

SCIENCE

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RESEARCH IN EUGENICS¹

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MAN is studying all phenomena. He has at last come to study himself. Not his diseases, not his language, not his customs merely, but also his more intimate self. Man is studying man as an animal, who varies in his traits, who selects his mates for better or worse, who has a larger or smaller number of children that are more or less healthy and live for a varying period. The races of man are being studied not merely to list their differences, but to find how those differences arose and how they are transmitted to progeny and how they intermingle. We are studying the laws that govern the distribution of traits in the family; we are studying the consequences of combinations of these traits in the instincts, interests and behavior of individuals. At last we are studying man as the product of breeding and as the subject of an evolutionary process. And we are studying the human germ plasm, its composition, its mutations and its mixtures.

And why do we investigate? Is not enough known to warrant *propaganda*; and should we not better organize for a campaign to change what needs changing? Alas! we have now too little precise knowledge in any field of eugenics. We can command respect for our eugenic conclusions only as our findings are based on rigid proof, a proof that is either statistical or experimental. Only as we are able to base our statements on scientific, quantitative data can we hope to carry conviction and not arouse contrary opinion. People do not have heated discussions on the multiplication table; they will not dispute quantitative findings in any science.

It is largely due to the extraordinary vision of Mrs. E. H. Harriman, the founder of the Eugenics Record Office, that in this country eugenics is more a subject of research than of

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¹ Address at the opening session of the International Congress of Eugenics.

propaganda. She maintained that we should be more concerned with knowing than with doing. Ascertained facts do not require propaganda.

It is sometimes asserted that research in eugenics belongs to the realm of applied science, and much of it does. But not all. There are fields of eugenical research, especially in human genetics, that are pure research in as much as they are devoted to investigations that can not be carried out so well on any other material. For example, inheritance of psychological traits, of temperament and of sense perception.

In so far as eugenics may lay claim to being a science, it has not only a subject matter—but also a method of its own. In studying the genetics of the lower animals, we proceed by the method of control of matings. Now this method is obviously not applicable to man in modern civilized countries. It has to be replaced by the collection of the history of matings that have been already made and a study of their progeny. We replace the experimental mating of the geneticist with the principle that every fertile human mating is an experiment in genetics, and it is for us to record the result of the experiment. Some day, we may hope, human matings will be carried beyond the stage of experiment.

At present, then, the student of human genetics must collect data on human matings and their outcome. Of course, he must know, as thoroughly as he can, the genetic nature of the matings; so that he can give the probable genetic composition of the gametes. This means that he must know for the mated pair, the parents, uncles and aunts and their children. He can then check his findings by studying the traits of the children. Since the capacity of one man for collecting by himself is very limited, it is necessary to train observers to collect data. Hence has arisen the profession of eugenical field worker whose function it is to study through three or more generations and as analytically as possible all the members of an inter-generating group so that their probable genetic composition may be known. By gathering together in one de-

pository a large quantity of carefully ascertained family data, the basis is laid for human genetical studies.

The history of the development of the method of eugenical field workers is not a long one. Dr. Alexander Graham Bell was one of the first to use it extensively in this country. He employed such field workers in his study of deaf mutes especially those of Martha's Vineyard, in the early eighties. The Reverend Oscar McCulloch made use of field workers in his study of the Ishmaelites in the nineties, and at the Vineland Training School such workers were employed before 1910. A large number of eugenical field workers (about 200) have been trained by the Eugenics Record Office since its beginning in 1910.

Besides trained field workers, numerous volunteers are in a position to contribute data. Thus, in 1884, Francis Galton distributed his questionnaires called "Record of Family Faculties," and over 150 persons volunteered to fill them out and return them to him for study. The Eugenics Record Office has made use of a similar questionnaire called "Record of Family Traits," of which 4,000, of varying degrees of excellence, have been deposited in that office. Some of these "Records" are exceptionally valuable. It appears that many persons show the capacity for and interest in filling out such schedules excellently. A few others will take the pains to make a still more detailed analysis of the individuals of their families. Many of these records have to be considered as *finders* merely; as guides to further inquiries.

Additional records that are often of value are the printed genealogies and town histories, of which so many have been printed in this country, especially for the northeastern section. In addition, biographies, especially sets of biographies relating to members of a single family, will yield to the analyst of human traits data of the greatest importance. Finally all records—those of field workers, of volunteers and the printed records—must be indexed by name, place and trait so that their contents shall be readily available.

In inquiries into human genetics it is de-

sirable, where possible, to breed experimentally mammals, if any are available, which show the same trait that we are studying in humans. This is often possible, and such study will afford a control of results gained on man. Thus have been studied hare-lip in dogs, fecundity in sheep, instincts in dogs, polydactylism in fowls.

In other studies the method employed will be that of accumulation of statistics, their tabulation and analysis. Thus we investigate mate selection, the relative fecundity and relative mortality of the various stocks and the effect on the germ plasm of a country of the different immigrant races.

Some of the results of analytical study of these eugenical data are fairly well established. A few clearly simple Mendelian traits have been found. Such is eye color in which brown is dominant over its absence. It is possible that in some cases additional factors may be present, but the rule serves as a first approximation. Dominant, also, appears to be curliness of the hair as contrasted with recessive straight. And there are various diseases and defects that appear either as simple dominants or recessives, such as abnormalities in number and form of fingers and toes, which are mostly dominant over the normal condition; various defects of the eye such as cataract, certain types of congenital deafness, various abnormalities of skin, and hair and nails.

Other, and probably many other, traits are due to multiple factors—so often this is true as to suggest the hypothesis that in mammals, as contrasted with insects, traits are genetically relatively complex. Thus stature and build and proportions of parts and pigmentation of hair and skin are dependent on multiple factors. Indeed, there seems to be evidence that negro skin color is dependent upon two pairs of factors which merely reinforce each other.

Other traits are associated with sex in the remarkable fashion called sex-linked. That is, they are usually found only in the male sex and are inherited through the mother, though she, herself, is not affected. In such cases one usually finds male relatives of the mother who are affected. Such are color blindness, hemo-

philia and atrophy of the optic nerve. The facts of sex-linked heredity bring home, even to the layman, the lesson that heredity is a matter of the gametes; and that bodily appearance often gives no hint of the nature of the particular germ-cells carried and, in so far, of what the inheritance shall be. The parents of an albino may have pigmented hair and skin, but both carry gametes which lack the capacity of forming pigment.

Our knowledge of the inheritance of these physical traits is sufficiently precise to be applied practically in cases of doubtful parentage. If the child, the known mother and both of the putative fathers can be seen, and some inquiry be made as to family stock of the three adults a decision can generally be rendered with a high degree of certainty ranging from 75 to 99 per cent. For usually there will not be one critical trait merely but several traits whose combined evidence will be overwhelming. Already the Eugenics Record Office has been asked to answer certain questions about the inheritance of traits in a case of a claimant who maintained that he was the son of a wealthy man who died without known heirs. As lawyers get more used to the idea of utilizing the advances of knowledge for evidence, it is probable that eugenical knowledge will be more and more called upon.

Not only of the physical traits referred to above but also of those of behavior we are learning the hereditary basis. It appears probable, from extensive pedigrees that have been analyzed, that feeble-mindedness of the middle and higher grades is inherited as a simple recessive, or approximately so. It follows that two parents who are feeble-minded shall have only feeble-minded children and this is what is empirically found. It has been urged against this finding that it is improbable that so complicated a thing as full mentality depends upon only one factor. On the other hand, a consideration of the effect of internal secretions, of thyroid, of hypophysis and others leads to the conclusion that a brain with well differentiated intellectual centers may fail of complete development because of the absence of proper developmental impulses of glandular origin.

Two persons whose brains are thus under developed may differ greatly in their mental capacities, because they have fundamental nervous differences, just as seedlings of different species, while all alike under-developed, differ in certain specific traits. Apparently one group of hereditary mental defectives is such because those who belong to it lack a single factor for an adequate developmental impulse.

Epilepsy, of the ordinary juvenile, dementing type, seems to be due, like feeble-mindedness, to a single developmental defect. Also, dementia præcox has been found by several investigators to be due to a similar cause.

But not only mental but also emotional states have a hereditary basis. The prevailing depressed mood appears to be due to a glandular condition that is determined by a certain developmental defect; and a prevailing excitability appears to be determined by a hereditary condition, which may be a tendency to excessive secretion of the suprarenal glands.

Moreover, the quality of our senses has a clear hereditary basis, as the still unpublished work of Dr. Hazel Stanton on musical families clearly shows. It appears from these studies that not only have great musicians an innate capacity for discriminating between closely similar qualities of pitch, intensity, time and for tonal memory but they belong to families with these innate capacities. Also, it has been shown that these capacities are not improvable by training; they depend upon our very constitution. Now we have evidence that persons who have these capacities enjoy exercising them. Those in whom the capacities are slightly developed get no pleasure from exercising them. We conclude that the reason why musical people are such is primarily because of their possession of inborn musical capacities. The musician is born, not made. From these principles certain deductions seem naturally to flow. A great color artist is one in whom the innate capacity for color discrimination is well developed and his family shows other examples of colorists. The sculptor has the hereditary capacity for form discrimination and that is why he finds his highest pleas-

ure in the art. The author is one whose verbal machinery is especially perfect. The sailor is one who finds his greatest pleasure in the beauty of form of the vessel, or perhaps in broad horizons and distant lands; he is neither claustrophil, nor domestic. In general, our vocations, or at least our avocations, are determined by our sensory structure and this is hereditary.

The fact that not only our physical but also our mental and temperamental characteristics have a hereditary basis has certain important social bearings. It leads us to regard more charitably the limitations of our fellow men. The false doctrines of human equality at birth and of freedom of the will have determined a line of practise in the fields of education and criminology that, it seems to me, is not productive of the best results. In education we must know the child's native capacities before we can properly train. In dealing with delinquents we must know the hereditary, mental and emotional make-up before we can get an explanation of the bad conduct and before we can intelligently treat the delinquent. Organized society is too prone to "pass the buck" of its own shortcomings to the hypothetical "bad-will" of the offender against the mores. We should do better if we treated the misdemeanant as we treat a puppy whose actions displease us. Either train him carefully, if he is trainable; otherwise, put him in a position where the exercise of his instincts will not offend us.

The relation of the glands of internal secretion, commonly known as endocrine glands, to human development and human behavior is becoming daily more obvious. Stature, build, proportions; details of development of bone, teeth, nails, hair, skin; intelligence, emotional control, all these things can be shown to be influenced by endocrine secretions. Indeed, it seems naturally to follow that the hereditary differences between people are due to hereditary differences in the activity of these glands. Now these glands, as is well known, secrete substances called "hormones" which regulate our physical, mental and temperamental constitution. The special quality and quantity

of these hormones is determined by the idiosyncrasies of the enzymes of the germ cells. The hormones that determine our personality, constitute the bridge that connects this *personality* on the one hand, with the *specific enzymes* packed away in the chromosomes of the germ cells, on the other. You and I differ by virtue of the difference of atomic structure and atomic activity of the enzymes and hormones which make up that part of the stream of life-yeast which has got into and is activating our protoplasm and will activate that of the fertilized egg that results from us and our consorts. Thus each is what he is in his physique, in his thoughts and in his reactions largely by virtue of the peculiar properties of those extraordinary activating substances, which are specific for him and other members of his family and race or biotype. The future of human genetics lies largely in a study of these activities, and the origin of differences or mutations in them.

The study of human genetics leads into numerous fields of the physiology of human reproduction. Of these one of the most significant is that of twin-production. This topic has many aspects. As is well known twins are of two types. Two-egg twins come from two eggs simultaneously ovulated and one-egg twins arise by a division into two embryos of a single young embryo. The two children which thus arise from one egg are often so marvellously similar that they are called "identical twins." Now these identical twins give a measure of the relative importance of heredity and environment, as Francis Galton pointed out. It is, indeed, marvellous to see how such twins, even though living far apart, retain their initial resemblance, experience at almost exactly the same time similar disease and emotional disturbances. Even the thoughts, as measured by the so-called "association" tests and the finger prints are marvellously similar. The dissimilarity of environment has had little effect on altering the rhythm of development, which is controlled by an internal mechanism. The two-egg twins are merely ordinary brothers and sisters who are born simultaneously and though the in-

trauterine environment and that of early years is as nearly identical as possible, yet they are as dissimilar as brothers and sisters are apt to be.

Though human heredity is the leading branch of eugenical research, yet it is only one. A fascinating branch of the subject is that of mate selection, including a study of those external and internal conditions that control in this phenomenon. While propinquity is often considered the all-sufficient basis of mate selection, yet statistical research reveals such facts as these; that there is a selection of mates of corresponding divergence from the mean in stature; that red-haired persons do not marry as frequently as expected on a random basis; that persons of opposite temperaments tend to marry with each other.

Research on fecundity, especially the differing fecundity of peoples having dissimilar social values in the population has not received the attention it deserves; still we know something of the fractions of sons and daughters of college men and women and have some facts available towards a study of fecundity of the socially inadequate. Always, however, it is not to be forgotten that it is the residuum of surviving children of a marriage that counts in the race and the children of the less socially adequate strains are permitted a larger selective death rate than are those of the more efficient strains. That is one reason why from the less developed strains, vigorous and effective progeny are occasionally arising; while some lines of the more effective and prosperous families end in weak and lethal descendants. Modern surgery has done much to keep alive weak and defective individuals, but little to improve racial qualities. Selection and its effects, including those of war, have been all too little studied.

But fecundity of stocks is only a part of the problem in a country which, like ours, has in a single year, added about as much to the population by immigration as by birth. Probably never before in the world has such a migration of all sorts of races in such numbers, over so great a distance, taken place. Here in America we have watched the process

with misgivings, and felt a lack of sufficient knowledge to direct our action. The present policy of *selecting* immigrants is a reasonable one, certainly; and every one who recognizes the effect of quality of the germ-plasm on national life, hopes it will be continued and extended until we know something of the family, as well as individual performance, of each applicant for entry into the United States. The best, as well as the most recent study of the effect of a mixture of races upon a country is Mr. Charles W. Gould's "America: A Family Matter," and his conclusions are not encouraging. But the student of human genetics hopes to put this marvelous mixture of races to account in his study of human inheritance. The greatest opportunity in the world is offered for the study, since nearly all the races of mankind can be found in New York City alone, in considerable numbers, talking the one language and making mixed marriages, which are often strikingly diverse. This is a field that is extremely alluring and which has been little worked.

But I fear I tire you with this prolonged discussion of the results and the future of eugenical research. No doubt there are many who are inquiring "But where does environment come in?" And there are others who would urge that the great problem for investigation is that of the relative importance of heredity and environment. It seems to me that we should not formulate the problem in this manner. There is no heredity without environment and few environmental effects which are not dependent also upon heredity. Schooling is good for those who are not feeble-minded; moral training yields excellent results in the case of such as have normal inhibitions; musical education is valuable if the elements of musical capacity are present; painting lessons are fine if the pupil be not color blind. Certainly every child deserves the greatest possible opportunities; but the same conditions will be an opportunity to him who is able to take advantage of them, and no opportunity to him whose hereditary limitations do not enable him to use them.

And finally, what are some of the practical applications that we may expect to be made of eugenical research? One, certainly, is a higher estimation of the importance of hereditary capacities in human behavior. This may save us from disregard of innate differences—capacities which lead us on the one hand to adjudge all men equally capable of acting in accordance with the *mores*; and, on the other, to explain all offences as due to poor environment. Both false views neglect the fact of differences in inborn capacities.

Again, there will come a realization of the importance of heredity in marriage matings. Young persons to whom marriage is so serious a matter, will be led to stop and consider, when they feel they are falling in love, and inquire concerning consequences to offspring. Already there is being developed a well-defined conscience in the matters of cousin marriages, and of matings into families with grossly defective members. This is shown by the extensive correspondence that the Eugenics Record Office has been obliged to enter into with persons who are contemplating marriage. They are quite willing to submit an extensive account of their family traits; and they write to learn what is known about the inheritance of some family weakness or defect. The people who make these inquiries are often unusually intelligent and not at all radical; some of them stand high in the social world. It is a high idealism and a forward looking one which leads them to seek the desired knowledge and one can only respond to these requests, telling what is known, or highly probable, in respect to the recurrence of the family defects in the offspring. Whether the conclusions that one is able to give are always very valuable or not, at least the custom of considering children and their inheritance of familial traits is one to be encouraged. Normal persons marry to beget normal children and it is natural for them to seek information concerning heredity of particular traits.

And again, it may be hoped that the study of racial characters will lead men to a broader vision of the human race and the fact that its fate is controllable. We may hope that reason-

able persons will consider the progress of mankind, not by the years of generations merely, but by centuries or millenia. We may learn by the history of mankind in the last 20,000 years how near it has come to extinction; and we must recognize that it will take only a little interference with natural instincts and a little interference with natural selection during a few generations to bring the species, or one race of it, rather abruptly to an end, just as other human races have come to an end in historical times. The human species must eventually go the way of all species of which we have a paleontological record; already there are clear signs of a wide-spread deterioration in this most complex and unstable of all animal types. A failure to be influenced by the findings of the students of eugenics or a continuance in our present fatuous belief in the potency of money to cure racial evils will hasten the end. But if there be a serious support of research in eugenics and a willingness to be guided by clearly established facts in this field, the end of our species may long be postponed and the race may be brought to higher levels of racial health, happiness and effectiveness.

CHARLES B. DAVENPORT

JOEL ASAPH ALLEN

THROUGH the death, on August 29, 1921, of Dr. Joel Asaph Allen, science has lost a pioneer and a most devoted servant. A memorable career, filled with achievement and marked by years of unflagging application and energy, has been closed in its eighty-fourth year.

Joel Asaph Allen was born in Springfield, Massachusetts, July 19, 1838, of New England parentage. Through his father, Joel Allen, he traced his descent back to an Allen who came to the Colonies about 1630, while the maternal line of descent was from John Trumbull who settled in Massachusetts in 1639. The eldest of five children, his early life was spent on the paternal farm in an atmosphere of puritanical strictness. His schooling began with attendance at the rural school, generally in the winter only, because

of the demands of the farm for the summer months. The boy very early displayed an intense love of nature and a keen interest in all its manifestations. While this did not meet with the wishes of his father there was no active or unkind opposition, and from his mother he met only sympathy.

Dependent at first solely upon his own efforts, without the aid of books or the acquaintance of naturalists, the boy showed a great determination to interpret the life about him. Later, when his attendance at Wilbraham Academy led up to Cambridge and the opportunity of studying under Louis Agassiz, he was prepared to make the most of every opportunity. However, this zeal for the constant study of nature, in addition to the work necessary in helping on the farm, resulted in the overtaxing of his strength and the impairment of his health, a condition which gave him much trouble throughout his lifetime and finally put an end to all field work.

His association with Agassiz began when he entered Cambridge as a special student and lasted until the latter's death. Among his associates in these classes conducted by the great teacher, were men destined to become famous, authorities in their special fields. The names of Alpheus Hyatt, E. S. Morse, A. S. Packard and A. E. Verrill are to be found on the rosters of those days at Cambridge.

The story of his schooling at Wilbraham Academy and later at Cambridge is that of a young man anxious for knowledge, but especially eager for the subjects bearing upon the natural sciences. With an ardent desire to do editorial work, young Allen found difficulty in composition and set himself to acquire this facility by keeping a daily journal, among other items making note of current weather conditions. When a summary of these weather reports were handed in as a composition at the academy, the boy was delighted to discover that Professor Marcy, his instructor, thought them worth publication. The summary came out in the *New England Farmer* and was the first of a long series from