On inheritance of mental characters : the Harveian oration for 1910 : delivered before the Royal College of Physicians of London on October 18th / by H.B. Donkin.

The Harveian Oration
1910

H. B. Donkin, M.D., F.R.C.P.

With the compliments of the Author.

ON

INHERITANCE OF MENTAL CHARACTERS

THE HARVEIAN ORATION FOR 1910

DELIVERED BEFORE THE ROYAL COLLEGE OF PHYSICIANS OF LONDON ON OCTOBER 18TH

BY

H. B. DONKIN, M.D.OXON., F.R.C.P.

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> "Let parents choose betimes the vocations and courses they mean their children should take; for then they are most flexible: and let them not too much apply themselves to the disposition of their children as thinking they will take best to that which they have most mind to."
>
> *Francis Bacon.*

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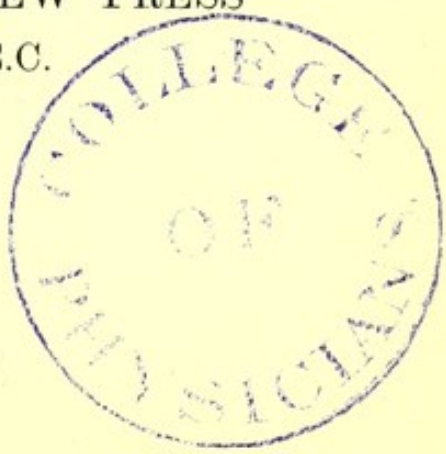

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THE HARVEIAN ORATION

ON

INHERITANCE OF MENTAL CHARACTERS

Mr. President and Fellows,—In offering the Harveian Orator's solemn apology for accepting the honour conferred upon him I am personally conscious of discharging no vain formality. Having been long occupied in public duties but partly medical, and thus prevented from duly obeying the Presidential biddings to the Comitia, I appreciated highly the compliment so graciously bestowed upon me by Sir Richard Douglas Powell in appointing me to this important office. The choice, however, of a fitting theme, and the difficulty, on an occasion like this, of handling that to which I inclined, caused me to hesitate gravely before taking up this honourable burden. Permit me now, Sir Thomas Barlow, while

respectfully and cordially congratulating both yourself and the College on your succession to this famous Chair, to plead for your merciful judgment on my present effort to fulfil your predecessor's behest.

The lapse of time since Harvey ordained this annual oration has rightly lessened the rigour of literal obedience to his injunctions. No oration in Latin has been heard for nearly half a century, nor has the annual feast been always celebrated, within the College walls. In recent years, at least, no orator but Dr. Frederick Roberts has succeeded in the task of commemorating all our benefactors by name, this first Harveian injunction being usually fulfilled by the mention of such gifts made to the College, or such work achieved by its alumni during the past year, as may be deemed to increase its usefulness or redound to its glory. I cannot find that the year now passed has added to our benefactions of either kind. But there is one great name, besides that of Harvey whom we delight to honour unceasingly, that calls for signal note to-day. I am reminded that on the sixth of this month, four hundred years ago, was born John Caius, nine times President of this College, virtual founder of the Cambridge college that popularly bears his name alone, and the second of the three illustrious ones on our roll to whom we can apply, in changing one word, the Lucretian saying, "Quasi cursores *medicinæ* lampada tradunt." Our own Scholar-Physician, Dr.

Payne, whose frequent presence here is so sorely missed, has left in the minds of all who heard or read his Harveian Oration a vivid picture of Dr. Caius, stretching out one hand to our Founder, the famous medical humanist of the fifteenth century, the other to our immortal scientific physiologist of the seventeenth.

Though Caius, who taught Greek in Padua, and, later, essayed to prove that the University of Cambridge was founded in the fourth century before the Christian Era, may, in some respects, have been more nearly related in spirit to Linacre than to Harvey, yet his introduction of Practical Anatomy into this country, his work on 'Some Rare Plants and Animals,' and, especially, his admirable study of the Sweating Sickness, to which Payne refers as "the first original contribution to clinical medicine of which this country can boast," all, surely, tend to show that he had a true bent towards independent investigation, that his face was well set forwards, and that he sighted the beams of the rising sun of modern method. Let us, then, praise this famous man to-day as the first scientific physician on our roll.

I think that due reflection on the actual words and import of the historic document, wherein Harvey, among other express commands, enjoins the delivery of this oration, will justify some further adaptation of his orders in my endeavour to fulfil the spirit of

his intentions. Harvey's motives were determined by the conditions of his time. Very prominent in this deed of gift is his intense desire to promote concord among the College members. The deed virtually begins and ends with insistent and particular warnings against discord, delicately though these warnings are expressed in terms of earnest call to professional harmony. Even the time-honoured order "to exhort the Fellows to search and study out the secrets of Nature by way of experiment," brief as it is in comparison with his other and more emphatic injunctions, seems to echo his regret for the prevalent dogmatism and intellectual apathy of the physicians of his day. Doubtless Harvey enjoyed the high appreciation of many colleagues to whom he imparted his great discovery before giving it to the world. He was President Elect of this College. But it may be suggested, in view of his manifest superiority of intellectual grasp, that his commands were largely inspired by his sense of the defects of his medical contemporaries. Medical England was not ready for Harvey, albeit the spirit of science was abroad in the land, richly informing other branches of knowledge. This college, until long after his time, achieved little to foster even such a quest after a scientific basis for medical art as had been followed with insight by the great Greeks of old. Instead of encouraging scientific work by various honours and awards, as it does in

our day, or of paying reverent tribute to scientific genius, as it did on that ever-memorable occasion when some of us were enabled at least to say, *Darwin vidi tantum*, or of using its high privilege as a scientific body, by opening its doors, as it did this year, to the Defenders of Research, it seems to have been busier in coercing the apothecaries, and in warning away from London the medical graduates of Oxford and Cambridge. But Harvey was in love with science ; like Huxley, the great modern prophet of scientific method, he was penetrated by the missionary spirit ; and eager to turn away his fellows from personal quarrellings and verbal disputations, he directed them towards the fruitful acquirement of medical truth by bidding them to the scientific study of nature for their better enlightenment.

If this view find favour, I may be pardoned for passing over what appears to me, in its literal sense, the most important of Harvey's exhortations, and for modifying adaptively that other special injunction to which, in common with my predecessors in this office, I strive to make response.

If Harvey were with us now he would acknowledge that his dominant exhortation is needed no more ; for he would note the extinction of rancorous disputes on medical superstitions and the rarity of overt personal jealousies, and would congratulate the physicians of to-day that only gross treason to medical truth and

dishonourable conduct are likely to strain those fraternal bonds of science and a common profession which now so generally unite them. He would recognise also that the "way of experiment," even in the strict and modern sense of artificially designing conditions for the purpose of discovery, is now very widely followed; and would even justify the contention that this way of experiment, regarded exclusively as the only way to the attainment of sound knowledge, may sometimes lead to error instead of truth.

It is solely in view of the biological nature of my subject, which, briefly, is that of some aspects of Heredity in relation to Mind, that I venture to say here a few more words on scientific method. Outside the field of biology, or even of that section of it which is concerned with heredity, I might be charged with serving up a *crambe repetita*. But there seems to be a difference of opinion among biologists concerning the function and scope of experiment in the solution of scientific problems; some of them apparently holding, in view of the paramount necessity in some branches of science of the use of experiment in the ascertainment of facts or in the testing of hypotheses, that facts arrived at by observation alone are of minor value or comparatively negligible. At any rate, the well-known and accredited method of investigation which has been followed by Newton, Harvey, Darwin,

and all great discoverers whose work is of permanent value, is not always employed. I mean, of course, the method (1) of observation (including the artificial variety called experiment), (2) of comparison and classification, leading to inferences or hypotheses or inductions, (3) of deduction, or prediction of the consequences which must follow on the assumption of such hypotheses, and (4) of verification, by the widest possible appeal to all attainable and relevant facts, whether ascertained by observation or experiment, in order to see whether such consequences do or do not occur. The position that this—the method of "trained and organised common sense"—is the method of all sciences *of which the final aim is the discovery of causes, or interpretation,* is perhaps not openly assailed; but there are some instances in biological writings where special value is apparently attributed to a fact because it has been found out by experiment rather than by simple observation; and also some instances of omission to test by deduction, and by a wide appeal to further relevant facts, hypotheses which have been based on experimental discovery alone. It is, of course, true that in sciences where, as in physics and chemistry, many of the facts are, in their nature, latent and obscured, the method of observation by way of experiment is indispensable for their discovery. So also is it indispensable over a large area of the field of physiology. But many facts in biology and medi-

cine are patent to observation alone. Harvey, as a great physiologist, saw vividly the paramount importance of experimental work, both in ascertaining his facts and in deductively testing his conclusions; but surely neither he nor any other clear thinker would deny that when, in any field of study, such as that of the human being, normal and morbid, many patent and important facts present themselves clearly to direct observation, an injunction to proceed by the way of experiment only would prove to be a harmful limitation, and especially inimical to biological and medical inquiry. This subject of method is dealt with very luminously by Dr. Archdall Reid in his recent and attractive work on the 'Laws of Heredity'—a book full of valuable thoughts and observations, which must tend to clarify greatly the reflections of many on the difficult problems of heredity, and especially those which relate to mankind.

In the present context this author says, "An hypothesis merely founded on facts, previously obscured, which have been revealed by experiment, has no special claim to accuracy. The subsequent thinking may or may not be accurate. To discover the accuracy of the thinking, we have to use tests which that particular experiment, of course, cannot furnish. A neglect to *test* thinking founded on experiment, combined with an assumption that such thinking is necessarily accurate, is very frequent."

This contention, that a deductive test of conclusions arrived at by induction is necessary to establish proof, self-evident though it appears, has been stigmatised by some modern writers on biology as "merely deductive," "logical," "philosophical," "pre-Baconian," or even as mere "ratiocination," this last Latinised epithet being apparently preferred by the critic to the simple word "reasoning," for the sake of avoiding open discomfiture.

Such writers may well be referred to these words of De Morgan: "Modern discoveries have not been made by large collections of facts with subsequent discussion, separation, and resulting deduction of a truth thus rendered perceptible. A few facts have suggested an *hypothesis*, which means a *supposition* proper to explain them. The necessary results of this supposition are worked out, and then, and not till then, other facts are examined to see if these ulterior results are found in nature. The trial of the hypothesis is the *special object*, prior to which the hypothesis must have been started, not by rule, but by that sagacity of which no description can be given, precisely because the very owners of it do not act under laws perceptible to themselves. Wrong hypotheses, rightly worked from, have produced more useful results than unguided observation. But this is not the Baconian plan . . . What are large collections of facts for? To make theories *from*, says

Bacon; to try ready-made theories *by*, says the history of discovery."*

I trust, therefore, that these few remarks prompted by my subject, which is concerned more largely with observation and reasoning than with actual experiment in the modern sense, will serve to excuse the version of the statutory exhortation which I now venture to deliver, in the form of a reminder, to all searchers of Nature: To study out her secrets in every field, not by following any exclusive way, but by the use of that comprehensive method, common to interpretative sciences, which takes account of all authentic and relevant facts, and tests all thinking: the method, indeed, that was followed so notably by Harvey himself.

My occupation of late years, much concerned as it has been with such matters as crime, inebriety, and mental defect, has directed my attention afresh to the subject of the evolution and inheritance of mental characters—a subject which attracted me, when, in the course of somewhat erratic reading for the Oxford Classical School, I perused the 'Origin of Species,' then "mewing its mighty youth"; and also the first edition of the 'Physiology and Pathology of Mind' by our now renowned Fellow, Dr. Maudsley. As a further excuse for my choice of matter, I may claim,

* See De Morgan's *Budget of Paradoxes*, pp. 55–56, quoted in Welton's *Manual of Logic*, vol. ii, p. 60.

as an encouraging precedent, the recent Harveian Oration by Dr. Ormerod, in which he showed, by quotations from the 'Exercitationes de Generatione,' that Harvey's mind had certainly dwelt on the subject of heredity in some of its aspects. And I hope, before I close, to show, from my own study of this great work on "Generation," that Harvey had at least a glimpse, among other cognate questions, of the want of some useful distinction between so-called "innate" and "acquired" characters—a want which, indeed, furnishes the point of many of the remarks I shall now submit. These are chiefly intended to emphasise the immense importance to man's life and progress of the characters called "acquired": an importance, in my judgment, greatly under-rated by some modern biologists.

I must first assume, with but brief comment, the position that mind has been evolved. Only on this assumption is it possible to inquire scientifically into the question of the inheritance of mental characters, and to seek for even a proximate explanation of their development and defect. I know, indeed, of but one living evolutionist of great and rightful fame, the co-discoverer with Darwin of the Law of Natural Selection, who, Darwinian or even ultra-Darwinian though he is on other points, explicitly holds that the origin of the mind and of sensation or consciousness in all organisms is, equally with that of life itself,

outside the field of natural operations, and necessitates the assumption of a new power of spiritual essence.*

However true it may be, such a belief can be neither disproved nor contested by scientific reasoning. But while some relegate wholly such questions as these, with that of the primal origin of the universe, to the sphere of super-nature, others feel compelled to seek for natural laws in any direction where scientific method may possibly guide them. For these, the study of man, as we find him, practically pre-supposes that the development of his mind, with all its capacities, has depended on that of his mighty brain, which has been organically evolved under the influence of natural selection. Darwin himself taught the grammar of the evolution of mind, tracing it upwards from instincts to reason, from lower to higher organisms. Thus he laid the foundation for further scientific inquiry into the questions of the development and transmission of mental characters.

In making this assumption regarding the evolution of mind, I assume, too, without argument, and for brevity's sake, the Darwinian doctrine which implies that the variations on which natural selection mainly works in the evolutionary process are germinal or innate, and are not caused by the action of the environment. Darwin, himself, in the chapter on the

* See Wallace's *Darwinism*, pp. 461, *et seq.*

"Conditions of Life" in his book on 'Variation * of Animals and Plants, etc.,' after discussing the different possible causes of variation, sums up as follows: "We may conclude that the constitution of the individual is of far higher importance than the conditions to which it has been exposed. It is a general rule that conspicuous variations occur rarely, and in one individual alone out of millions. As the most strongly marked variations graduate insensibly into the most trifling, we are led by the same train of thought to attribute such slight variations much more to innate differences of constitution, however caused, than to the definite action of the surrounding conditions."

And lastly, I shall assume the accordant doctrine, which is now held generally by most biologists, though apparently ignored by some and explicitly rejected by a few, that characters, commonly called "acquired," which depend on somatic modifications caused in the individual after birth, or, as some express it, are developed in the parents only under the influence of use and experience, are not developed in descendents in the absence of similar influences, although the potentiality of such development is organically inherent in the innately variable germ-plasm.

I need hardly say that it is not my intention to attempt a discussion of the doctrines that conflict

* See Chap. XXII of this work.

with these assumptions. Believing, however, (1) that the part played by non-transmissible acquirements has been, and is, of paramount importance to the progress of man in his never-ending attempts to make conquest of natural forces, or to destroy the effects of his own mistakes; (2) that the present biological evolution of man is to a predominant extent limited to a struggle against disease; (3) that there is no evidence to show that human mental *capacity* on the whole has materially increased within, at least, historical times; and (4) that the theory of natural selection according to Darwin, supplemented, as I have indicated, by that of Weismann, is the best explanation available of the development and inheritance of cerebro-mental functions, I cannot avoid certain incidental references to the teaching and methods of some who hold widely different views. And here I desire it to be understood, once for all, that in my incidental references to Mendelian *views*, I am not calling in question such *facts* as have been established by this school of workers. I protest here mainly against the Mendelian *hypothesis* of "unit-segregation" being termed a "*discovery*," and employed as a *fact* in argument.

The topics of "*criminology*," *mental defect*, and "*eugenics*" may serve to illustrate the necessity of clear conceptions and a definite use of terms when we speak of the difference between "innate" and

"acquired" characters. The first topic, that of so-called "criminology," demands, for the purpose in view, but a brief notice. Law-breaking, or criminality, is no unity. There are no special qualities, physical or mental, common to all criminals. The only important link between the study of crime and that of heredity is the fact that a considerably larger minority of persons with clearly appreciable mental defect, apparently of congenital nature, is found among convicted criminals than in the population at large. The notable number of mentally defective persons among criminals who are sentenced to penal servitude, and are, usually, the perpetrators of serious crime, impressed me at the outset of my prison work. Though it is difficult, and often impossible, to obtain an adequate history of the early life of these men, it is practicable from inquiry, and from study of the men themselves, to assert with much confidence that a significant proportion of them are of primarily defective mental capacity, or, as the old legal phase has it, are "a nativitate mente capti." This conclusion is arrived at, independently of their criminality, from positive indications of mental defect observed in their conduct, and, in some cases, from certain concomitant physical characters. This class of mental defectives includes criminals of many kinds. They are, it seems, innately unable to acquire the complex characters which are essential to the average man;

and, according to their surroundings, they follow the path of least resistance. This path is more often than not, but by no means always, the path of unsocial or criminal action. These statements about criminals will appear to be dogmatic, but are, I think, capable of proof. I have reason for believing that the report of an extensive inquiry now nearing completion, which has been carried out by the medical officers of our convict prisons, will go far, in itself, towards their justification. This matter, indeed, is of importance, not because any serious students of this subject now accept the doctrine of hereditary criminality, or consider the so-called science of "criminology" as aught else than a mass of imperfect and unclassified observations linked together by untested hypothesis; but because this doctrine, so much emphasised by Lombroso, Max Nordau, and others, of the hereditary nature of crime, or, in other words, of the criminal being a racial "degenerate," is still very dominant over the public mind. It is widely popularised, at the risk of producing practical effects, not only by writers of fiction, but also by philanthropists, journalists, and public speakers on social questions. It is apparently assumed as true by at least one prominent writer on biology*; while another

* Professor Bateson, in his book on *Mendel's Principles of Heredity*, p. 306, writes as follows, after having stated on a previous page that in "the pre-Mendelian period, the expression 'genetic' had no definite meaning": "Genetic knowledge" (by which, it

disciple of Mendel proclaims that an "anarchist" is a germinal "mutation," which will breed true like other "sports." As all know, there is, in this context, much loose talk about so-called "degeneracy." This word "degeneracy" is mostly used without regard to its only legitimate meaning, which, of course, denotes *racial* change; and abounds in many works which are popularly mistaken for scientific studies. It follows from these remarks that it is unnecessary to discuss any question of relation between this doctrine and the scientific problems of the evolution and inheritance of mental characters; for no really rational hypothesis of hereditary criminality has been even formulated.

My second illustrative topic is that of the causation of such mental defect as is usually called "congenital." The evidence concerning this matter, which was abundantly tendered by medical and other witnesses to the Royal Commission on the Control of the Feeble-minded, of which I was a member, evinced a frequent confusion or absence of thought on the meaning and right use of the word "heredity." This evidence,

may fairly be presumed, is meant the doctrine of heredity according to the Mendelian hypothesis of unit-segregation) "must certainly lead to new conceptions of justice, and it is by no means impossible that in the light of such knowledge public opinion will welcome measures likely to do more for the extinction of the criminal and degenerate than has been accomplished by ages of penal enactment."

some of it being of great value, was accepted, after some discussion, by the Commissioners, although the question of causation had not been explicitly referred to them. It was therefore dealt with to some extent in the Report, although the constitution of this commission, in common with that of some others on cognate subjects, was not adapted to deal exhaustively with questions involving scientific, and, especially, biological problems in relation to human beings. Some of the witnesses held that the forms of mental defect under consideration were largely inherited, while at the same time they attributed their occurrence in offspring to quite different characters in the parent, such as alcoholism, tuberculosis, malnutrition, or other disorders incident on slum-conditions or unhealthy surroundings generally. Others considered all cases of mental defect as "hereditary" when there was any history of insanity or "nervous disorder" of almost any kind among the more or less immediate ancestors. Others, again, used the word "heredity" in the strict sense, and applied it only to characters which appear to be organically innate or "germinal," and are *of like nature with ancestral traits.* So apparent, indeed, even to the non-medical members of the Commission, were the confusion of thought and the inaccurate language which pervaded much of the evidence on this head, that the Report expressed the unanimous opinion that the important subject of

heredity should be especially emphasised in the medical curriculum.

It is impossible to discuss here the complicated question of the causation of congenital mental defect. My main object in speaking of it is, as I have said, to illustrate the importance of forming clear conceptions concerning heredity, and of carefully defining the terms we use. It may be said, however, that although there are no adequate statistics showing the comparative numbers of such defectives engendered by normal and defective parents respectively, there is a wide consensus of opinion, based on much accurate observation, that a lineal sequence of defectives is sufficiently frequent to render it highly probable that this condition is in a large number of instances truly innate and thus transmissible, or, in other words, that it is thus dependent on a germinal variation of the brain. Those who accept, as most biologists ostensibly accept, the conclusion that characters developed by parents after birth in response to environmental influences are not transmitted to offspring as innate characters not requiring such influences for their development, must reject wholly the doctrine that bad nutrition, or other evil conditions or diseases contracted by the parents, can appear in the offspring in the form of such abnormalities of the brain as must subsist in all, as it is known to subsist in many, of the cases of mental defect we are now considering. They will

hold, as a more likely hypothesis, that such mental defect, especially in the absence of any injury to the brain of the offspring during fœtal life or at birth, is, at least in most cases, a spontaneous variation, probably in the direction of some ancestral condition, and tending to be transmitted to descendents. Those, on the other hand, who attribute such mental defect to various modifications acquired by the parents during their life-time, must not only believe in a multiplicity of causes for a similar effect, but must also hold the view of the modification of the germ-plasm by environmental influences to such a wide extent as would involve the necessary inference of the rapid degeneration and ultimate destruction of the race as a whole. I cannot now pursue this interesting subject, and will but express my opinion that the conclusive answer to this particular question will probably not be given without a more extensive knowledge of facts than is at present available. From all that I have been able to gather from the best authorities on the physical characters of the brain of imbeciles, no absolutely positive statement can yet be made from the anatomical point of view as to how far true retrogression, or how far arrest of fœtal development, can be said to contribute towards the solution of this problem.*

* But see note on p. 48, quoted from Dr. J. S. Bolton, *Brain*, part cxxix, Macmillan & Co.

My *third* topic is that of "eugenics," a subject of present-day interest, both to scientific workers and to the public at large. The main object of human eugenics, according to Sir Francis Galton, the inventor of the term and the originator of the inquiry it embraces, is the discovery "of the amount of change in racial qualities which can reasonably be anticipated," and what can practically be done in the direction of effecting an improvement in such qualities "by selective breeding."* I shall refer here to the method of this research only as it concerns the question of the inheritance of *mental* characters. The method, generally, is to deal measurably and statistically with "faculties" or "characters" that are variously distributed in a large population. If, for instance, the proposition be true that there is, in any nation, greater "fertility" of the mentally inferior than of the better and more abler "stocks," and if it be assumed that the use of the word "stock" implies that the mental difference referred to is of innate or germinal origin, then it follows that the only remedy would be a possible alteration of the relative fertility of such stocks. Now, without raising here any question as to the definition of the word "fertility,"

* See the "Herbert Spencer" lecture by Sir F. Galton, 1907, Clarendon Press, Oxford. See also "Natural Inheritance," 1889, "Huxley Lecture" (1901), and several papers by the same author in the *Memoirs of the Sociological Society*; also Prof. Pearson's "Huxley Lecture" (1903) in vol. iii of *Biometrika*.

it is apparent that any possible improvement of a stock depends on some assumption that the qualities under consideration are really innate and transmissible. However accurately the calculating apparatus may work in dealing statistically with the material collected for its operations, the practical value of the result attained must rest entirely on the nature of the items of material which are thus operated upon. And the important question then arises: Are such "characters" as, for instance, "ability" or "probity," really indications of "stock" qualities? Are they germinal and transmissible, or acquired? As to "ability," if this term were strictly defined in a certain way the answer might be that it is germinal; if defined in another way that it is acquired. As to "probity," it seems to me, at least, plain that the reply must be that it is acquired.*

Touching the mental and moral characters of man, there is massive evidence which shows that many even of the most importantly adaptive among them are the result of "modifications," developed in each individual under the stimulus of actual use and

* I am aware that it may possibly be said that any statistical inquiry resulting in the inference that "probity is inherited" does not necessitate any special theory of heredity; but it seems clear that a definite conception of what the word "inherited" means *is* necessary in the practical context of this matter of selective breeding, which explicitly concerns the research in question.

training alone. Such characters are mainly and clearly traditional; they are handed down by each generation to the next through teaching and example, not through real inheritance; but their constant acquirement by every generation gives them the appearance of naturally inherited qualities. This question should cause all students to pause and consider seriously before they assume that any given character is not only inborn but has also been developed apart from such influences, or in other words, is not an "acquired" or "somatic" modification. These remarks appear to apply also to the utterances of many adherents of the Mendelian school of biologists, who, though widely differing from the biometrical school in respect of fundamental questions of evolution and heredity, seem, in common with their opponents, to consider acquired mental characters, or "modifications," as unimportant; and to class such qualities as they deem at all important with those which are "germinal" and require no external stimulus for their development other than such as is implied in life itself.

I must especially state here that I fully recognise the importance of possible attempts to improve the human race either by limiting or eliminating the bad, or by encouraging the good stock. We may, perhaps, have knowledge enough already to make some practical advance in what has been styled, and,

by some, depreciated, as "negative" eugenics. But we must bring much more biological knowledge and very clear minds to bear upon the subject before attempting any measure in the direction of "positive" eugenics, and, especially, in that of "selective breeding" on the basis of what we regard as innate mental characters. In connection with the desirability of limiting the production of mental defectives on the hypothesis—which, although not demonstrated, is regarded as highly probable by most observers—that mental defect is largely innate and transmissible, I would mention the following facts, taken from Dr. Ireland's book on 'The Mental Affections of Children,' as suggesting reflection on the question of making such a step in the direction of negative eugenics as that of trying to minimise the production of mental defectives. The average mortality, during a certain period, of imbeciles between the ages of five and twenty years, in two large asylums, was at least nine times as great as that of sound-minded young persons at the same period of life in corresponding years. Dr. Ireland adds that in an asylum well known to him, the substitution of a non-resident doctor for a resident medical superintendent was followed by a rise in the death-rate above double. His comment on this implies his opinion that the protection of the lives of imbeciles is an important function of medical art. From one point of view this opinion is right; but

from another, we are led to reflect how often Nature's method of negative eugenics is effectively antagonised by man. Though imbeciles in asylums are of course incidentally prevented, for the most part, from propagating, infinitely larger numbers of many grades are permitted to bear and beget children from sentiments very similar to those which tend to foster any measures for prolonging the life of all.

The necessity of some clear conceptions of the nature of "innate" and "acquired" characters, as well as of heredity, and of the evolutionary process, is now abundantly evident, whether mental or bodily characters be the subject of study. Even though biologists may perhaps agree in the belief of the continuity and a high degree of inviolabitity of the germ-plasm, in the consequent non-transmissibility of acquired modifications, and in the doctrine of evolution by the action of natural selection on germinal variations alone, they certainly differ as to what characters should be classed as germinal variations or acquired modifications respectively; and such differences are manifestly important. They also notoriously differ as to whether the material for natural selection consists mainly of small and so-called fluctuating variations as necessarily implied in the theory of Darwin and Wallace; or only of "sports": "large," or "discontinuous," or "saltatory" variations, now commonly called "mutations," which are said to

be stable from the first, and alone to be of "genetic" value in evolution. This latter hypothesis was long ago opposed to Darwin's theory by the late Mr. St. George Mivart, who held that new species manifest themselves with suddenness and by modifications appearing at once; and, in a more elaborate form, based on "some facts and a hypothesis," is promulgated by mutationists and some Mendelians of the present day, who more than hint that the Darwinian theory of natural selection is largely a superstition. Differing hypotheses are also upheld, by the followers of the Mendelian and Galtonian methods respectively, in connexion with the hereditary transmission of characters; the one school adopting that of the unit-segregation of characters in the germ-plasm, the other those which are known as the laws of "ancestral inheritance," and of "filial regression."

I have said that I have no intention of discussing here the various opinions alluded to. I shall consider, only and briefly, that exposition of biological evolution and heredity in relation to man and his mind which seems to cover fitly the complex facts which present themselves and to be contradicted by none of them: I mean the theory of evolution as set forth by Darwin and by Wallace, and as supplemented by the doctrine of the non-transmissibility (to offspring) of acquired modifications, *i. e.* modifications developed in the parent after birth under the stimulus of use and ex-

perience alone. Darwin himself, as I have said already, taught the grammar of the evolution of mental and moral characters, basing his argument on the existence of the social instinct in man. He formulated, however, no positive theory of heredity, though he saw the need of one; and, assuming the probability of some characters acquired by parents being transmitted as such by immediate inheritance to their offspring, he suggested the hypothesis of pangenesis. In his 'Descent of Man,' nevertheless, he displays in more than one place some hesitation in accepting his own tentative opinion on this point. Writing of Spencer's hypothesis of the *transmutation* of experiences of utility, by a process of continued transmission and accumulation, into inherent faculties of moral intuition, he suggests that, if insanity and other morbid mental or moral tendencies connected with cerebral or other bodily states can be transmitted, it is probable that good tendencies are transmitted likewise. "Even the partial transmission of virtuous tendencies," he says, "would be an immense assistance to the primary impulse derived from those social instincts which are the true basis of moral evolution by selection." "Admitting," he says further, "for a moment that virtuous tendencies are inherited, it appears probable that they become first impressed on the mental organisation through habit, instruction, and example continued during several

generations in the same family." But he adds, "My chief source of doubt with respect to any such inheritance is that customs, superstitions, and tastes, such as the horror of a Hindoo for 'unclean' food, ought, on the same principle, to be transmitted. I have not met with any evidence in support of the transmission of superstitions, customs, or senseless habits."

The doctrine of the leading biologists of the present day who recognise the truth of the principles of evolution as established by Darwin, and who hold, in substitution of Darwin's supposition of the transmissibility of some acquired characters, that it is "educability," or the organic capacity for making such acquirements, not the acquirements themselves, which is innate and transmitted, seems to form the only synthesis which covers the known facts of heredity, is contradicted by none, and tends, in consequence, to be of further interpretative value. The conclusion is evident, in the application of this doctrine to mental development, that "the mind of the human *adult* is mainly a social product, and can be understood only in relation to the special environment in which it develops, and with which it is in perpetual interaction." "The recognition of this truth," said Sir Ray Lankester in his Presidential Address to the British Association, "seems to be the most important advance in psychology in recent years."* It follows that the innate and trans-

* See Lankester's *Kingdom of Man*, p. 122 (Constable), 1907.

missible factor of the mind of Man is the organic potentiality for making mental acquirements, which, in Man, has been highly evolved by natural selection. In this context I would make special reference to several pages which follow on the quotation from the address I have just mentioned. I can, however, quote now but one passage, which very closely bears on the relation of scientific psychology to the theory of the origin of structural characters by natural selection. "In discussing," says the author in a communication to the Société de Biologie of Paris in 1899, "the significance of the great increase in the size of the cerebral hemispheres in recent as compared to Eocene mammals, and in Man as compared with apes, I came to the conclusion that the power of building up appropriate cerebral mechanisms in response to individual experience, or what may be called 'educability,' is the quality which characterises the larger cerebrum, and is that which has led to its selection, survival, and further increase in volume. The character which we describe as educability can be transmitted; it is a congenital character. But the results of education *cannot* be transmitted. In each generation they have to be acquired afresh. On the other hand, the nerve mechanisms of *instinct* are transmitted, and owe their inferiority as compared with the results of education to the very fact that they are not acquired by the individual in relation to his particular needs. To a

large extent the two brain mechanisms, the instinctive and the 'individually acquired,' are in opposition to one another. The loss of instinct is what permits and necessitates the education of the receptive brain."

A very full and detailed exposition of this most important truth, with its numerous bearings, is given by Dr. Reid in the remarkable book to which I have already referred.* In that part of it which treats of the development of mind he maintains, by an array of evidence, that the great peculiarity of the human being as compared with other animals is that the most distinctive characters of his mind arise much less, as he expresses it, under the stimulus of nutriment alone, and much more under that of use and experience; that his instincts are fewer, while his capacity for making acquirements is infinitely greater and more variable; and that since "nature" has rendered man transcendently responsive to the "nurture" of use and experience, the question, so often asked, whether nature or nurture plays the most important part in the development of the human mind, has really but little meaning. "Capacity" or "ability" for making mental acquirements is innate and transmissible; it resides, in various degrees, in the immense brain of man; but for its development in special directions it requires the appropriate stimulus. The physical and

* *The Laws of Heredity*, by Dr. Archdall Reid, M.B., F.R.S.E. Methuen & Co., 1910.

mental *maturity* of the normal human being thus depends very largely on acquirements, the making of which is as essentially a part of adult development as is the growth of head and limbs of fœtal development.

In terms of structure we may regard the innate mental characters as depending on cerebral mechanisms which are germinal, inherently active, and transmissible; and the acquired characters as depending on mechanisms developed after birth in the still organisable substance of the brain, but as developed only under the influence of the environment, as somatic modifications, not transmissible.

In a recent and practical text-book on 'Mental Deficiency,'* the following expression of the difference in question is somewhat similar in effect to those which I have mentioned. "The development of mind," says the author, Dr. Tredgold, "takes place in consequence of two influences: spontaneously, or an inherent tendency of the brain-cells to develop, and stimulation of these cells by external impressions. The brain of the healthy child is capable of utilising and responding to any surroundings, within ordinary limits, in which it may be placed. The defective mind is lacking in this power. One of its chief characteristics is a want of what may be termed 'mental aggressiveness.'" It seems to me that the

* *Mental Deficiency* (*Amentia*), by Dr. Tredgold. London: Baillière, Tindall & Cox, 1908.

author here implies that what he terms "mental aggressiveness" is innate, and that the power of response to the environment is in direct proportion to the development of this quality.

If, then, it should be proved that imbecility is largely transmissible and innate, it may be thus far regarded as a possible reversion to an ancestral condition, though the reversion is, of course, not complete. Stated by Dr. Reid, in terms of mind, the defect of the imbecile is that he cannot learn; he lacks, or is greatly deficient in, the power of making mental acquirements; he is not able, as the normal individual is, to profit from experience; he has little or no *memory*, a mental quality depending on a late stage of cerebral evolution, and constituting the primary factor in the power of making mental acquirements. While he has lost the power of profiting by experience he has regained no part of the lost power of being guided by instinct. Therefore he is comparatively helpless as compared to the lower animal. But the instincts which normal beings possess, such as, for instance, the sexual, may appear unduly prominent in him, for he cannot *learn* to control them.

These general considerations on the subject of "innate" and "acquired" characters afford a good illustration of the different conclusions which may be arrived at, on this and other matters, according to the

different views held by inquirers concerning evolution and heredity, or to the different methods of investigation followed.

Some biologists, holding certain principles of heredity, and basing their inferences mainly on facts statistically arranged, appear to regard most moral and intellectual characters as instincts, and, as such, inherited. In common, apparently, with the otherwise widely differing school known as Mendelian, these regard the body and mind of an adult human being as consisting of innate and acquired characters, and hold that all the important mental characters are germinal and transmissible, and can therefore be made, by selective breeding, factors in true evolution. It is needless to dwell on the wide gulf which practically separates this view from that of those who believe that the innate mental characters of man, though of immense racial importance, and possessing great variability, are few in comparison with those which have been acquired and are demonstrably not transmitted; that most characters of the highest social importance are only traditionally handed down; and that even the achievement of civilisation by a savage race implies no necessity of germinal alteration.

Reflection on these problems leads, I think, to the probable conclusion that man's mind, like his body, is certainly both born and made, but that his *adult* mind is much more made than born. The slow evolu-

tion of the brain and its functions through the natural selection of adaptive variations has produced the enormous inborn power of making mental acquirements that is now the organic heritage of man. Thus, among innumerable acquirements, he has gained the unique facility of recording his discoveries and thoughts by the instruments of speech and letters, and thus he has created a traditional wealth of knowledge —a veritable and priceless heritage of a wholly different kind "treasured up on purpose to a life beyond life."*

The manifest bearing of these truths on the principles of education indicates that the right object of education is to fit human beings for their social existence, to make them good citizens, and to afford those with gifts above the average the opportunity of developing them. Education modifies and greatly makes the individual, but it does not affect the biological evolution of the race. It has been strikingly written by an eminent Darwinian — Sir William Thiselton-Dyer—that, "there is no more pathetic feature in human experience than to see descend into the grave, to pass away for ever, all those endowments with which genius and labour have adorned individual human beings. The cunning

* See in this connexion A. R. Wallace on "Evolution and Character," *Fortnightly Review*, January, 1908; Archdall Reid, *The Present Evolution of Man*, 1896; and *Laws of Heredity*, 1910. See also Basil Thomson, *The Fijians* (Introduction on "Decay of Custom"), 1908.

hand of the artist, the entrancing skill of the musician, the song of the poet, the eloquence of the orator, all perish with their possessors, and 'leave not a wrack behind.' Were it otherwise the toil of education would have been mitigated, and there would have been no bounds to the mental acquirements of the race. But when our first parents tasted of the tree of knowledge, the tree of life was denied them, and knowledge perishes with its possessor."* It is perhaps from reflections such as these that some men eagerly welcome any biological teaching which tends to minimise the immense importance to man of his acquired characters, or to justify in any degree the belief that such characters are naturally transmitted from parents to offspring.

But Tennyson's words still ring true for us. Though "the individual withers, the world *is* more and more"; though Nature seems "careless of the single life," she is very "careful of the type": and we may still join in the poet's youthful and stirring cheer to—

> "Men our brothers, men the workers, ever reaping something new;
> "That which they have done but earnest of the things that they shall do."

Since man invented speech and letters the results of his acquirements have been immortalised. The

* See *Edinburgh Review* for October, 1902—article on "Darwinism."

age-long lessons and records of his thoughts and achievements have alone directed and still increasingly illuminate his onward march. But were it possible for these lights to fail; were all the knowledge and civilisation acquired by the human race to perish, "the mind's great age" would hardly "begin anew," for the race itself in the struggle for life would probably cease to be.

Small as is the knowledge we possess as yet of the beginning, limitations, qualities and operations of the mind, there may be much for us to learn from further observation of various diseased states of the brain, as well as from continued use of the methods of experimental psychology, and from the investigation of hypnotic phenomena, so ably advocated by Dr. Savage in last year's Harveian Oration. But we know a little more, perhaps, about the evolution and development of the body, including that of the brain. By those who incline to that view of heredity which seems to make the nearest approach to truth, the germinal factor in this organ will be regarded as the substratum and condition of all mental development, endlessly transmissible, infinitely variable, and richly endowed with capacity for making acquirements; but as standing, nevertheless, in absolute need of external influences in order to develop most of the distinctive and special characters which we recognise as intellectual and moral. With the germ-plasm, as a whole,

in all its variability and liability to death and injury, the mind's organ is approximately inviolable to vital and transmissible change from the action of the environment, and no mental acquirements or modifications developed during an individual life-time are transmitted to descendents. The germ may die, but, living, it will not surrender its essential qualities to the action of external forces. The *spontaneous variability* of the germ appears to be a basal conception, necessary, at present, to all evolutionists; for the origin of so-called "genetic mutations" is confessedly as mysterious and "spontaneous" as that of the fluctuating variations, among which, according to the theory of Darwin, natural selection mainly works in the production of fixed species. The origin of mutations, indeed, would seem to be the more mysterious, since these are said to be "genetic" or fixed from the start, and thus might as well be described as "special creations." Further, the belief in the great resistance of the germ-plasm to transmissible organic change from external action seems to be necessary for any explanation of *heredity* whatever. The *cause* of normal hereditary transmission is surely, at least, as mysterious as that of any variations, small or great, fluctuating or discontinuous, unless the well-nigh demonstrable doctrine of the continuity and approximate inviolability of the germ-plasm be fully accepted. Without the aid of this pregnant

hypothesis, all biologists must confess that the simple, but weighty question, asked by Harvey, "How does like ever generate like?" is still wholly unanswered.

That some of the problems I have glanced at were even vividly present to Harvey's mind appears from the following quotation from Willis's translation of the work on Generation. The question of hereditary transmission and of reversion to ancestral types is raised when he writes: "In reference to the subject of family likeness we may be permitted to inquire as to the reason why the offspring should at one time bear a strong resemblance to the father, at another to the mother, and, at a third, to progenitors both paternal and maternal, further removed, particularly in cases where at one bout and at the same moment, several ova are fecundated. And this, too, is a remarkable fact that virtues and vices, marks and moles, and even particular disposition to disease are transmitted by parents to their offspring; and that while *some inherit in this way, all do not.* Numerous qualities, in fact, both of mind and body, are derived by hereditary descent." Again, he says: "I have frequently wondered how it should happen that the offspring, mixed in so many particulars of its structure or constitution, with the stamp of both parents so obviously upon it in so many parts, should still escape all mixture in the organs of generation; that it should

so uniformly prove either male or female, so very rarely an hermaphrodite." Here the modern problem of the *alternative development* of certain characters is apparently suggested.

In the Exercise "Of the Order of the Parts According to Aristotle," and in a context which need not be specified here, Harvey quotes some of Aristotle's words as follows " . . . *as then man's growth being complete and mind having been superadded* . . . ," and he adds, "In other words (and as I interpret the passage), adult man having acquired sense and prudence." Is there not an inkling here of the great question regarding "inherited" and "acquired" characters? Again, in the next Exercise, Harvey writes, "The proportion of the body to the extremities in children after their birth continues excessive until they begin to stand and run." May he not imply here the necessity of use in the development of certain physical characters which otherwise would not appear? And, further on, he says, "Man comes into the world naked and unarmed, as if Nature had destined him for a social creature and ordained him to live under equitable laws and in peace, as if she had desired that he should be guided by reason rather than be driven by force; therefore did she endow him with understanding and furnish him with hands that he might himself contrive what was necessary to his clothing and protection."

Once more, Harvey profoundly reflects: "The vegetative faculty of parents engenders in conformity with determinate laws in the same way as light things rise and heavy things descend; and the semen arrives at the form of the fœtus as the spider weaves her web, as birds build nests, or as bees and ants construct dwellings and lay up stores for future wants, all of which is done naturally, and from a connate genius or disposition, by no means from forecast, instruction, or reason. That which in us is the principle or cause of artificial operations, and is called art, intellect, or foresight, in the natural operations of lower animals is nature, which is *αὐτοδίδακτος*, instilled by no one: what in them is innate or connate, is, with us, acquired." Here Harvey's thought verily seems to have been searching for some distinction between the nature and mode of development of innate and acquired characters, and dwelling on the immense importance to man of what we have regarded as his acquirements, the mechanism of which he cannot transmit to his offspring.

We may hold, then, that by the achievements of his mighty brain, with its inborn "educability," "memory," or ability to make acquirements in response to his environment, man has entered into his kingdom. This ability, of infinite variety though it is in different individuals, is normally immense, and its organic mechanism marks man's brain alone. At birth the

individual mind is equipped in full measure with that capacity of development which is its lot. This capacity is shown at its highest power in early life, though its activity endures for years. But the direction such development takes depends mainly or wholly upon influences or stimuli from the external world, and what we recognise and speak of as the intellectual and moral faculties are the immediate products of external influences which actuate the potencies of each individual brain. We may fancifully figure man's mind at birth as a many-chambered mansion of noble plan and wondrous structure, awaiting the majority of its owner for its full utility and final adornment. More justly, perhaps, for the purpose of illustrating these reflections, we may liken it to a garden endowed with bountiful soil, the produce of which depends on the quality and the nurture of the plants grown within it. And the lesson is, man must still "cultivate his garden" and cultivate it aright. Should he neglect it, and should he not then inevitably perish (for it is his only resource), it would revert to its earlier and wilder condition under the cessation of selection, and the forces of circumambient Nature. In his book—the 'Kingdom of Man'—from which I have already quoted, Sir Ray Lankester says, "Civilised man is a successful rebel against Nature, who by every step forward renders himself liable to greater penalties. His only hope is to control

the sources of these dangers." Now if it be admitted, as Dr. Reid has so fully shown, that man's evolution to-day is mainly against disease and other destructive agencies, that there is no evidence in favour of any marked germinal improvement, within at least historic or even much earlier times, of man's mental capacity; and that his enormously increased and increasing powers of adapting himself to Nature and of controlling her forces, or, in other words, his advancing civilisation, are mainly the products of his acquirements, it follows that in all our attempts to promote "eugenics," and still more (because the object is immediately practicable), to improve the education of our youth so as to adapt them to the inexorable exigencies of their time, we must duly recognise that the progress and the efficiency of man, whether destined to be permanent or not, are by no means questions of breeding alone. "Education," says Huxley, "is the instruction of the intellect in the laws of Nature, under which name I include not merely things and their forces, but men and their ways, and the fashioning of the affections and the will into an earnest desire to move in harmony with those laws." There is truth, too, in Huxley's saying "that the stupidity," and I might add, the superstitions observable among the so-called "educated" classes of to-day, "is largely caused by the repressive action on natural intellectual appetites of a Procrustean system of artificial teaching." In

these classes especially abound the Christian Scientists, Telepathists, and other spiritualists of many colours, as well as anti-vivisectionists, anti-vaccinationists, and divers other persons, whose only bond of union seems to be impatience or hatred of the scientific method of thought. One high duty, at least, of men whose life-work is to "search out the secrets of Nature" appears to be plain: To strive for the reform of education according to the dictates of science—*Hic labor, hoc opus est.* Even though all aims at the artificial improvement of the human germ be disappointed, we can truly and fruitfully educate our race by insisting on a thorough and enlightened study of Nature and her laws. We know at least that the unity of the universe is a scientific fact. "We are governed by physical laws which it is our duty, as scholars of Nature, to investigate; and by moral laws which it is our duty, as citizens of Nature, to obey."*

We are not without object lessons of what intelligently directed education can achieve for a whole people even in one generation. To no germinal change can possibly be ascribed the recent development and marvellous transfiguration of Japan. Doubtless, indeed, we may sing, with the matchless poet of humanity who was Harvey's contemporary, "What a piece of work is Man, how noble in reason, how infinite in faculty! In form and moving, how express and

* See Winwood Reade's *Martyrdom of Man*, p. 180.

admirable; in apprehension how like a god"; but we can also endorse his further reflection:

> "Sure He that made us with such large discourse,
> Looking before and after, gave us not
> That capability and god-like reason
> To fust in us unused."

Note.—With reference to last paragraph on page 24 I quote the following passages from Dr. J. S. Bolton's interesting paper in *Brain*, part cxxix (1910), which came to my notice after my MS. went to press:

"Whilst histological differentiation probably indicates the limits of possible educability, it does not necessitate the existence of functional activity. A very obvious illustration of this truth may be seen in the motor exhibitions, evolved by the psychomotor area of the brain, which constitute the sole objective indications of cerebral activity. Whether we consider the infinite variety of skilled movements, the numerous highly complex written and spoken languages, or the wonderful gamut of expression and gesture of which the intelligent human subject is capable, we see in each case gross individual differences in educability. Histological differentiation probably supplies the key with regard to individual potentialities, but it is doubtful whether any single individual has ever even approached the limits of his potential education."

Again: "I employ the term *Amentia* to connote the mental condition of persons suffering from deficient neuronic *development*. Cases of this kind exhibit a lesion of the cortex of the præfrontal region of the cerebrum, which is of the nature of a true sub-evolution. In cases of *Dementia*, which term I use to signify the mental condition of persons who suffer from a permanent psychic disability due to neuronic *degeneration*, the lesion exhibited is of the nature of a true *involution*, or dissolution."

These observations are in harmony with the hypothesis of congenital amentia being possibly referable to retrogressive variation, or reversion.—H. B. D.