with their I.Q. ratings.

– –□– – Distribution curve to show the distribution of the children of the institutionalized persons who also have been placed in a state institution for the care of the feeble-minded, in accordance with their I.Q. ratings.

– –●– – Summation curve for the overlapping portions of the curves that show the distribution of I.Q. determinations. This curve, when considered with the coincident portions of the other two curves, gives the distribution curve for the I.Q. determinations for the whole group of children in regard to whom data concerning the education were available. The total number of children considered for this curve was 81.

..... Normal frequency distribution curves, $y = y_0 e^{\frac{-x^2}{2\sigma^2}}$, that best fit the actual data of the corresponding distribution curves.

FIG. 1.—A figure to show the distribution of the children of the institutionalized persons (parents) in accordance with the amount of their advancement or retardation in school. For purposes of comparison, the distribution of these same children in accordance with their intelligence quotients is also shown, and in order to facilitate such comparison, the scales for the abscissæ of these two curves have been made essentially the same. For purposes of further comparison, the distribution of the children of the institutionalized persons, who also were institutionalized in an institution for the care of the feeble-minded, in accordance with their I.Q. ratings, and the summation curve for the institutionalized group and for the school group, have also been presented. For each of the three curves that show the distribution of the I.Q. ratings, normal frequency curves have also been drawn. The smooth transition in the I.Q. ratings between the institutionalized group and the school group is here clearly apparent, while the mode of the summation curve for the whole group of children occurs, definitely, at a subnormal value of I.Q. rating.

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as progression in school, and on the basis, on the other hand, of an innate, natural, biological factor such as the intelligence rating.

School systems vary widely. Under some conditions an attempt is made to promote practically all of the members of a class in order to provide adequate facilities for the instruction of those promoted from the next lower grade, and the extent to which it may be necessary to do this may vary from year to year. Under other conditions, and especially in rural, one-room country schools, a low-grade child may be allowed to remain in one grade for several years, when the space is available, and the training, though but little understood, nevertheless does no harm, and, with practically no trouble at all, provides supervision for the child which might otherwise be provided only with great inconvenience.

On the other hand, the intelligence, as measured by the intelligence quotient, as stated and explained by Blackburn (13), Terman and Merrill (15) and others, is quite free of such artificially variable factors and of environmental factors in general. Instead, it is an innate, natural, biological quantity, and as such, varies in accordance with the usual biological variability of all similar quantities or structures. This type of variability accords with the normal distribution curve, $y = y_0 e^{\frac{-x^2}{2\sigma^2}}$, and the curve of this type that conforms best with the distribution of the children in public schools in accordance with the I.Q. determination is also shown in Fig. 1.

The concordance between the frequency distribution curve and the I.Q. distribution curve for the school-children is best, as may be seen from Fig. 1, in the right-hand portion of the curves. The left-hand portion of the I.Q. distribution curve falls much more rapidly than does that of the normal frequency curve. This is due to the fact that a certain factor of selection, namely, school or institutionalization, has been introduced which tends unnaturally to reduce the number of persons with low I.Q. ratings that occur in the school group. An examination of the normal frequency curve and the I.Q. distribution curve for the group of institutionalized children shows a similar discrepancy between the two curves, but in the case of this group the discrepancy occurs in the right-hand portion of the curve. If, however, the I.Q. distribution curve for the whole group of children, including both the institutionalized and the school-children, be compared with the normal frequency distribution curve, as has been done in Fig. 1, a rather good fit on all parts of the single, unimodal curve is obtained. It is clear from this curve that there is *no indication* of a demarcation between the feeble-minded and other persons, as Goddard (20) assumed would be the case. The mode of the curve, for this group, occurs at the 60–69 I.Q. class, and this is distinctly subnormal.

This curve is based on a total of 81 children. In order further to study the nature of the frequency distribution of intelligence quotients among these

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children, the I.Q. determinations among the whole group considered in this study were recorded. There were 138 children whose I.Q. determinations were known. Practically all of these determinations were made on children between the ages of 14 and 17 years, when the changes in I.Q. with age, as has been described by Woodall (19), would be essentially eliminated. The determinations were made, in the case of the school group, by the school teacher, or by a psychologist of an orphanage, welfare agency, or clinic, while those of the institutional group were made by the psychological staff of the respective institution. It is believed that these determinations have been made by experienced teachers or psychologists who have been well trained to administer the Stanford-Binet test for intelligence. The need for experience and training in order to obtain a reliable evaluation of intelligence with this test has been carefully described by Blackburn (13), Terman and Merrill (15) and many others. Unfortunately, without a specific provision for the purpose, it would be impossible to have all the children of the group tested by the same psychologist, and in lieu of such a provision, any conclusion that may be based on the values of I.Q. determinations that were used in this study must be evaluated in terms of this condition.

With this limitation in mind, the frequency distribution of these children has been expressed in accordance with their I.Q. determinations, and the curve for this determination has been presented in Fig. 2. For purposes of comparison, the normal frequency distribution curves, one, that which best fits the actual data, the other, that which best fits the data provided by Terman and Merrill (15) for the distribution of I.Q. determinations that were obtained on the basis of extensive tests on a general population, have also been presented. A comparison of these four curves shows that the distribution curves for the actual data conform quite closely, in general shape, to the normal frequency curves which have been presented for comparison, but that the mode for the curve which represents the I.Q. distributions of the children considered in this study occurs at a distinctly subnormal value, namely, at an I.Q. of about 65.

This shift from normal in the value of the intelligence quotient in the children is highly significant. It is known that the parents of these children constitute a group of persons that has been carefully and rigidly selected, essentially on the basis of a low I.Q., and for the purposes of facilitating a definite comparison between the I.Q. distribution of the children and of the institutionalized parents, the distribution curve for the I.Q. determinations, based on the I.Q. ratings of the 72 institutionalized parents of this group of children, whose I.Q. ratings were known, is also shown in Fig. 2. The mode of this curve occurs at approximately 55. The occurrence of a few high I.Q. ratings among the children of these parents, however, as can be seen from the frequency distribution curve that corresponds to the I.Q. distribution curve, is simply due to the greater range of variation that is to be expected as the total number in the population considered for the curve increases, while

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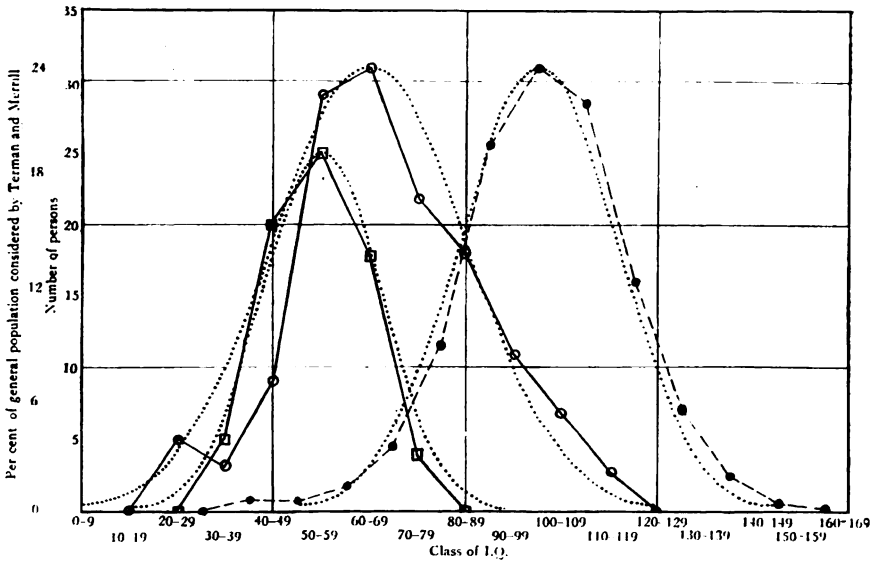
the actual increment in the value of the I.Q. in these children is shown, reliably, only in the shift in the location of the mode, in this case, of approximately 10 I.Q. points.



Distribution curve to show the distribution of the children of the institutionalized persons (parents), in accordance with their I.Q. ratings.

Distribution curve to show the distribution of the institutionalized parents of these children in accordance with their I.Q. ratings.

Distribution curve based on data provided by Terman and Merrill for the distribution of I.Q. determinations on the basis of a general population.

Normal frequency distribution curves, $y = y_0 e^{\frac{-x^2}{2\sigma^2}}$, that best fit the actual data of the corresponding distribution curves.

FIG. 2.—A figure to show the distribution of the children of the institutionalized persons (parents) in accordance with their I.Q. ratings. For purposes of comparison, the curve for the distribution of the parents of these children, and the curve based on the data provided by Terman and Merrill (15) for the distribution of I.Q. determinations on the basis of a general population, have also been included. For each of these three curves, the normal frequency curves have also been drawn. Of these curves, the mode of that for the children occurs at a value of about 10 I.Q. points higher than does that for the curve for the parental group, but the modes of both of these groups are from 35 to 45 I.Q. points below the value of 100 for the mode of the curve that is based on the data for a general population.

Although there was very little definite information available concerning the consorts of these 72 patients, there were, so far as the records showed, no commitments to an institution for the care of the feeble-minded in the cases of these consorts, and so it is probable that they were slightly superior to

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the patients. In so far, therefore, as the values of the I.Q. determinations may be due to hereditary factors, this condition would serve to shift the mode of the I.Q. distribution curve of the children somewhat to the right of that of the corresponding curve for the institutionalized parents, as has been observed to be the case, as shown in Fig. 2.

Discussion.

The continuously variable nature of the intelligence ratings in a general population with a complete absence of any indication whatsoever of a line of demarcation between low I.Q. groups and other higher I.Q. groups, as shown in Fig. 1, definitely negates the conclusions of Goddard (20), in so far as feeble-mindedness may be considered to be synonymous with a low intelligence quotient, a synonymy that was by him (20), and is now generally considered to be valid. On this basis, feeble-mindedness is not, as Goddard (20) believed, a single entity, partaking of the nature of a unit Mendelian character, but rather, is a strictly quantitative character that merges smoothly and imperceptibly with the normal type.

This smooth, continuous type of variation in a quantitative trait, as intelligence appears to be in so far as one may base a conclusion on the evidence provided in the foregoing sections, is a type of inheritance, in regard to quantitative traits, that occurs frequently, and that is well known to geneticists, and though it is true, as Doll mentioned in a discussion of the paper of Woodall (19), that a quantitative character, such as tallness-dwarfness, may, as Mendel observed (21), be due to a single genic character, i.e., a Mendelian unit character, it is also true that but very few quantitative traits are inherited in that manner. On the contrary, as has been carefully explained by East (22), Davenport (23) and many others, by far the more frequent type of inheritance of a quantitative trait is the system where several allelomorphic pairs occur, and where each of these is inherited independently of the others. Each pair serves to add cumulatively and independently its appropriate increment or decrement to the ultimate final level, according to whether it be present in the homozygous high, the heterozygous, or the homozygous low genic condition. On this basis, it would follow that the more extreme conditions of such a quantitative trait would be produced by the occurrence of a large proportion of the allelomorphs for that character in the homozygous condition for the extreme state, while in the intermediate size classes, a large proportion of the allelomorphs would be in the heterozygous condition.

If further studies confirm the observations presented in this study, it would be possible to establish that intelligence is an inherited, continuously variable, quantitative trait, produced by a large number of independently inherited allelomorphic pairs, which, by dint of the large number of combinations possible, produce the innumerable quantitative gradations that have

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been recorded, and, to an extent, occasionally produce a child with a high I.Q. rating, though the parents and sibs all have a generally low rating, as has been noted by Vanuxem (18). On this basis, too, the shift of general I.Q. level noted by Woodall (19) to be 16·3 points of I.Q., and in this study to be approximately 10 points of I.Q., and the essentially similar shift that may be observed by drawing the I.Q. distribution curves on the basis of the data provided by Vanuxem (18), receives an explanation, for, owing to the probable slightly higher I.Q. of the consort, it would be probable that a few more of the allelomorphic pairs of such consorts would be in the heterozygous condition, and the high I.Q. genes thus introduced into the population of the offspring would serve proportionally to elevate the general I.Q. level of the group. On the other hand, the group of institutionalized parents would represent a group of allelomorphs that would be predominantly in a homozygous low I.Q. condition. Such a concentration of low I.Q. genes produces persons who are incapable of caring for themselves, and so must be cared for, in institutions, by the other members of the society. To this extent, therefore, such genes are definitely and distinctly deleterious to the welfare of the society.

SUMMARY.

On the basis of the precept that any sound sterilization policy should be based upon a clear-cut demonstration that the germ-plasm of the person to be sterilized must be distinctly deleterious to the welfare of society, a study was designed to determine the degree to which the intelligence quotient of persons institutionalized for reasons of an "undifferentiated mental deficiency" might be considered to depend upon hereditary factors. The study was based upon the records concerning 488 children of patients institutionalized at a custodial institution.

There were records concerning the early developmental environment in the case of 441 of these children. Of these, 15·42% were cared for by parents, grandparents, or other relatives, 24·26% had to be cared for at a custodial institution, while the remaining 60·32% were eventually and finally cared for by orphanages, boarding-homes, or adoption. There were records concerning the school attainments in 114 cases. Of these, 45·61% were patients at an institution for the care of the feeble-minded, 36·84% were definitely retarded in their school attainments, 17·54% were in a grade normal for their age, and none had attained to a grade in advance of that normal for his or her age.

This retardation-advancement was presented graphically in a way such as to facilitate comparison with the distribution of the I.Q. ratings of the group. The two curves correspond (1) in the general location on the graph, (2) in the general range of variability, and (3) in the general location of the modal class, though the advancement-retardation curve is much more irregular than is the I.Q. distribution curve. In order more adequately to study the

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I.Q. distribution of this group of children, all the data concerning the I.Q. determinations were presented graphically. In all, there were determinations for 138 children and 72 parents (patients). The curves were presented separately and show a smooth, normal distribution in both cases, with modes respectively at 65 and 55 points of I.Q.

The continuously variable nature of the intelligence ratings in connection with the nature of the shift of the mode in both of these groups indicates that intelligence is an inherited, continuously variable, quantitative trait, produced by a large number of independently inherited allelomorphic pairs, which, by dint of the large number of combinations possible, produce the innumerable quantitative gradations that have been noted, and the group of institutionalized parents would represent a group of allelomorphs that would be predominantly in a homozygous low I.Q. condition. Such a concentration of low I.Q. genes produces persons who are incapable of caring for themselves, and so must be cared for in institutions by other members of society. To this extent, such genes are definitely and distinctly deleterious to the welfare of the society.

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