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THE NATURE OF DISEASE*

BY

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Doctors are apt to evade the question of the real nature of disease by giving certain states of body and mind names, as if these had an independent existence apart from their patients who suffer from them. Some we call after their primary causes (for example, fractures and cases of poisoning); others after the reactions of the body (for example, fever and reticulosis); some after the functional disturbance manifest during life (for example, diabetes, heart failure, and schizophrenia); others after the structural changes found in the body after death (for example, tuberculosis and cancer); some after the most arresting symptom or sign with which they are associated (for example, measles and mumps); others even after the clinicians who first described them (for example, Cushing's syndrome and Addison's disease). This, I admit, is clearly necessary for practical purposes. No system of nomenclature could, however, be more chaotic, and it is not surprising that we all get into the habit of thinking of diseases as if they had a real existence independent of our patients. And yet, a moment's thought, and we realize that diseases are not to be found in books or bottles, not even in post-mortem rooms or laboratories, but only in our individual patients who suffer from them and come to us for help. In fact, there can be no disease without a patient to suffer from it, any more than there can be a mind (in our ordinary experience) without a body and a brain to maintain it.

Before we can even start to discuss the question, therefore, we must form some idea of the nature of the potential patient who at any moment may develop his disease, and, on the evidence before us, is it really very difficult to arrive at a working concept on which we can all more or less agree as a common frame into which to fit our individual special interests? For must not every man be in part, at least, the product of three sets of factors: his genetic origin, his environment (physical, biological, and mental), and the use which he has made of his own free will? And to anticipate for one moment, just to give you an inkling of what I am aiming at, are not these three factors in his genesis in the last analysis also the only three possible factors in the pathogenesis of his diseases?

Body and Mind

But to return to the nature of the potential patient before we embark on a discussion of the nature of his

disease. Everyone naturally thinks of himself as two separate things—a body and a mind—and yet how can two separate things be so intimately related? It does not make philosophical sense. Further, it is contrary to our own experience. The mind can upset the working of the body. It is well known that ill-health of the body can profoundly influence the mind. What, therefore, is the body? What in fact is the mind? Whence do both come? What is the relationship which exists between them? These questions must be answered, at least we must attempt to answer them, or how can we hope to understand the nature of disease of the body, or of the mind, or, more difficult still, of, as we see it, the body-mind relationship?

Nature and Origin of the Body

We will start with the body. First, what is it? From the point of thermodynamics it is a physico-chemical machine, made of compounds of carbon, hydrogen, oxygen, nitrogen, and sulphur, which converts the energy in the food we eat (derived originally from the light of the sun) into heat and kinetic energy which enable us to live and move and have our being. In that respect, in fact, it differs from a man-made machine only in that it is constructed of rather different stuff and works at rather lower temperature. Nevertheless, it exhibits the criteria of life. It is self-adapting, self-maintaining, self-repairing, and, if it mates, self-reproducing, reproduction of fixed form and structure being the main characteristic of living things.

Next, whence does it come? On evidence before us (and there would appear to be no escape from the conclusion) a man's body is the product of a plan laid at his conception when the genes in the chromosomes of his two parents were reshuffled in the fertilization of an ovum in much the same way, to give a rough analogy, as a house is the product of an architect's plan; and it is through this plan that he inherits all the ordinary characteristics of the human race, many of the particular characteristics of his ancestors, and some characteristics peculiarly his own. The motive force responsible for the execution of the plan remains one of the mysteries of life, but the right physical conditions are normally provided by the body of the potential mother, while the necessary building materials are supplied at first from her food through her blood and after birth direct from the environment into which the child is born. Its execution is not, however, finally

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finished for over twenty years, and the original plan may be modified in the process of development and growth or actually spoilt at an early stage or in later life. No two men, therefore, can be the same in body, because (identical twins excepted) all are derived from different genetic plans, and all (identical twins included) are ultimately subject to different experience, mental and physical, in their environment.

Nature and Origin of the Mind

So much for the body. Now what about the mind?—and it helps us to understand its nature if we ask ourselves where it comes from, rather than what it is, first. For, as I see it, the body alone permits the development of the mind. (In ordinary human experience there can be no mind without a body, any more than there can be a disease without a patient.) It would, in fact, appear that the higher development of the nervous system in animals permits the development of consciousness, and that experience, writing on consciousness through the sensory machinery of the human body, leads to the development of the human mind. Thus the individual mind depends in part on the brain which a man possesses (as a result of his genetic origin and his physical environment) and in part on the conscious experience through which he has passed; and no two men can be the same in mind, because their brains are different and they have passed through different experience. Nevertheless, I do not think that on the evidence before us (scientific observation and experiment and human experience down the ages) the human mind can be explained *entirely* in terms of the brain, which a man has been given, and the experience through which he has passed. There is more to the human mind than that. The mystery of consciousness which permits of pleasure and pain, so unnecessary if we are but machines operated by conditioned reflexes (as the philosophy of behaviourism will have us believe), remains. We are all convinced that within limits we possess free will. Aesthetic sense cannot be explained on this basis. A strong case can be made out for the existence of intuitive as opposed to empirical knowledge. Faith in the real existence of the human soul is deeply rooted in human experience down the ages. Nevertheless, within factors capable of analysis at present, it is clear that the individual mind depends in part on the brain and in part on experience, and both of these are coming more and more under our power to control.

Psychosomatic Development

The development of the body in general and of the brain in particular therefore conditions the development of the mind under the stimulus of experience in the same way, to give a rough analogy, as the surface of a slate conditions the form of the writing on it. For example, the male body conditions the mind in such a way that it comes to exhibit the characteristics which we associate with a man, and the female body in such a way that it comes to exhibit those which we associate with a woman. And is there not reason to suppose that the mind so developed influences in some way which we do not yet understand the further development and maintenance of the body? We all know that a man's character is reflected in his face, and we must admit that psychological experience can have a profound effect on physical health. Therefore, not only are no two men the same either in body or in mind, but no two men are the same in their body-mind relationship. In fact, every man has his own particular psychosomatic constitution, because mind and body are mutually interdependent in their

development (although, of necessity, there are average types), which determines his reactions to physical and mental experience.

Adverse Action on Body and Mind

Now there may be a fault in the genetic plan whence a man is derived. Those which are hereditary are easily recognized, but those produced *de novo* by unfortunate combinations of genes are difficult to distinguish from those produced by adverse influences acting during the early months of intrauterine development. (The wrong environment can spoil the execution of a perfect plan.) For both during intrauterine development and throughout life the body is exposed to risk. At any stage it may suffer from lack of one or more of those substances on which its development and maintenance depend—food, water, salt, oxygen, iron, calcium, and vitamins. It may be damaged by physical trauma, excess of heat or cold, or by over-exposure to some form of radiation. It may succumb to some chemical poison taken by accident, used in industry, indulged in for pleasure, or swallowed, injected, or inhaled with suicidal intent. It may be infected by one of the larger parasites or by pathogenic protozoa, spirochaetes, bacteria, or viruses. It also runs risk because it is the basis of an individual human mind. Emotion can interfere with the physical health of the body through the nervous system or lead to maladaptation to social living. Free will enables a man within limits to choose his environment and his way of life.

Reactions of Body and Mind

In fact, the body would not survive long in the environment in which we live were it not endowed (presumably through the genetic plan whence it is derived) with the potentiality to react in such a way as to protect it from many of the risks to which it is exposed and often maintain its life when it does succumb. Now many of these reactions are part of everyday experience—for example, functional adaptation to exercise, change of temperature and altitude, intake of food and drink—and are therefore classed as physiological. Others are evoked only under unusual circumstances and are therefore regarded as pathological—for example, reactions to injury, chemical poisons, and infection. Similarly the mind would not maintain its balance long were it not endowed (presumably through the structure of the brain) with the capacity of adaptation to ordinary conscious experience. Now, most men react to experience in much the same way. Their behaviour is predictable. Reactions of this kind are therefore classed as psycho-physiological. Others, however, as a result of genetic predisposition due to the structure of their brains on which their minds are based, and/or as a result of previous experience, react abnormally. Their behaviour is not predictable. Reactions of this kind are classed as psychopathological.

Pathological Processes

Thus we arrive at the concept of primary pathological processes. A primary pathological process of the body is abnormal action on it evoking normal reaction by it. A primary pathological process of the mind is normal action on it evoking abnormal reaction by it. While, however, a pathological process of the body can run its course independently of the mind, a primary pathological process of the mind depends on the body, for the simple reason that the mind depends in part at least on the body. Therefore no absolute distinction can be maintained between primary pathological processes of the mind and primary pathological processes of the body, which often lead to secondary disturbance of the mind. In fact, the psychoneuroses—namely, anxiety states, obsessional states, and hysteria—merge into the organic psychoses, due to primary pathological processes of the body affecting the brain, through the so-called “functional” psychoses—namely, mental deficiency, schizophrenia, mania, endogenous depression, and involution melancholia.

Symptoms and Signs

Symptoms and signs due to physiological and normal psychological reactions to change of internal and external environment are a matter of everyday experience, but pathological processes, as above defined, lead to symptoms and signs which cannot be explained on this basis, although they can be identical with them. Primary pathological processes of the body lead directly—that is, through the body—to alteration of structure and disturbance of function of the body, with the result that the patient complains of physical symptoms and physical signs are often discovered on examination, but, if his brain (or any function of the body on which it depends) is affected, a primary pathological process of the body may lead to a secondary disturbance of the function of the mind and therefore to mental symptoms and mental signs. Primary pathological processes of the mind lead directly—that is, through the mind—to mental symptoms and signs, but they may also lead to a secondary disturbance of the structure or the functions of body and therefore to physical symptoms and signs, either through emotion and the autonomic nervous system, as in anxiety neuroses, or through conscious and unconscious thought and the skeleto-motor nervous system, as in malingering and hysteria. Some of the symptoms in any one case (in view of the nature of pathological processes) are due to action on the body or the mind and others to reaction by the body or the mind. The clinical picture produced by a pathological process is, however, often so complex that exact analysis on these lines is impossible.

Definition of Disease

A disease, therefore, so far as definition is possible, is that condition of a man, woman, or child of a certain psychosomatic constitution, and at a certain stage of his or her life, when a pathological process of body or mind is leading to alteration of structure or disturbance of function, with the result that he or she sooner or later starts to complain of symptoms, or signs are discovered on examination, most diseases being due to complicated interactions between genetic weakness, the adverse factors to which a man is exposed in his environment, and the psychosomatic machinery of his individual constitution. No two cases, therefore, are ever quite the same, although certain types of reaction are common, justifying the abstract conception of the real existence of diseases, apart from the individual patients who actually suffer from them.

Classification of Disease

Can we, however, classify the different manifestations of disease in order to help us in our understanding of it? For the human mind craves for classification and would impose discontinuity into the obvious continuum of the phenomenon of disease if it could. It is certainly very difficult. In the first instance there is no absolute dividing line between normality, that which is most common, and abnormality, that which is unusual, the extreme limit of generally accepted normality merging in one direction into the superathlete and the genius and in the other into disease of the functional variety in which body or mind is insufficiently strong (for obscure genetic or acquired reasons) to stand up to the demands on function which ordinary life in an average environment imposes on the psychosomatic machinery of the individual man. In the second place, although functional disease, weakness of body or mind as thus defined, is not a progressive process and is not, therefore, usually regarded as disease, it sometimes renders body and mind more liable to succumb to adverse factors in environment and therefore merges into disease proper, as I have attempted to define it. In the third place, no absolute dividing lines can be drawn between somatic, psychoneurotic, and the psychosomatic disease for the simple reason that body and mind are mutually interdependent in their development. Nevertheless we must make some attempt to classify disease.

Somatic Disease.—Somatic disease, as I see it, is alteration of structure and disturbance of function of the body

due to a primary pathological process of the body—that is to say, abnormal direct action on the body evoking potential reactions by it. If the brain or any function of the body on which it depends is affected, somatic disease as thus defined may lead to disturbances of the mind. Its recognized causes are genetic defects, any form of physical trauma, deficiency of any substance on which the development and maintenance of the body depends, chemical poisoning of any variety, and infections of all kinds. All somatic disease is organic in the sense that it is associated with structural or more or less permanent functional change, but all organic disease—that is, disease associated with structural change—is not necessarily somatic in the sense in which it has been defined in this paragraph.

Psychoneurotic Disease.—Psychoneurotic disease is alteration of structure or disturbance of function of the mind due to a primary pathological process of the mind—that is to say, to normal direct action on the mind and abnormal reaction by the mind. It may interfere with the functions of the body through the nervous system. The predisposition of the mind to react abnormally depends on unfortunate previous experience and/or genetic predisposition. Psychoneurotic disease therefore links up, as I have already pointed out, through defective personality, mental deficiency, and the functional psychoses with disorder of mind due to primary pathological processes of the body (the organic psychoses).

Psychosomatic Disease.—Psychosomatic disease is that to which a man succumbs under circumstances of stress in his environment on account of his own individual peculiar psychosomatic constitution. For, as I have already pointed out, no two men are the same in body or mind, or in the relationship which exists between body and mind. As thus defined, psychosomatic disease falls into two groups. In one group some peculiarity of body, as evidenced sometimes by hereditary tendency and association with physical characteristics, seems to have predisposed the mind to succumb to adverse factors in conscious experience. I am thinking of the people who fail to adapt to widening experience (the schizophrenics) or to dwindling experience (the involutional melancholics), or those who fail to control their emotions and lapse into uncontrolled excitement or unjustified depression. In the other group some peculiarity of the way in which the body has conditioned the development of the mind, and the mind the subsequent development of the body, seems to have predisposed the body to react to emotional experience in a way in which the average body does not react. I am thinking of people who develop asthma or thyrotoxicosis under circumstances of emotional stress. And I am sure that disease of this kind “piles up.” For instance, emotional stimulation of the bronchi renders them more sensitive to physical stimulation, and physical stimulation more sensitive to emotional stimulation, with the result that asthma or thyrotoxicosis, emotional in origin in the first instance, can actually lead to death.

Unclassifiable Disease

Nevertheless, there are many diseases normally regarded as organic, in the sense that they are associated with structural change in the body, which cannot be classified at present as psychoneurotic, somatic, or psychosomatic. They must, however, be due to some combination of the only three possible causes of disease which we can envisage—namely, genetic predisposition and adverse factors in environment, and the influence of the conscious mind on the physical state of the body. That cancer and old age are due to some complex interaction between genetic predisposition and adverse environmental factors seems likely. But can anxiety, stress, and disappointment lead to structural and functional change, such as hypertension, atherosclerosis, and cardiac infarction? For instance, can a person die of a broken heart, as is popularly supposed? Can the news of Napoleon's victory at Austerlitz have killed, as has been said, our great Prime Minister, the younger Pitt? Now, there is no theoretical reason why states of mind should not lead to structural change in the

body. For the will to execute the simplest movement leads to physico-chemical change in the nerves and muscles taking part, and chemical change, the body being basically a physico-chemical machine, is structural change. Further, we now know of three physiological mechanisms through which mental states can exert an influence on the body: the autonomic nervous system, the pituitary-thyroid mechanism, and the pituitary-adrenal mechanism. And it would be unscientific to expect consistency. All experience suggests that one man's psychosomatic constitution is such that his body can stand up to mental stress, while another man's is such that under the same circumstances he inevitably succumbs. One is like a castle built on sand and another like a house built on rock.

There remain, therefore, a group of diseases associated with structural change in the body for which at present no certain cause can be found, and in which the part played by the mind cannot as yet be assessed. It may well be very important. True that some of these—disseminated sclerosis and diabetes, for instance—may prove to be somatic only; that is, due to some combination of genetic predisposition and adverse factors acting on the body. Others—for example, duodenal ulcer and malignant hypertension—may well prove to be in part psychogenic in the sense that the psychosomatic constitution of the individual was such that he was predestined to succumb in this way when exposed to mental stress of that type or of that degree of intensity, while another person of different constitution under similar circumstances would have stood the strain.

The Future

What, therefore, of the future? For modern medicine, with its emphasis on the prevention of disease rather than on the treatment of the established condition, now that the age of materialistic optimism is past, can no longer ignore the psychosomatic concept or the part played by mental states in the pathogenesis of structural disease. Short of eugenic control of human mating we have no power (and one can hardly see how we could ever gain it) to alter the plan whence the individual is derived, and, although we should theoretically be able to modify its execution by controlling the environment in which it is carried out, the plan laid at the conception is hidden, so that, even if we could modify it in its execution, indications for the attempt are always wanting. We can, however, by controlling environment minimize the risks to which body and mind are exposed. But how is environment controlled? That depends on teaching the patient how to live, the doctor how to work, and the State its responsibilities (and the limits of its responsibilities) in this direction.

Lastly, will it ever be possible to alter the psychosomatic constitution of the individual so as to reduce the risks to which he is peculiarly exposed in one direction without increasing them in another? To give one example to indicate my meaning. Maleness is one form of psychosomatic development, as I have already pointed out, and femaleness another, while it is well known that men are predisposed to certain diseases and women to others by virtue of their constitution. If the female constitution could be converted into the male, and vice versa, it seems reasonable to suppose one would alter the diseases to which that person was liable to succumb by virtue of his or her sex. Whether in the future this will become possible is one question. Whether, if it ever does become possible, it will be wise or justifiable to do it, is, however, another.

Conclusion

One thing is certain. Our power over body and mind has increased, is increasing, and is likely to increase still further, and, as our power increases, it becomes more and more important that it should be used in the right way in the interests of society. This depends on a proper understanding of the nature of disease and on establishing the right relationship between the potential patient, the doctor, and the State.

IMMUNIZATION OF YOUNG BABIES AGAINST DIPHTHERIA

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This paper records some of the first results obtained with one prophylactic in an investigation of the methods of immunizing young babies against diphtheria. The whole work includes a comparison between the efficiency of different prophylactics, and a consideration of the effect of age at the time of the first injection and of the interval between injections on the levels of immunity produced.

Immunization against diphtheria is usually started during the second half of the first year of life. It is now generally recognized that immunization can be carried out successfully in the great majority of babies if the first dose of prophylactic is given earlier than this. Immunization against diphtheria has not the same appeal to mothers as protection against whooping-cough. Their eagerness for immunization against whooping-cough, however, can be used to include early immunization also against diphtheria: work on early protection against whooping-cough is being carried out by one of us (N. R. B.) in conjunction with other workers.

Although diphtheria is not at present a danger to young babies there are several advantages in early immunization. Large doses of prophylactic can be given without fear of undue reaction, and injections can be made at the same time as those of *H. pertussis* vaccine, which should be given as early in life as possible. The chief disadvantage lies in the possibility that inherited passive immunity may interfere with active response by neutralizing some or all of the injected prophylactic. The extent to which such interference may occur may increase as the proportion of immunized mothers increases. It is therefore important to employ methods of immunization that are effective in the presence of considerable passively acquired antitoxin. At all times there is also the question of post-inoculation poliomyelitis, and it would seem that the incidence of poliomyelitis in very young babies is not so low as had been supposed (Wright and Owen, 1952).

Barr, Glenny, and Randall (1950) found that babies in whom the maternally conferred antitoxin had fallen below 0.04 unit per ml. at the time of the first injection could be successfully immunized by two doses, each of 0.5 ml. (25 Lf) of A.P.T. When, however, the passive antitoxin was in higher concentration, immunization was unsatisfactory as judged by antitoxic response two months after the second injection. Barr *et al.* (1952) have shown that babies with low maternally conferred antitoxin titres can be successfully immunized by two doses of 0.5 ml. of A.P.T. even when the first dose is injected at the age of 6–10 days. They also found, however, that a high proportion of failures could be