THE BIOLOGICAL FOUNDATIONS OF SOCIOLOGY¹

G. ARCHDALL REID, M.B., F.R.S.E.
London

Probably no facts can be named of such importance as those of heredity. They lie at the basis of every science and every pursuit that deals with living beings. Hardly a social, moral, or intellectual question can be thought of but we find that in its deeper aspects it is a problem of heredity. Heredity concerns not only the philosopher and the man of science, but also the parent, the teacher, the doctor, and even the statesman, the social reformer, and the historian. Properly handled, it is not a very abstruse subject. We are able to reach tolerably certain conclusions without traveling much beyond the range of knowledge common to most educated men. Nevertheless, though in all ages heredity has greatly interested all men, it has as yet few real students. The very interest it has excited has burdened it with superstitions, which in the past have been accepted as matters of common knowledge by men of science, who have added to the obscurity by elaborately seeking to explain the existence of the non-existent, the possibility of the impossible. Only very recently have some of these cobwebs been swept away.

The basis of all life is the cell. A cell is a minute mass of living protoplasm. Cells multiply by absorbing nutriment and dividing into two or more daughter-cells. In the lowest organisms the daughter-cells separate. Each individual, therefore, consists of a single cell. Higher organisms consist of many, it may be billions, adherent cells which work together for the common benefit. Among the cells of multicellular individuals are the germ-cells, to which is delegated the function of producing future individuals, future cell-communities. A germ-cell from one indi-

¹ Read before the Sociological Society, at the School of Economics and Political Science (University of London), Clare Market, W. C., October 24, 1905. Sir John A. Cockburn in the chair.

vidual unites with a germ-cell from another. The compound cell thus formed, the fertilized ovum, multiplies by dividing and redividing many times the one cell into two cells, till a new individual, a new cell-colony—a man, for instance—arises. During multiplication, differentiation in form and function occurs among the cells, so that ultimately the individual is compounded of many different kinds of cells—muscle-cells, skin-cells, gland-cells, nerve-cells, and so forth. In the fertilized ovum is a dot, the nucleus. In the nucleus are ultra-microscopical dots and threads of a substance which, when multiplication occurs, displays remarkable movements and is divided, seemingly with great precision, among the daughter-cells. In this way it passes, apparently with little change, from the germ-cells of the parent to those of the offspring. This substance has been identified, with a high degree of probability, as the germ-plasm, the bearer of heredity. We need not pin our faith to any theories as to the composition of the germ-plasm; but some such substance there must be—some substance which is the bearer of heredity. If this theory of the transmission of the germ-plasm from germ-cell to germ-cell be correct—and all the evidence indicates that it is correct—the child resembles his parent, not because his several parts are derived from similar parts of his parent—his head from his parent's head, his hand from his parent's hand, and so on—but because his germ-plasm is derived by direct descent from the parental germ-plasm, and therefore is very similar. The nature of the germ-plasm, therefore, determines the nature of the individual that arises from the germ-cells. Thus from one variety of germ-plasm proceeds a man, and from another a rabbit. When a species undergoes evolution, the germ-plasm undergoes gradual change. When we improve our domestic plants and animals, the alteration is always in essence a germinal change. It is the germ-plasm that is the main fact to be grasped in a study of heredity.

All the characters, all the physical and mental parts, of a living being are either “inborn” or “acquired.” An inborn character is one which comes to the individual “by nature,” as part of his natural inheritance. An acquired character, on the other hand, is a modification of an inborn character caused, as a

rule, by use, disuse, or injury. For example, a man's hand is inborn. It comes to him by nature; it arises because the germ-plasm in the germ-cell whence he sprang was so constituted that it caused that germ-cell, under fit conditions of shelter and nutrition, to multiply into a being having a man's hand. In brief, a man's hand is a germinal character; but the thickening of the skin in the palm of the hand which results from use, or a scar which results from injury, is not an inborn character, but an acquirement.

The principal mass of both inborn and acquired characters are ancient possessions of the race. Thus the hand and the thickened skin of the palm have been possessed by innumerable generations of men. But in some characters offspring differ from their parents. When these new characters are inborn, they are technically termed variations. Thus, if the child of normal parents were "blind," "by nature," his peculiarity would be a variation; but if he became blind by injury, it would be an acquirement. The great importance of distinguishing between inborn and acquired characters lies in the fact that the former, including variations, tend to be inherited by offspring, whereas most students of heredity deny that the latter are ever inherited. It should be noted that some acquirements are of great magnitude. Thus, in the human being, the limbs develop beyond the infantile standard mainly under the influence of use, a paralyzed infant limb growing little, if at all. Almost all growth, therefore, that occurs in the limbs after birth is an acquirement.

Offspring tend to reproduce the main mass of the parental inborn characters, but always with variations—with innumerable inborn differences—which, as a rule, are minute as compared with the likenesses. Thus the child of a human being is always another human being, but "by nature" he is invariably somewhat different from his parent—a little taller or shorter, stronger or weaker, fairer or darker, and so forth. The chief problem of heredity, both theoretical and practical, is the question as to what causes offspring to differ from their parents in this inborn way. The importance of the problem at once becomes evident when we remember that all racial change, all evolution,

depends on the variations of the individual members of the species; that is, on changes in the germ-plasm. A race evolves when it piles variations on variations during successive generations. It is in this way that species undergo change during a state of nature. It is in this way that we improve our domesticated plants and animals.

Several theories have been formulated to account for the occurrence of variation, but they may all be placed in one of two categories. On the one hand, it is supposed that the variations of offspring are caused by changes in the environments of the germ-cells whence the offspring arise; on the other hand, it is supposed that they are not so caused, but arise "spontaneously." The first theory is very popular with medical men. Thus it is believed by them that, if a man leads a healthy, active life, his children will be innately stronger and more vigorous than they would otherwise have been; whereas, if he falls into ill-health through want, hardship, disease, dissipation, or some such cause, his germ-cells will be injured, and his offspring will tend to be innately inferior. A natural corollary to this hypothesis is a belief that a race will grow strong and vigorous if placed under conditions that benefit its individuals; whereas it will degenerate if placed under opposite conditions. This belief, of course, is fundamentally opposed to the doctrine of natural selection, which supposes that races evolve only when placed under influences which, because injurious to the individual, weed out the weak and the unfit, and leave the race to the strong and fit.

We can easily test these opposing doctrines by noting what has happened to various races of men. Negroes on the west coast of Africa, for example, have been exposed for hundreds, perhaps thousands, of generations to severe malaria. This disease is caused by a microbe which invades the body in great numbers and floods it with a virulent poison, in which, therefore, the germ-cells are literally soaked. Practically speaking, every negro suffers for a prolonged period from malaria, and many perish of it. If ever the environment of the germ-cell causes variations in offspring, it should do so in this instance. But what do we find? Neither the negroes nor any other races exposed to malaria

have grown degenerate. The negroes, for example, are a tall and robust race. On the contrary, every race that has been exposed to the disease is resistant to it precisely in proportion to the duration and severity of its past sufferings; and this, apparently, is the sole effect that malaria has had on any race. The same is true of every other disease and every other adverse condition to which any race is subjected. Thus Englishmen, who have suffered much from consumption, are more resistant to it than negroes, who have suffered less, and much more resistant than Polynesians, who have had no previous experience of the disease and are exterminated when it is introduced to their islands. Extreme cold has not rendered degenerate the Eskimos, nor extreme heat the Arabs; they have merely been rendered, by the survival of the fit, resistant to heat or cold respectively. Many races have been afflicted by alcohol for thousands of years. Some men are naturally more susceptible to the charm of alcohol than others. These, because they are more tempted, drink, on the whole, to greater excess, and thus are weeded out to a greater extent. As a consequence, every race is temperate precisely in proportion to its past experience of alcohol. Thus west-African savages, who have long possessed unlimited supplies of palm toddy, the Jews, and the inhabitants of the vine countries of the south of Europe are more temperate than north-Europeans, and infinitely more temperate than most savages. What is true of alcohol is true also of opium. Thus the natives of India, who have long used the drug, are very temperate; the Chinese, who have used it for two centuries, are less temperate; whereas Burmans, Australians, and Polynesians, who have only lately made its acquaintance, are extremely intemperate. City life, particularly slum life, is injurious to the individual. Each succeeding generation of slum-dwellers presents a very debilitated and puny appearance, and the mortality is immense. But races that have been most subjected to the influences of city life—the Chinese, for example—are in no way degenerate. The Chinese are a particularly fine race of people.

On the other hand, as is well known, if a race is placed under conditions highly beneficial to its individuals, so that the elimina-

tion of the unfit is reduced to a minimum, it tends to degenerate. Thus we cannot improve or even preserve our breed of race-horses merely by supplying good food and the other conditions necessary for a healthy existence. We must weed out the unfit, and so breed the race with care.

Were the prevailing medical doctrine, that variations are normally caused by the direct action of the environment on the germ-plasm, true, all life would be impossible on earth; for all living species are subjected to deteriorating influences, such as cold, want, and disease. Unless the germ-plasm were resistant to the environment, every species would drift steadily and helplessly to destruction. Natural selection could not preserve it. There could be no selection when all variations were unfavorable. There could be no improvement in a race when in each generation all its individuals were inferior to their predecessors. Medical men found their belief chiefly on certain statistics, compiled mainly by gentlemen in charge of lunatic asylums, which demonstrate that a large number of feeble-minded people have parents or grandparents diseased or intemperate. But these statistics fail to take into account the proportion of cases which have inherited parental defects, or which have varied spontaneously from the parents. They fail also to demonstrate that asylum patients have parents diseased or intemperate in a greater proportion of cases than people of the same social stratum outside the walls. I hope it will be understood that, in controverting the prevailing medical doctrine, I do not mean to imply that variations in offspring are never caused by parental disease or intemperance. I mean to imply merely that instances of variations so caused must be very rare. Otherwise the race would become extinct. We know that the offspring of diseased and intemperate people are often perfectly normal and robust. That implies that their germ-plasm was insusceptible to the action of toxins and alcohol. This insusceptible type survives. The susceptible types are weeded out. A high degree of insusceptibility is thus established as a necessary condition of individual and racial survival, and in the process of ages becomes almost absolute. Doubtless the germ-plasm of every species is most insusceptible to the influences to which it is normally exposed.

Under exceptional circumstances, as when exposed to novel and powerful influences, the whole race is sometimes rendered really degenerate, as is proved by the deterioration of European dogs in India and horses in the Falkland Islands. But the mere fact of deterioration under novel conditions proves clearly how necessary for the preservation of the race is a high degree of insusceptibility to the influences to which the race is normally exposed. In view of the indisputable fact that races undergo evolution, not degeneration, when exposed to disease and alcohol, the medical doctrine of heredity amounts in effect to this, that if only a race goes down hill long enough, it will ultimately arrive at the top. It is literally inconceivable that evolution can have resulted from continuous degeneration.

We must conclude, therefore, that variations are very rarely due to the direct action of the environment on the germ-plasm. This conclusion is confirmed by another set of facts, which serve also to indicate the true source of variations—the true reason why offspring differ innately from their parents. The members of a litter of dogs, cats, or pigs always vary, not only from their parents, but among themselves, and may vary very greatly. Thus one puppy may be large, strong, vigorous, dark, and rough-haired; while others may exhibit different qualities in all sorts of combinations. One puppy may resemble the father, another the mother, and a third some distant ancestor. Obviously, their extreme variations cannot be due to the action of environment; for all the germ-cells and all the puppies before birth were placed under conditions that were practically identical. We have no choice, therefore, but to believe that the variations of the litter are spontaneous; in other words, that their source lies in the nature of the germ-plasm, not in the action of the environment. We know that a germ-cell, on being fertilized, spontaneously produces many different kinds of body-cells, such as skin- and muscle-cells. In just the same way it produces spontaneously germ-cells which differ among themselves. These variations are absolutely necessary to the persistence of the species. Otherwise natural selection would have no material to work on. Children would be exact copies of the parent, and the race could not adapt itself to changes

in the environment. Thus it is only because children vary spontaneously from their parents in all directions, like bullet marks round a bull's-eye, that natural selection has been able to render the races of mankind resistant to all the diseases by which they are assailed.

We reach thus two fundamental biological laws. The first law is that the germ-plasm is very highly indifferent to the action of the environment, and therefore that children are seldom affected by the influences to which their parents are exposed. The second law is that germ-cells, and therefore the individuals that arise from them, vary spontaneously among themselves, just as the body-cells vary, and for the same reason. It follows that we cannot improve races of plants and animals by improving the conditions under which they exist. Such a course benefits the individual, but results in racial degeneration. The race can be improved only by restricting parentage to the finest individuals. All the practice, if not the theory, of breeders confirms us in this belief.

It will be well worth our while to devote a little space to a consideration of some of the effects resulting from man's evolution against disease. Probably this evolution is the only form of evolution which civilized races are now undergoing. Such is our care for the weak in body and mind that there is nothing to indicate, for example, that big and strong and active men, or clever men, have, on the average, more children than smaller or duller men. Nearly all our deaths are due to disease or old age. The few that are otherwise caused are not selective in the sense that they eliminate particular types of individual. Thus death by drowning does not select particular types. It falls on the fit and unfit in a fashion that is quite haphazard.

Zymotic diseases—that is, diseases due to living microbes—appear to have originated among the ancient and crowded populations of the Old World. Our oldest histories, even our oldest myths, tell of plague and pestilence. But we have no indication, with the exception of malaria, that any such diseases existed in the Western Hemisphere before the arrival of Europeans. On the contrary, while we never hear of European adventurers in the

Western Hemisphere falling ill of any new disease except malaria, we have quite definite accounts of the first introduction of this or that Old World malady to this and that region of the western world. The microbes of certain diseases, such as malaria and the sleeping-sickness, are transferred from one human being to another by winged insects, and may therefore prevail in regions where the population is scanty. But most other zymotic diseases pass directly from man to man, and therefore prevail most where the population is densest. Thus the mortality from consumption, and therefore the stringency of selection by consumption, is much greater in the slums of great cities than in the open country. During uncounted centuries, therefore, with the advance of civilization and the increase of population, man in the Old World underwent evolution against many forms of disease. By means of this evolution he achieved the power of dwelling in towns and cities, of living a civilized existence in spite of the prevalence of disease. Then, when the germs of disease were rife in every home and thick on the garments of every man, Columbus discovered America. At once the vastest tragedy in human existence began. The New World was swept from end to end by recurrent pestilences of air- and water-borne diseases, such as small-pox, measles, and cholera. Whole tribes and nations were destroyed or decimated. But an equal part was played by consumption. This disease particularly affects such dark and ill-ventilated houses as are built by men of European race in cold climates. The natives of all the temperate parts of the New World melted away before it. They could not at once achieve, under the worst conditions, an evolution which the natives of the Old World achieved during the course of many centuries, at the cost of hundreds of millions of lives, under conditions that became worse only very slowly. Nowhere in all the temperate parts of the New World has a settlement of white men a native quarter such as every white settlement has in Asia and Africa. The destruction wrought among the inhabitants of the tropical forests was less. Malaria, to which they had become resistant, protected them from the inrush of Europeans, while the abundance of heat and light, and the absence of towns and cities, checked the prevalence of consumption.

While, therefore, the native races of all temperate America, as well as of all Australasia and Polynesia, seem irrevocably doomed to extinction, it is possible that the aborigines of tropical America, strengthened as they have been by a large infusion of European blood, may persist. In the more temperate regions even half-castes perish of consumption; hence the absence of a mixed race.

The political effects of the invasion of the New World by the disease of the Eastern Hemisphere have been very remarkable. Spain and Portugal, powerful nations in the fifteenth and sixteenth centuries, had the first start in the race for empire, and chose the seemingly richer tropics. But there malaria checked colonization, and consumption did not cause the elimination of the natives. The weaker British were shouldered into the inhospitable north, where the vast void cleared by disease gave their race almost limitless room for expansion. Subsequently they secured all Australasia, in which the conditions are similar. In the New World, then, the Anglo-Saxons have founded permanent empires. Under no probable conjunction of circumstances are they likely to be uprooted. But the fate of their Old World dependencies will be different. Here the natives outnumber, and will always outnumber, them. In the course of time they are sure to be expelled or absorbed. Their fate will be like that of the Romans and the Normans in England, not like that of the Saxons who nearly exterminated the Britons. Disease has spread over the whole world, and no other race will ever again have the opportunities so unconsciously used by the Anglo-Saxons. So vast and fertile are their territories that it seems probable that their world-predominance in the future has been secured by disease.

Roughly speaking, the stimuli under which a human being develops are three in number: nutrition, use, and injury. All individuals develop at first under what may be regarded as the sole stimulus of nutrition. Thus up to the time of birth the human being develops under the influence of this stimulus alone. Subsequently some of his structures continue to develop under it; for example, his ears, his hair, and his teeth. He never uses his hair nor his external ears in any active sense; obviously, therefore, they grow simply because they absorb food. He uses his teeth,

but we have no reason to suppose that they would not grow equally well if he did not use them. But after birth other of his structures develop little, if at all, except under the added influence of use; for example, his limbs, his heart, and his brain. If no strain were placed on these structures, they would grow little, if at all. Food alone is not sufficient for their continued growth. Lastly, if the individual be injured at any time, as by a cut, the stimulus of injury causes growth to take place during the process of healing. In man the development which results from injury is of infinitely less importance than that which results from nutrition, and from nutrition plus use.

Now, since no parts can be used or injured unless they first exist, and so are capable of being used and injured, nutrition must always play the first, and generally the principal, part in the development of living beings. And, moreover, when living beings first came into existence, it must have played the sole part in their development, until subsequently there was evolved the power of growing under the stimulus of use and injury.

The power of growing and developing under the influence of use is apparently quite a late product of evolution. It seems quite absent except in the higher animals, and is present to the greatest extent only in the highest. Thus an adult man owes the greater part of his bulk to growth made under the influence of use; but there is not the least evidence that most insects, for example, owe any part of their growth to its influence. They grow, as the infant grows before birth, under the sole influence of nutrition. Indeed, the most of their structural changes occur when they are quiescent undergoing metamorphosis; that is, when they are not using the growing part of their structures. But it is not body but mind that supplies the clearest evidence that the capacity of developing under the influence of use is a late and a high product of evolution. This is easily seen when we contrast the mental development of a typical insect with that of man.

A certain beetle (*Sitaris*) lays its eggs at the entrance of the galleries excavated by a kind of bee (*Anthophora*), each gallery leading to a cell. The young larvæ are hatched as active little insects, with six legs, two long antennæ, and four eyes, very different from the larvæ of other beetles. They emerge

from the egg in the autumn, and remain in a sluggish condition till the spring. At that time (in April) the drones of the bee emerge from the pupæ, and as they pass out through the gallery the *Sitaris* larvæ fasten upon them. There they remain till the nuptial flight of the *Anthophora*, when the larva passes from the male to the female bee. Then again they wait their chance. The moment the bee lays an egg, the *Sitaris* larva springs upon it. Even while the poor mother is carefully fastening up her cell, her mortal enemy is beginning to devour her offspring; for the egg of the *Anthophora* serves not only as a raft, but as a repast. The honey, which is enough for either, would be too little for both; and the *Sitaris*, therefore, at its first meal, relieves itself from its only rival. After eight days the egg is consumed, and on the empty shell the *Sitaris* undergoes its first transformation, and makes its appearance in a very different form. . . . It changes into a white, fleshy grub, so organized as to float on the surface of the honey, with the mouth beneath and the spiracles above the surface. . . . In this state it remains until the honey is consumed; and, after some further metamorphoses, develops into a perfect beetle in August.²

Now, the notable thing about *Sitaris* is that he appears to have no memory. He seems to learn nothing; for instance, he does *not learn* how to do anything. Many of his actions he does only once, and all of them he does as well the first time of doing as the last time. Memory, therefore, would be of no use to him. He arrives in the world perfectly equipped for the battle of his life, and is quite independent of all experience. He absorbs food, and, as he grows, his mind, such as it is, develops. Nothing besides the food is necessary for its development. He uses his mind, but the use of it does not add anything to it. His mental characters, therefore, are all inborn. They are instincts. An instinct is an emotional impulse which develops under the mere influence of nutrition, and which prompts to a corresponding action, the instinctive action. A man is very different. He is born very helpless, with few instincts, most of which are very imperfect. He has the instincts of sexual and parental love, but he *learns* to love this or that particular person. He has the instinct to sport, and so to develop his body by using it. He has the instincts of curiosity and imitativeness which cause him to use his mind, and so to develop it. He has, besides, the instinct to eat when hungry, and to rest when tired, and one or two other instincts. But, on the whole, his

² Lloyd Morgan, *Animal Intelligence*, pp. 438, 439.

equipment of instinct is reduced to a minimum, which is the reason he is so helpless at birth. But he has a most enormous memory, a most prodigious power of growing mentally as he uses his mind. From birth forward he continually stores experiences, by which he guides his future conduct, and thus becomes the most helpful of animals. Only a very little part of his mind, therefore, is inborn and instinctive; immensely the greater part is acquired, in the sense that it develops under the influence of use, of experience.

Now, because the beetle's mind is inborn, owing nothing to experience, therefore one beetle is mentally almost exactly like every other beetle of the same species. If different beetles have different experiences, that makes no difference to their minds, since they are incapable of profiting by it. But, because a man's mind develops almost wholly under the influence of experience, the minds of no two men are alike. Think how different are the minds of the various people in this room—how different the contents of their memories, how different their hopes and hates, their ideals, and ambitions, and temptations. If, were it possible, we exchanged minds one with another, and were conscious of the change, we should feel almost that we had entered a new and extraordinary world. But if one *Sitaris* exchanged mind with another, he would not know the difference. In brief, our minds differ because we are able to store in memory our experiences, which are never alike in any two men. The minds of beetles, on the other hand, are alike, because they are not affected by experience. According to the experience he has, an average baby may become a fool or a wise man, a yokel or a statesman, a savage or a civilized man, a saint or a thief. He may be trained to love or abhor a particular religion, or code of morals, or country. *Sitaris* can be trained to nothing, because he is able to learn to remember nothing. It is possible to trace the evolution of memory, of the power of learning by experience. In the fish and frog this power is extremely limited. These animals have almost purely instinctive minds. Their bodies also appear to develop almost solely under the influence of nutrition, for frogs imprisoned in cavities from the tadpole stage have emerged with the body and mind fully

developed. The cat, on the other hand, learns much. By its play it develops both body and mind. A dog is still more capable of learning. This capacity of learning and utilizing experience is what we term "intelligence." All our domestic animals have some intelligence, which is why we are able to tame them. Man, the latest product of evolution, is pre-eminent above all other animals in his capacity for storing and utilizing experience. It is this that makes him human. It is this alone that makes him rational. All thinking depends on memory. Such an animal as *Sitaris* cannot think; it can only feel. Man is inferior to *Sitaris* in instinct, but in intellect, which is the product of stored experience, he is immeasurably superior.

To sum up, man is distinguished from all other animals, first, by his enormous power of storing mental experiences, a power which we term "memory"; and, second, by his equally splendid power of utilizing the contents of his memory, a power which we term "reason." These powers are possessed by all races of mankind and by all sane individuals; though it may be that this or that race or individual has greater powers than another. Similarly, all races and sane individuals have the same instincts; for these, like memory and reason, are not sudden developments, but products of prolonged evolution. It is possible, of course, that one race or one individual has more or less of this or that instinct than another, but the difference can seldom be great. No word is more abused in popular, and even in scientific, literature than "instinct." Thus we often hear of the "instinct" of the savage for tracking game. But no savage baby is born with a knowledge of the appearance and habits of wild animals, nor does the knowledge arise in him during later life, in the absence of experience, any more than a knowledge arises thus in a civilized baby. Presumably, an English child, under fit tuition, would acquire the knowledge just as quickly and easily. So also we hear of a blow being dodged "instinctively;" but no human being dodges blows until he has learned the nature of blows and how to avoid them. In the house-fly, on the contrary, the knowledge, if we may so term it, of dodging blows is really instinctive. We hear of the human "instinct" of fear; but a baby fears nothing till he has

learned what to fear. We hear of the "instinct" to scratch an itching spot; but, unlike the bird or the rabbit, no baby ever scratches until he has learned how and when and where to scratch. Man is almost the one mammal who is unable to swim instinctively. It is, indeed, very plain that instincts have greatly dwindled in man. It is fortunate for him that they have dwindled. The loss of them has rendered him all the more adaptable. Reason is a greatly superior substitute, provided his parents tend and protect him till he has acquired it.

We know that different individuals and races of man differ greatly in body and mind. Thus the Englishman has one set of physical and mental characters, the Chinaman another, and the west-African black a third. We know that, to a large extent, the physical differences between races are inborn, and we are apt to assume that the mental differences are also innate. But when we remember how little is instinctive in the mind of man, and how much acquired, a strong suspicion is raised that we are mistaken in supposing that inborn mental differences between races and individuals are so great as are commonly supposed, or, at any rate, are of the kind that most people think they are. In practice, we assume that mental training is everything, and for that reason we carefully educate our children, seeking to endow them with a fund of useful knowledge, with energy and ability, and with high ideals. But if we meet a man who is clever or stupid, or energetic or slothful, or morose or amiable, and so forth, we almost invariably assume he has been made what he is by nature, not by the experiences through which he has passed. We cannot settle the question as to whether nature or nurture plays the more important part in molding character by observing individuals, for, after training a man under one system, we cannot make him young again so as to train him under another. But what we cannot observe in the case of individuals we can observe in the case of races, which, after all, are only aggregates of individuals. Races are perpetually young, for each generation starts afresh. The so-called old races are only races whose history is known for a great length of time.

Many races quite suddenly changed their mental environment.

That is to say, the new generations have been differently trained, have developed under different sets of mental experiences, as compared to their ancestors. If, under these circumstances, the race has changed its mental characters, we may be sure that the alteration is an acquired, not a germinal, one; for the latter can occur only under a very slow process of evolution or degeneration extending over many generations. The Greeks are a case in point. At first they were rude barbarians, apparently in no way distinguished from the surrounding tribes. Then quite suddenly, in quite a few generations, they became the most splendid race of which history holds record. Subsequently, with equal suddenness, they became an exceedingly wretched and degraded people. Obviously, these great mental differences were due in the Greeks to mere training, not to a process of evolution. A remarkable thing about Greece, in its period of greatness, was the vast number of able men that it produced. Among a population hardly equal to that of an average English county more really great men arose in a couple of hundred years than all Europe produced in fifteen centuries. Ancient Rome is another case in point. It also produced numbers of able men in quite a short time. Much the same thing happened in western Europe during the fourteenth and fifteenth centuries. Flocks of great men arose in all countries that the Renaissance touched; that is, in all countries in which Greek learning and Greek methods of thought were revived. The doctrine of averages and the theory of evolution forbid the belief that these crowds of great men were due to sudden innate, that is germinal, changes in the races that produced them. On the contrary, we are forced to the conclusion that they occurred in greater numbers in some generations than in others, because in those particular generations the youth were better trained mentally than in preceding and succeeding generations. And this belief forces on us the corollary that the mental status of any individual or of any race is not necessarily in accord with the innate mental powers. It may be due, and generally is due, largely or wholly to mere training, to mere education.

The truth is vividly illustrated by a study of the mental effects produced on their followers by various religions. Every religion

influences its followers, not only by its distinct doctrines, but even more by the method by which the doctrines are taught. Some methods of religious training permit much greater intellectual freedom than others, even when the doctrines are much the same. Thus the Protestant section of the Christian religion imposes fewer restrictions than the Greek church. A little thought makes it evident that every race is enlightened and progressive, and produces men of distinguished achievement, precisely in proportion to the intellectual freedom permitted by the religion it follows. Mahomedans, Buddhists, and Hindus produce few great men. Mediæval Europe produced few. Modern Christianity is divided into three great sections. For the last century and a half almost every man who has achieved world-wide fame has arisen from among members of only one of those sections, or has been a rebel against the doctrines and restrictions of the other two. This section of Christianity has not a monopoly of innate genius, but it has a large monopoly of effective genius.

All this evidence renders it abundantly plain that mental power is not a mere matter of innate capacity, but is very largely a matter of intellectual training. No doubt, men differ as much in their inborn mental capacity as they do in bodily powers; but the former is much more difficult to detect. You can train a man of great innate capacity to have every appearance of a fool. You can so train a man of comparatively mean capacity that among worse-trained men he has every appearance of ability. When, therefore, we meet a distinguished man, it is unsafe to jump to the conclusion that he is necessarily of great mental capacity. And when we see a distinguished son follow a distinguished father, it is not entirely safe to conclude that great innate capacity has been inherited. We must remember the child's imitative instincts and the environment in which he has been reared — an environment in which his father, with his own intellectual methods and his energy, bulked large. Statistics of distinguished families illustrate the power of training quite as much as they do the power of heredity.

Since, with rare exceptions, variations of offspring from parents are spontaneous, it is obvious that we can improve a race

only, as breeders do, by restricting the output of offspring to individuals who have varied favorably. But we have seen how vast are the acquirements of man. Therefore we can often greatly improve the individual by improving the conditions under which he develops. We have our choice then. Shall we improve the innate qualities of our race by eugenic breeding; or shall we improve the acquirements of the individuals of the race by improving their surroundings; or shall we do both? I think all people with any sense of duty to their fellow-creatures will declare that, if practicable, we ought to do both. We should bear in mind, however, that, were eugenic breeding possible, we could improve the race to an unlimited extent; whereas our power of improving the individual by placing him under better conditions is strictly limited. We should remember, moreover, that an improved environment tends ultimately to degrade the race by causing an increased survival of the unfit. Our power to benefit the individual physically by improving his acquirements is less than our power to benefit him mentally. Most civilized people develop under fairly good physical surroundings. Only in the slums of great cities, as a rule, is bodily growth much stunted and the individual enfeebled by insufficient nourishment and by bad hygienic conditions. There is every hope, besides, that, with the spread of knowledge and the awakening of the public conscience, the worst features of slums will disappear in the near future. If, then, we wish to improve the nation physically, it must be mainly by selective breeding. Since we are a strong and robust race, most people will agree that this is unnecessary as regards stature, strength, and stamina. But, as we have seen, certain types of men are unfit for existence under civilized conditions of life; for example, people susceptible to consumption or to the charm of alcohol. The experience of very many centuries has proved that it is impossible to abolish the abuse of alcohol. Among civilized peoples especially, repressive measures—at any rate, severely repressive measures—actually increase the total amount of drunkenness. It will, I think, prove equally impossible to banish the tubercle bacillus. It is spread by the mere act of coughing. Improved hygiene will result in such a revival of people suscept-

ible to consumption that the mortality will always tend to keep pace with the improvements. In the Pacific islands a very susceptible race dwelling under ideal hygienic conditions undergoes extinction when consumption is introduced. Probably, therefore, our only hope of permanently reducing the mortality and misery caused by intemperance and consumption lies in selective breeding.

As regards mind also, we have our choice between selective breeding and an improved environment; that is to say, improved mental training, improved education. No one who contrasts the ancient Greek type of mind with the modern Thibetan type, and realizes that the difference resulted mainly from mere education; who knows that the cannibal Maoris in a single generation have acquired all the characteristics of a civilized race except the power to resist disease; who is aware that during one year a school of aborigines produced better results than any school of white children in Australia; who thinks of what Japan has done within thirty years; and who perceives how vile is the present system of education in this country, especially the education of the upper classes, will doubt that it is in our power to affect an immense and immediate improvement in mind. There is no reason why we should not rival, and even surpass, the Greeks. We have their example, a knowledge of their methods. We could stand on their shoulders, and possess a vastly larger fund of positive knowledge. The subject of education is far too large to enter on here, but we may note that, when we compare Greek and modern methods of instruction, one fundamental difference becomes manifest. The Greeks taught their youths how to think; we teach them what to think. The Greeks devoted their main attention to developing the understanding; we devote ours to loading the memory. Whatever the Greek boy learned linked up with the interests of adult life, and was therefore remembered. Much that the English boy learns has no bearing on the interests of adult life, and therefore is forgotten. In brief, the Greek youths were educated in a real sense; the English youths, in a sense, are merely crammed. Dogmatic education is, of course, the merest cram, with the added element that care is designedly taken to stifle independent thought. Classical education in which

the language, but not the methods of thought of the ancients, are inculcated is also cram. But perhaps the least excusable form of cramming, since it is perpetrated by men who should know better, is that utter neglect of the reasoning faculty, combined with an enormous overloading of the memory, by means of which the thinking powers of scientific students are destroyed.

So vast might be the benefit to mind which would quickly follow a mere improvement of education that, until we have done all that it is possible in this direction, any attempt to exalt the innate mental qualities of the race by the slower process of selective breeding would be lost time. As we have seen, such an attempt, owing to our present lack of means to distinguish in practice between inborn capacity and acquired ability, would present peculiar difficulties. In one particular, however, the selective breeding of mind is imperative. The number of the insane is very rapidly increasing in all civilized countries. Various explanations have been offered. It is said that the stress of modern life is the cause of the increase. But there is no evidence that the stress is greater than formerly, except perhaps among that small class which is wealthy enough to devote itself to pleasure. The falling death-rate would seem to indicate the contrary. Moreover, the rise of insanity is as great in remote country districts, where conditions have changed little—for example, in the west of Ireland—as in towns. Again, it is said that the rise is due to parental intemperance and consumption. But consumption and, probably, chronic alcoholism are much less than formerly. Moreover, this theory is opposed to the doctrine of natural selection. Were it true, life would be impossible on earth. Yet again, it is thought that improved medical treatment has caused insane people to live longer, and so to accumulate, and that the registration of the insane is more efficient than formerly. No doubt this theory contains a large element of truth. But the rise of insanity is so great and continuous that it is manifestly insufficient to explain the whole facts. We must seek for an additional factor. Formerly the insane were treated with the greatest barbarity.

While many were burned as witches, those who were recognized as insane were compelled to endure all the horrors of the harshest imprisonment. Blows, bleeding, and chains were their usual treatment, and horrible accounts are given of madmen who had spent decades bound in dark cells . . . not until the eighteenth century was the condition of this unhappy class seriously improved.³

We may judge of the former treatment of the insane from Shakespeare's words: "Love is merely a madness I tell you, deserves as well a dark house and a whip as madmen do."⁴ Until very recently, then, in the vast majority of cases, the unfortunate lunatic was placed under conditions which insured death or permanent insanity. From the moment his mental unsoundness declared itself he ceased to have offspring. The natural selection of the sane, therefore, was very stringent. For some generations past, however, lunatics have been treated with great humanity and skill. Beyond all classes of the community, they are now watched over by the state. Men of sound mind, but suffering from bodily illness, may perish in the slums for want of proper nourishment and care; but the insane are removed to special sanatoria, where, without expense to themselves, they receive food and lodging, and are placed under the care of trained nurses and medical specialists, over whom in turn the Commissioners in Lunacy exercise a jealous supervision. As a consequence, the lunatic frequently recovers, and is restored to his family and to the right to have as many children as other people. Here is a case in point. A lady writes:

For years I have been struggling to prevent idiots and lunatics being sent from our county asylum to marry and breed idiots — just as if the thing were desirable. I gave it up in hopeless despair about four years ago, owing to the following case: A woman who is more than half idiotic came to live with two sisters — one a total, the other a partial, idiot. She married a very dull, partially idiotic man, and had almost immediately to be taken to the asylum. There she gave birth to a complete idiot, and was sent home a few weeks afterward, with the result that the same thing has been repeated nine times.⁵

The severity of natural selection with regard to the insane has been greatly reduced; and, as in all similar cases, characters

³ Lecky, *History of European Morals*, Vol. II, pp. 86, 87.

⁴ *As You Like It*. Act III, scene 2.

⁵ Quoted by Dr. Rentoul.

which selection formerly eliminated are tending to become more common. The huge brain of man is a very complex and delicate machine. A defect (an unfavorable variation) in any of its parts is apt to throw the whole out of gear; and, like other variations, such a defect, such a predisposition to insanity, tends to be inherited. Unless, therefore, we find means to check the output of children by the mentally unsound, the insane will multiply until the state is no longer able to bear the weight of their maintenance. Selective breeding in this case is a dire necessity, and, therefore, a certainty in the near future.

As I understand him, Mr. Galton proposes to exalt our race by encouraging the finest types to have large families. I venture to suggest, instead, that, for the present at least, we shall limit our efforts to discouraging the multiplication of the most unfortunate types. The latter proceeding would be more practicable, since, as regards mind at least, the feeble types are more easily detected than the best, and since it is always more easy to stop a horse drinking than to make him drink. But, as a fact, both Mr. Galton's suggestion and my own are utterly impracticable in the present state of public opinion, and even, if I may say, of public intelligence. Before the one proposal or the other can be thought of as anything more than a mere subject for academic discussion, we must have a more enlightened public, a wider diffusion of the knowledge of the laws of heredity. Of sheer necessity, that diffusion of knowledge will come ere long. I think I know the path it will follow. The medical profession comprises the largest and, if united, the most powerful body of scientific men in the world. At present no systematic instruction in heredity is given to its members. Presently that will be changed. The doctor will realize that other things and more things are known about heredity than he supposes. He will recognize that the science is not summed up by the hypothesis that, if a man contracts a disease or is drunken, his offspring will tend to be sickly or insane. He will perceive that the facts of heredity are just as essentially and naturally a part of his medical equipment as the facts of physiology and anatomy. At present he is in no way distinguished intellectually above his contemporaries of the same

social stratum. Man of science though he be, he and his fellows contribute less to the thought of the nation, and guide public opinion less, than any other of the great professions. But when he studies heredity, he will understand the development of mind in the individual; he will separate the acquired from the inborn, and will know why certain systems of education have depressed some nations, whereas other nations have been exalted by different systems; and then he will reform his own education and come into his kingdom. Indeed, the mere study of heredity will constitute the necessary reform; for, though the additional facts with which he will have to load his memory will be few, yet the close, accurate, and prolonged course of thinking that he will have to undergo will develop his intellectual powers, and, lifting him above the often petty minutiae of his daily life, will bring him in contact with many great subjects. A trained expert now in all that is connected with the development of the body, he will become a trained expert in all that is connected with the development of mind. His will be the most commanding voice in that most vital of all questions, the education of the young. Under his influence, mental training will become scientific, in the sense that it will be conducted with a full knowledge of means and ends. In that day he will perceive also that selective breeding, the only possible remedy against dangers that loom great and terrible in the future, is really a question of public health; and then men like Mr. Galton, who have devoted their lives to a noble purpose, will not speak to a small and impotent circle, but to the intellectual flower of the nation.