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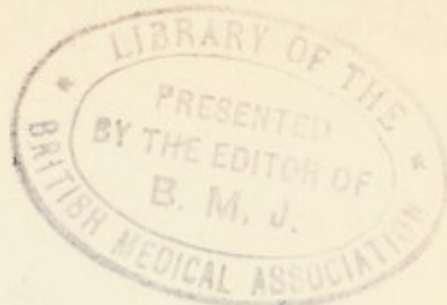
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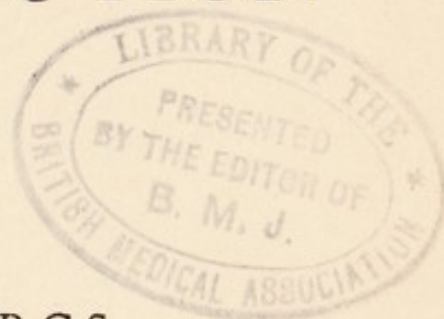
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VITALITY AND ENERGY
IN RELATION TO
THE CONSTITUTION

BY

T. E. HAMMOND, F.R.C.S.

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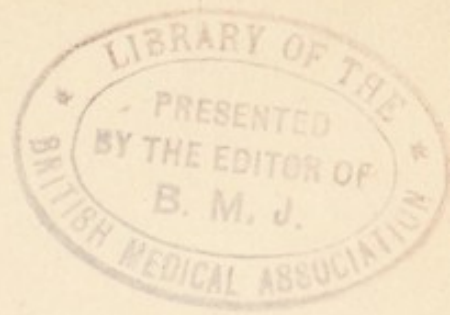
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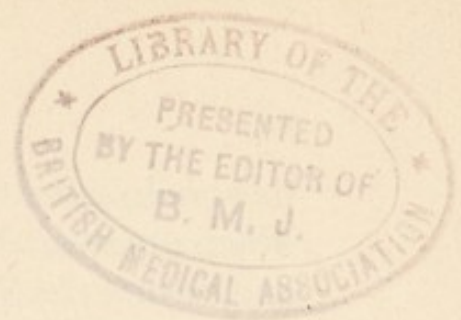


TO
SIR ARCHIBALD GARROD
K.C.M.G., F.R.C.P., F.R.S.



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PREFACE

SOME years ago a practitioner told me that a want of vitality was the principal complaint of the vast majority of his patients : and by this was meant that there was not sufficient energy to do work and to enjoy life. In at least 80 per cent. no definite disease was detectable, nor did one develop if the state went on for years. If only he could give vitality and energy, the confidence of his patients would be restored. For they were indifferent to disease and to death, fatalism being part of their creed. The subject was of great interest to me. As a young man I had failed at rugby and boxing, because I had not the stamina to stay the course ; and experience had taught me how impossible it was to develop this. Was vitality just the same as stamina ; the former being essential to enjoy life and the latter to be successful at games ?

This book attempts to deal with the problem. My original intention was to make this a single contribution to its study. But the subject has been much neglected in recent years, and few references are to be found in current literature. Consequently many of the chapters are disconnected and incomplete, and each should be read as an entity in itself. As definition of certain of the states is so difficult, a certain amount of repetition is unavoidable. The book could have been made more extensive by references to research work. But the difficulty then would be to know not what to put in but what to leave out ; and the intention of the book to view the subject from the clinical aspect might be missed.

Learned readers may object to the references to boxers, etc., on the ground that vitality is too delicate a subject to be treated along such lines, and may contend that medicine should confine its attention to the care of the sick. But

this book is an attempt to throw light on vitality and energy, which are seen at their best in those who are strong. Before and during the War much of my leisure from hospital work was spent watching boxing. I could not help noting the want of energy in one place and its exuberance in the other. If only it could be more evenly distributed, how happy man would be ! In later years I was disturbed at the restlessness which was becoming evident in those who were not well. So often it seemed that a want of discipline alone prevented complete recovery. But this restlessness was not just wilfulness ; rather did it seem to be due to something over which the individual had no control. It was as if he had not sufficient energy to relax. By the side of the river I used to note how easily peace came to life in nature. And yet, because of its want, the power to enjoy life is so often denied to man. The reader with a sound constitution can reason out vitality and energy in terms of himself ; though the chances are that, so long as he has health, he gives no consideration to either. If, however, he once was a little envious of those who were fit and strong, and if he ever wondered why the health that was denied him came so easily to others, he can substitute these where I refer to boxers.

This book brings to completion certain thoughts on the constitution. In the first book, *The Constitution and Its Reaction in Health*, it is pointed out that man is a more delicate creature than some realise, his constitution being affected by the time of the day, by the winds, and by the seasons. Fresh air, exercise, sunlight, and bathing do good only if a reaction is forthcoming ; this varies not only with the age and state of health, but also with the constitution that has been acquired in the passage through life. As the majority of men have sound constitutions, they can easily adapt themselves to changes they are called upon to face. But at one end of the scale men deviate towards the hypersthenic, where the energy is too great ; and at the other to the hyposthenic, where it is too little. Each of these may

react abnormally to states that benefit the average man ; and what does good to the hypersthenic is likely to do harm to the hyposthenic. This is established in therapy, but applies equally to fresh air, exercise, sunlight, and bathing.

In the second book, *Principles in the Treatment of Inflammation*, a distinction is drawn between the prevention of inflammation in a wound and its treatment. The former is nowadays easy and is carried out on a truly scientific basis. With the latter little progress has really been made. For, though bacteriology has revealed to us the cause and the nature of bacterial disease and has shown how it can be prevented, it has given little help in treatment. Normally man has great resistance to bacteria, which can develop in the body only if a virulent strain gains entrance, if there is local damage to tissue, or if the resistance factor is impaired. Were no local reaction set up, septicæmia would follow. An inflammation should be regarded as an attempt to localise the activity of the bacteria, all the stages serving some purpose. If an organ can be removed, a direct attack is possible ; otherwise reliance has to be placed on the reactive power of the host. Nature is working towards a cure. The surgeon relies on this and his therapy is directed towards assisting her by increasing or decreasing the reaction. He is guided not only by the type of disease but by the constitution of the patient.

In the third book, *Infections of the Urinary Tract*, this argument is further developed. In gonorrhea the appearance of the discharge is not the disaster. This was coitus a few days previously when gonococci were deposited in the urethra. The application of some antiseptic then could have destroyed the bacteria and so have prevented the disease. The inflammation means that resistance is being established and that the infection is being localised. A direct attack on the bacteria is no longer possible. It is true that drugs act when given internally or applied locally, but in all probability only by modifying the reaction. The fact that antiseptics are excreted by the kidney or can be

introduced into the inflamed organ via the urethra has led to much confusion in our outlook upon infections of the urinary tract. In inflammation of the skin, antiseptics are valueless, though absorption through the skin does take place. And antiseptics can have no more power in the urine than when acting on the surface.

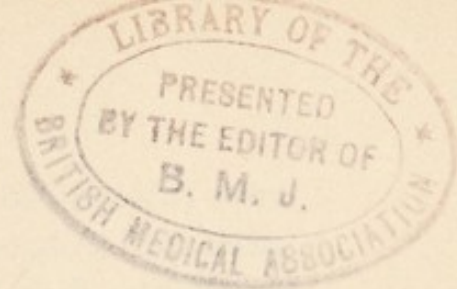
In this book much importance is attributed to the central nervous system in limiting and overcoming bacterial disease. This was referred to in the previous books. The aim of these would no doubt have been clearer had this book been written first. In the literature of the middle of the last century frequent references are to be found to the bearing of the nervous system upon disease. Then for a generation or two they disappear. But the belief is again arising that the state of the central nervous system plays a predominant rôle in the origin of bacterial disease ; and, when this has been overcome, the persistence of ill-health is often due to the damage the nervous system has sustained.

Chapter VII has appeared in the *Clinical Journal*. Appendix A has appeared in the *British Journal of Urology*. A few years back vitality was attributed to the internal secretion of the testes, and it was maintained that rejuvenation followed the engrafting of these glands. This article reveals the wrong line of thought to which research may lead, if uncontrolled by clinical work.

To-day much unnecessary therapy goes on. Appendix B has appeared in *The Practitioner* and is inserted here to stress the need for kindness rather than active therapy as the end draws near. My thanks are due to the editors for permission to publish ; also to the practitioners with whom the points referred to have been discussed ; to Mr. C. S. Home and the library staff of the Royal Society of Medicine, who have brought to my knowledge much that is in the literature ; to Mr. W. R. Le Fanu, librarian to the Royal College of Surgeons ; and to Mr. P. E. Garrett, who has taken so much trouble with the typing.

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VITALITY AND ENERGY IN RELATION TO THE CONSTITUTION

CHAPTER I

INTRODUCTION

ONCE aseptic surgery gave safe access to the deeper tissues and to the cavities of the body, many organs could be excised or transplanted; as a result information was forthcoming about the function they served and their bearing upon vitality and life could be ascertained. Some were of less importance than had been anticipated. The heart, for instance, merely maintained the blood-pressure; and, if it were removed and the circulation were maintained by connecting the vessels with those of another animal, life would go on. But other organs, that in the past had claimed little attention, were found to be of great importance. This applied to the endocrine glands, of which the thyroid serves as an example. Though not a vital organ in the sense that when removed life would immediately come to an end, its bearing upon health and vitality was considerable.

But just as knowledge of certain organs was becoming more exact, other factors, such as the hormones, with an important bearing on vitality were being discovered. So that, though science was telling us much, it was also revealing that life was more complicated than anyone had surmised.¹ Even the primary senses, that a short time before

¹ Metabolism will serve as an example. Thirty years ago this seemed fairly simple when the three primary elements were being considered. Carbohydrate metabolism was known to be bound up with the islets of Langerhans in the pancreas. It seemed that if the secretion from this could be isolated, our knowledge would be brought to completion. But

were thought to be so simple, were found to be extremely intricate. Vision will serve as an example. At one time it was believed that the eye was comparable to a camera, and that an image was focused by the lens on the retina, from which it was conveyed direct to the brain, which served the same purpose as a photographic plate. But it was soon found that vision was not so simple as this ; for certain areas of the retina were blind and only some parts were sensitive to colour.

Research work, however, was becoming complicated ; and, as it was often necessary for a man to give his whole time to the investigation of one organ, the tendency was for each worker to concentrate on certain work. In the circumstances it was natural for him to stress its bearing and to come to regard the organ as synonymous with life when its function was essential to vitality. There slowly sprang up a mechanical conception of life ; and many came to look upon this, not as a thing in itself, but as if it were nothing more than the sum total of the activities of the organs of the body.

Now, in the laboratory an animal could be seen alive, full of vitality and in perfect health ; and, when some organ was put out of action, it could be foretold with fair accuracy what disorder would arise ; for experimental work had shown what function it served. Again, the difference between an animal in health and when lying dead was obvious. And all states between the two could be produced experimentally and be maintained for long periods. Though at the start of his career it was difficult for the student to spot these, experience soon made this easier. For by

the discovery of insulin has revealed to us how complicated this is ; and nowadays we are, if anything, farther from a solution of the problem.

Certain diseases, such as scurvy, were believed to be due to some deficiency in the diet. When vitamin C was discovered, the problem seemed solved. But the vitamins in themselves now constitute a problem that is equally complicated. This is what is so often found. Whilst the recent advances of science have added to knowledge, they have served to bring little to completion.

practice his sense of perception became more acute ; and what at first was seen only by a trained observer was soon obvious to him. In the circumstances he began to think that knowledge of life was becoming exact and came to look upon life as something concrete. As teaching for examinations was somewhat dogmatic, many students had a materialistic conception of life and came to think that it could be estimated scientifically, much as a piece of flesh was weighed. Living as they were in an age when great advances were being made and greater were anticipated, few doubted that soon there would come a day when the basis of life would be discovered.

Great advances were also taking place in therapy ; and in the laboratory the great results that were obtained from research into bacterial disease in animals were evident. An animal that had been immunised against bacteria could overcome a lethal dose ; and, when bacterial disease had developed, the various antisera given enabled the animal to survive. A golden age was dawning, for a form of therapy that was regarded as specific, direct, and exact was available. All that the clinician had to do was to learn to use the remedies. Had we realised, however, that these experiments were carried out in healthy animals which normally have great resistance to bacteria, the chances are that we should not have been so impressed. For, when disease arises in such animals, they usually recover, whether specific therapy is carried out or not. In addition, animal life being cheap, when therapy failed, the animal could be destroyed. Consequently students saw only those that recovered. They had no opportunity for viewing that cumulative effect of failure which is often so humiliating in clinical work, but which serves the purpose of enabling a true perspective to be attained.

In the wards of the hospital before the War, students were presented with a humbler conception of life which was of inestimable advantage to those starting medicine. For, though all clinicians appreciated the great advances that

were taking place, the limitations of many of the claims of science at the bedside were obvious. Asepsis had lessened the risk of operative surgery which, in one generation, had become comparatively safe ; in addition, nursing was easier and convalescence less disturbed. The improvement that had followed the scientific application of antiseptics was obviously very great. But Lord Lister had only shown us that bacteria were the cause of inflammation in wounds, and that this did not occur if they were prevented from gaining entrance. His work gave safe access to the deeper tissues, and as a result operative procedures were rendered possible that in days gone by were not even contemplated. But the treatment of disease was thereby rendered more effective only in so far as it could be removed or the disorder to which it had given rise could be overcome. But Lister taught us nothing about the treatment of inflammation and never once did he claim to have done so. Sir Hector Cameron wrote :¹

“ It is hard to appreciate the fact that carbolic acid was not used by Lister (as it had undoubtedly been previously used by others) as a ‘ local dressing for wounds ’ with a view to acting directly with a specific healing influence on the wounded tissues, but rather that it was employed to destroy germs which, if they reached the wound in the living state, had the power of preventing the natural processes of repair. . . . His constant aim was to place wounds, as far as possible, in conditions resembling those of subcutaneous injuries, free from access of external morbid agencies, as well as from direct irritation by foreign substances.”

Though such statements as this are not infrequent in the writings of that time, their significance was grasped by very few ; and much of the confusion in the work of the pre-War and subsequent generations was due to the failure to realise that, whilst the efficient treatment of an infected wound might prevent its becoming inflamed, this, whilst permitting the removal of bacterial disease, gave no clue to its treatment.

¹ *British Medical Journal*, 1907, vol. i, p. 789.

Though all clinicians appreciated the great advances that were taking place, the limitations of many of the claims of science were obvious. Bacteriology had revealed to us a definite cause for disease and there was something concrete to deal with. As a result it was possible to say when bacterial disease began and when the patient was cured, and also at times to trace the source of the bacteria. Such accurate knowledge about the course and progress had before been possible in only a few diseases. But though bacteriology was making diagnosis more certain and tests such as the Widal and Wassermann gave much help, it did not provide one reliable test by which it was possible to foretell the course disease would run, nor even what the state on the morrow would be. On account of this the claims of therapy were so uncertain ; for the clinician had to rely on his knowledge of disease in general and on views he had formed about its natural course. But his work was rendered so difficult, because with a particular patient the course that would be run was peculiar to him. Now, bacterial disease is a contest between patient and bacteria, and the signs that denote the presence of disease may be as much an indication of good resistance as of the virulence of bacteria. For nature works towards a cure and endeavours to localise and eventually to overcome the harmful influence. Resistance was inherent in all living tissues. Though frequently spoken of, none was certain as to what was meant by resistance ; though it was in some way bound up with the power of the tissues to react. This reactive power of the tissue is best exemplified by a reference to operative surgery. Whilst the success of an operation depends upon the care with which asepsis is carried out and also upon the ability of the surgeon and the attention he gives to apposition of the cut surfaces, whether a wound heals or not depends much upon how the tissues of the patient react. For the granulation tissue that arises from each side of the incision and is later converted into fibrous tissue is formed by the patient himself. The surgeon takes no hand in this. If granulation tissue is not

formed, union fails. There was, unfortunately, no method by which the resistance of the patient or the power of the tissues to react could be estimated, but they seemed to be in some way linked up with the type of constitution, the temperament, the vitality, and the state of health.

The student was hearing for the first time reference to such expressions as vitality, the constitution and the temperament, and the power of the tissues to react. When he spoke to laboratory workers, they said that these were just abstract terms that were rarely used in the same sense by any two clinical workers ; and, as they could not be measured, they had no scientific bearing. But physicians and surgeons were definite that they were not abstract conceptions to those who had experience in clinical work and who were gifted with clinical acumen. Knowledge of them, however, came only by regular attendance at the bedside and was essential to anyone who wished to become proficient in the practice of medicine ; the reading of books gave no help, nor did work in the laboratory. Though often only of slight importance where diagnosis was concerned, they were of much importance in prognosis and treatment : and knowledge of them was possessed to a great degree by those who had clinical acumen.

Unfortunately there was no instrument by which one could be measured, and when estimating them the clinician had to rely on experience. And working from his knowledge of disease in general and from his knowledge of mankind, he tried to deduce what was going to be the result for that particular patient. In the circumstances the liability to error was very great. Consequently it was not surprising that the student during his ward work would find that his chief was not always right. For a patient who was apparently doing well would slip away, or one who was expected to die would recover. This uncertainty about the course the disease would run was to a large extent responsible for the uncertainty that prevailed with various forms of therapy. Though in the wards cases where bacterial

disease remained stationary or ceased to progress were common, only rarely were specific remedies tried ; and yet their value had been so much stressed in the laboratory.

The clinician felt that though certain antisera such as those for tetanus and diphtheria did good, it was only if given sufficiently early. They were valueless in established disease. He would point out that laboratory workers rarely told us that these sera could do harm and it was not possible to know beforehand what would happen. So often when reliance was placed upon good nursing and expectant measures, recovery took place. Nature worked in this way if she were given a chance. The dangers incidental to the use of sera were referred to. At times convalescence was prolonged and the impression was gaining ground that sera delayed recovery.

Drugs were used in the wards in a way different from that of the laboratory, where they were given for some physiological action that had been proved experimentally, the dose varying with the weight. Had they any antiseptic power, the aim in bacterial disease was to increase the concentration to the greatest extent possible. But clinicians were often sceptical about this direct action of drugs. Improvement, in their opinion, followed the administration of these only if some reaction on the part of the patient was forthcoming. Whether this took place would depend on the type of constitution, the temperament, the state of health, and any idiosyncrasy he might possess. Nature was working towards a cure, and the improvement that followed the administration of a drug might be just a coincidence. Though at that time papers were published advocating some drug after it had been employed for a few months in the laboratory, past experience had shown that clinically it was advisable to wait many years before expressing anything like a definite opinion. Sir Jonathan Hutchinson, whose experience of syphilis was unique and in the treatment of which he was such a master, wrote : ¹

¹ Sir Jonathan Hutchinson, *Syphilis*, p. 511 (London, Cassell & Co., Ltd.).

“ Amongst the most important of the many problems which yet remain to be solved by the industry of future investigators is the influence of treatment in the early periods upon the liability to tertiary phenomena. It is a question of extreme difficulty, being made so chiefly by the great departure from uniformity which syphilis presents. Tertiary symptoms are fortunately exceptional, whatever may have been the plan of treatment pursued, or even if all treatment has been omitted ; and we can never feel certain they have been prevented by any special measures which may have been adopted. Nothing less than a most painstaking collection of cases, each one of them extending over a period of ten years at least, can settle the question. When we remember that in very few indeed is the same plan of treatment pursued throughout, it will be easily seen that statistical evidence of the kind desired is not likely to be soon obtained. We must as yet, and for long, be content with general impressions.”

If therapy depended on the promotion of a natural reaction, the administration of a drug by impeding this might do harm. And the test of efficacy of a remedy was not that the patient left the hospital alive or that disease cleared up, but that health was eventually restored and that sufficient vitality was given to enjoy life and to do work.

This indirect action of drugs was exemplified by a reference to syphilis. For, though this had been proved to be due to the spirochæte, few believed that the action of mercury and the iodides was dependent entirely on their antiseptic power. For were this the case, progress would be proportionate to the amount taken ; yet at one time a marked effect might follow minute doses, and at another big doses could be taken with no change in the lesions. Idiosyncrasy or the reaction peculiar to each individual played some part, and there was no way of estimating this apart from trial and error.

Sir Jonathan Hutchinson, in his book on *Syphilis*, wrote :

“ Small doses of mercury assist the formation of fat and muscle. Everything depends on the dose and upon the

patient's idiosyncrasy. Whatever the idiosyncrasy, however, if the dose be reduced sufficiently, the drug will be borne, and, when it is borne it will cure. It is not the quantity of the drug that is needed but the effect on the organism ; and, if the specific effect is gained by a minute quantity, it is not only not needful but bad practice to attempt to increase it. The chief difficulties in treatment occur with those who are insusceptible, not in those who respond easily."

In his book *The Pedigree of Disease* he wrote of the action of iodides : ¹

" Probably there is no drug respecting which the action can be more easily demonstrated that it is not the dose but its effect which should be regarded. It by no means follows that because a patient has an idiosyncrasy against some drug or an article of diet, that he ought really to abstain from its use. Rather this susceptibility in the majority of cases proves that in him minute doses will effect the cure as efficiently as larger ones in others. I have repeatedly cured tertiary ulceration of the throat and skin in patients in whom I was assured iodide was a poison in all doses, by giving it in quantities of half or even a third of a grain."

Hutchinson was regarded as the greatest clinical teacher of his day. He considered that when a lesion cleared up it was not the action of the drug upon the bacteria so much as some reaction with the tissues to which it led. For susceptibility implied that this took place with a small dose. Much attention should be paid to his observations, for his clinical findings have stood the test of time.

The possibility of specific therapy was, however, never abandoned, for great results had been attained by antiseptics in operative surgery and were due entirely to direct action upon bacteria. Aseptic surgery was established on a scientific basis only as knowledge had come from bacteriology. As so many diseases were proved to be due to the action of bacteria, there seemed to be no reason why drugs should not also be produced that would destroy bacteria

¹ Sir Jonathan Hutchinson, *The Pedigree of Disease*, p. 50 (London, J. & A. Churchill).

when applied locally or when introduced into the body. Much had been hoped from vaccines which were supposed to have a specific action. But though good results at times followed, success could never be relied on. Too often they had no action and at times even did harm. For a diminished resistance to infection lasting many months might follow their administration, and it was not possible to foretell when this would take place. Whether they acted or not depended upon the production of some reaction. But just as men were wondering what this reaction was and were trying to discover the principle that was eluding them, salvarsan was introduced. From then on our outlook on therapy was never quite the same.

Béchamp had noted the action of atoxyl, a preparation of arsenic, upon the trypanosome. Syphilis had been proved to be due to the spirochæte; and, owing to the similarity between these organisms, Ehrlich considered it possible to produce some drug that would destroy the spirochæte. He based his work on the supposition that a dye stained protoplasm because it could penetrate the bacterial envelope, and felt it might be possible to attach various substances to the molecule of the dye that would make it toxic to bacteria and non-toxic to the cells of the body. Salvarsan was the 606th substance with which he experimented. After much careful work had been carried out on animals, he handed the drug over to certain members of the medical profession. The results were astounding. Gummata that had previously resisted all forms of treatment rapidly disappeared. Chancres, of a type that cleared up slowly with mercury, disappeared in a couple of days. As the results were attributed to the action of salvarsan as an antiseptic, the aim was to maintain a certain concentration in the blood for a sufficiently long time, and big doses were given. This drug did not appear to depend for its action upon some reaction with the tissues. For whilst it acted best when health was good, it also acted when health was poor and there was malnutrition. It differed also from the

specific treatment previously recommended in that the extent of the lesion and the time during which it had been present were not of great importance, provided the destruction of tissue was not too great. Rather did it seem that the drug was more effective where disease was established. Though bad results did occur from poisoning, etc., these were very few and were negligible when compared with the cures obtained. The claims for its action differed from those put forward for vaccines, etc., for they were obtained, not in isolated cases, but in the great majority ; and anyone who took the trouble to learn to use the drug formed a favourable impression. Salvarsan had first been thought out scientifically and the line of reasoning was comparable to that which had guided Lister in his work. It was one of the greatest achievements that had ever been attained in therapy. Just previously myxœdema had been proved to be due to deficient thyroid secretion and cleared up when thyroid extract obtained from animals was administered. Here again good results were forthcoming, even when symptoms had been present for months or years. In addition, tetanus had been proved to be due to a special bacillus introduced into a wound, and was preventable if antitoxin were injected sufficiently early.

It is not, therefore, surprising that everyone thought we were entering on an age when direct attack upon disease was possible. In consequence *therapia sterilisans magna* came to be visualised. Obviously all that we had to do was to find out the cause of disease and to bring this to the notice of scientists, who would provide us with remedies. In the circumstances few surely will blame the pre-War generation for the conclusion they reached. We were unaware that Ehrlich's earliest and probably best results were obtained by the intramuscular injection of salvarsan, so that the concentration in the blood was hardly ever great enough to allow it to act as a germicide. Nowadays we know that after an intravenous injection, 80 per cent. is excreted within half an hour ; and, as the syphilitic lesion leads to

much fibrosis and endarteritis, little salvarsan is likely to reach the spirochæte. Bismuth also clears up syphilitic lesions, yet has no action upon the spirochæte outside the body. In addition, nowadays, it seems unlikely that antitoxin prevents tetanus merely by neutralising toxin. More probably the antitoxin combines with the lipoid of the nerve-cell and so prevents the entrance of toxin. This phylactic action of antitoxin has been demonstrated in recent years.¹

The method by which drugs act is still doubtful. Though nowadays few are prepared to say that salvarsan has no direct action upon the spirochæte, it is likely that some factor comes into play that we do not as yet understand. And whilst in bacterial disease in general drugs have at times a definite action, recent knowledge suggests that a direct attack upon the bacteria seems scarcely possible. To attribute this action of drugs to their power as alteratives, to some reaction with the tissues, or to the production of anti-bacterial bodies is merely to put into words some action of which we have definite evidence but the cause of which we do not know. Unless this is realised, we shall continue to go astray in therapy. Far better is it for us to admit that, notwithstanding all the research work that is taking place, we have made but little advance in our knowledge of the action of drugs.

Round the Fountain

The British Constitution was established by laws and acts drawn up in the Houses of Parliament. But the principles on which these were based owed their origin more to quiet chats under the elms on the village green in summer than to what went on in Parliament itself. It is to be regretted that in modern villages allowance has rarely been made for the creation of such places which further the atmosphere that leads to quiet contemplation and thought.

At Bart.'s we were fortunate in having a square into

¹ *Phylaxis*, by G. Billard (Kegan Paul, Trench, Trübner & Co., Ltd.).

which we wandered after the visits of our chiefs were over ; and, as we sat round the fountain, we would discuss what we had seen and been told. Sir James Paget had just died, and all that he stood for in the life of the school and in British surgery was known to us. Sir Thomas Smith, who had been one of his assistants, was sometimes seen in the square. Sir Jonathan Hutchinson, who had been one of his first students, was still in practice ; and his fame as a clinician and as a syphilologist was " world-wide." Yet their views upon surgery savoured too much of an age that was gone. Even Hutchinson's great work on syphilis that a few years back was so much admired was thought to be of little importance owing to the discovery of the spirochæte and the introduction of the Wassermann test. As the bacterial conception of disease was being grasped, our eyes were turning towards the big laboratories that were being erected.

As, obviously, we were living in an age when great advances were being made, many opportunities were arising for young men with their fresh outlook on life. Operations, that a few years back were done with some trepidation owing to the risks from that unknown factor, hospital fever, were performed daily with little if any risk. And extensive resections of organs that a short time back were not dreamt of were performed each week. Consequently we were concerned not with surgery as a last hope, but rather as a means of restoration of health. Patients to whom we had spoken in the wards would be conveyed across the square to the operating theatre, where an opportunity was given us to see some cavity opened up and disease revealed. Then we would see them taken back to the wards, where they would be nursed back to health ; later they would come into the square, where vitality would begin to return and with it the enjoyment of life and the smiles to which this gave rise. On the other hand, death might supervene ; and it was strange to see the body of one to whom we had spoken a short time before lying so stiff and stark in the post-mortem room. Sometimes the relatives would cross the square ; and their sad

expressions would reveal to us the sorrow and grief that came when treatment failed. For some patients there was no hope. They just lingered on. Much better would be their lot when death made its claim.

Whether it was that we were inspired by the greatness of the men who in years gone had walked across the square, or whether it was that so many aspects of life came before our eyes, I do not know ; but our talk was often upon the broader conception of medicine rather than upon the signs of disease. The staff the hospital then possessed exercised a great influence. Devotion to truth and its constant search was their aim. Though they were not always right in their diagnosis, prognosis, and treatment, their honesty and integrity were never in doubt. For they never attempted to conceal mistakes from students ; and they were always prepared to revise their opinion as the case progressed and to give reasons for the change of view. They would point out that the discovery of truth in any art was not the work of a day. This particularly applied to medicine, where so many factors came into play. And the greater the experience, the more reluctant was anyone to speak of conclusions. So often when these had been reached after years of work and careful observation, some new discovery would prove them to be wrong. The difficulties that were bound up with the art and practice of medicine were much stressed, and no attempt was ever made to conceal ignorance by coining a phrase.

Medical and surgical consultations were held each week, and to these were brought not merely rare cases, but patients for whom the line of treatment was in doubt. Often it was not so much whether it was the correct treatment for a certain type of disease, but whether it was right to carry it out for that particular patient. And only those who attended such consultations can appreciate their broadening influence upon the student mind. For even amongst the elect it was obvious that, where the welfare of a particular patient was concerned, much uncertainty prevailed over

diagnosis and therapy. In this way there came home to us that much of the knowledge we had acquired in the laboratory was really very hollow and that the search for truth was more difficult than we realised.

In those days physicians were in no hurry to call in surgeons, and students were given an opportunity to watch the natural course of disease. Though this might result in the death of a patient when an operation could have saved, on the other hand we saw many recover. In addition, the surgeons belonged to no one school. Some, such as Mr. Lockwood, had extraordinary skill at operating, and their technique has rarely, if ever, been surpassed. Others, such as Sir Anthony Bowlby, who were extraordinarily good at diagnosis and were uncanny in foretelling the course the disease would run, were more inclined to rely on the natural powers of the tissues to localise and to overcome disease, and operated only when a definite indication arose. The students were consequently able to watch and to compare various schools.

Though there was no special follow-up system, few of the staff belonged to outside hospitals, and in consequence concentrated on their work at Bart.'s, where old cases were constantly turning up for review. As the hospital took upon itself the responsibility for nursing many of the sick in the neighbouring district, an excellent opportunity was given to students to observe the effect of therapy when no other aids, such as a change of air, etc., were available. We also had an opportunity of hearing the views of practitioners who would bring up patients for consultation and who would later come into the square for a chat. Students were thus in a favourable position to observe the bearing of therapy. In addition, the hospital was not too large. The big out-patient department was only in process of construction; there were few special departments; and attention was concentrated on the work of the wards. In such an atmosphere the student was likely to develop the inquiring rather than the critical type of mind. But no doubt the type

of student Bart.'s then attracted played some part ; for many of the best men were coming from Oxford and Cambridge. The refinement and culture of Oxford were obvious. So was the broad outlook on life that Cambridge gave to her graduates ; so often they were men of the world before they were out of their teens.

Great advances were then supposed to be taking place in medicine and surgery, and extraordinary claims for various forms of therapy were coming from other hospitals. For instance, one school stated that ill-health was due to some focus of infection which could always be discovered if the examination were thorough ; health would be restored when it was eradicated. Another school maintained that ill-health was due to some viscus being too freely movable or displaced, and the fixing of this in position led to restoration of health. Yet the operations that we had seen performed were by no means successful, if restoration of health was the real test. As it was just in these cases of ill-health that operative surgery seemed to fail, there was a reluctance to try out such work upon patients. Though we were proud of the conservative tradition of the hospital and had the greatest admiration for our teachers, we naturally wondered whether they might not be too conservative and in the circumstances might be failing to make use of reliable methods that were recently introduced. For we were aware that, when anæsthetics were discovered, there had been considerable opposition from many surgeons. Yet no one could deny the great boon they had been to surgery. Though aseptic surgery had attained a truly scientific status, Sir William Savory had produced statistics that proved that Lister's deductions were wrong. No one for a moment doubted that Savory at the time believed he was right. In the circumstances it was in no critical spirit that we were inclined to wonder whether our teachers might not be wrong. But our chiefs pointed out that surgery was passing through a phase.

As the younger men did not wish to be left behind, they were rushing too quickly into print. Consequently, papers

were published where results had been observed over only a few months. In addition, there was a tendency to try out new work upon patients before it had been established experimentally. Our chiefs also pointed out that rare cases and research were being given too much prominence. For the basis of medicine was sympathy, and its aim was the care and the cure of the sick. There was a real danger that the whole conception of medicine might be unwittingly changed. To prevent this happening some of us endeavoured to maintain a broad conception of our work. Though in retrospect it is not possible to be dogmatic as to the views we held, if I remember rightly, medicine was regarded from four aspects.

1. **Metaphysics, or the study of the soul**, by which was meant the question of whether there was such a thing as life apart from the body. Our work revealed to us the peace of mind that religion and the belief in a future life gave to a man as his end drew near. The bearing of faith and hope upon therapy was often evident; for, unless they could be maintained, everything might fail. But I am doubtful if the subject received much attention. For we were of an age that is generally not much concerned with the question of immortality.

2. **Philosophy, or the study of wisdom**. Psychology, or the science of mind, was beginning to claim attention, but the danger of trying to evolve this from careful study of a few sick people was very obvious. The problem was already becoming very complicated, because under psychology was included the question of education and the bearing of discipline upon life. Our teachers often stressed the fact that their duty was to teach us to think, which did not come just by making education easy. We realised that, though we were idealistic in our outlook, we were also inclined to be indolent; and the less the brain had to be used, the more pleased some were. Certain improvements in medical education were advisable, but few could agree as to what these should be. Many seemed to consider that the work

which they found difficult was that which needed special consideration.

3. **Set diseases.** These were well described in textbooks, and good examples were found in most museums. Modern methods enabled a diagnosis to be made at a stage and with a certainty that a few years before were not dreamt of. When such a disease had been present for years and could be completely removed, restoration of health often followed. Some of the most spectacular cures that resulted from operative surgery were found among these cases.

4. **Ill-health.** It was rather surprising to note the number of patients who turned up in whom health was not good and yet no disease could be detected. The physical condition was often difficult to describe. Rarely did they look ill; rather was it that they never looked robust. Nor was ill-health persistent; and when they felt well, there was no change apparent in their appearance. So often all that could be said was that they had not sufficient vitality to cope with what would have been a reasonable demand for a healthy person. When subjected to undue strain or when there was a sudden change in weather, disorder would arise in some organ or an infection would spring up. Many types of patient came into this class. But there was one that attracted much attention, where the patient though inclined to be emotional was at the same time often ambitious and intellectually above the average. For it was felt that, if only health could be maintained, the great things that had once been expected might yet be attained. Part of their trouble seemed to be that owing to their nervous system being more refined, they felt more acutely than the average person; as a result conditions that the more phlegmatic treated with indifference would lay them up. A want of tone was present in the muscles and ptosis of one or more of the viscera was not infrequent. And, as the functions of the various organs came to be investigated, disorder was not infrequently found. As bacterial disease was likely to arise in some mucous membrane such as the nose, the lung, the

gall-bladder, the uterus, or the urinary tract, this was regarded as the primary focus to which ill-health was secondary.

It was in this type of patient that successes were stated to follow removal of the organ or the fixing of it in position. The older practitioners told us that such results were by no means permanent ; and, as soon as the patient was subjected to any strain, the ill-health recurred and disorder broke out in some other organ. We were aware that patients who seemed so well on discharge would frequently turn up with some fresh complaint, and, pointing to the benefit they had previously obtained, would request and even demand another operation. Many practitioners felt that the ill-health was due to some constitutional weakness that was inherited or acquired. So long as life could go on at a certain level, health was present. But when the patient was subjected to any strain, the vitality became impaired and health broke down. At such a time the weakest organ became the seat of some disorder. This consequently should be regarded, not as a disease in itself, but as the local manifestation of some general disorder. When treatment was directed to the constitution and attention was paid to the mode of living, the local disorder would clear up. Practitioners still spoke of the diathesis or predisposition to disease and referred to drugs as alteratives, by which was meant that some change was caused in the cells or body fluids as a result of which the constitution was restored to normal and the predisposition for the time being overcome. Apparently small rather than large doses of drugs were required. For they would tell us that just as these patients had not sufficient vitality to allow them to adapt themselves to the strain of living, so their tissues did not seem to have sufficient vital power to react to those forms of therapy that did other patients good.

We naturally wondered what was this constitutional factor, what was this thing called vitality, and what was the reaction that was the aim of therapy. But

the bacterial conception of disease had us in its grip. For tuberculosis had been proved to be due to the tubercle bacilli, gonorrhea to the gonococcus, and typhoid to the bacillus typhosus ; and as our technique was improving, bacteria were found to be the cause of many other diseases. As some form of inflammation was often associated with the development of ill-health in these patients, we could not get out of our heads the impression that their ill-health was really secondary to abnormal bacterial activity. In addition, at that time salvarsan was introduced by Ehrlich and a direct attack upon bacterial disease seemed possible. In the circumstances we concentrated upon the discovery of *therapia sterilisans magna* and were inclined to ignore references to alteratives and the constitution.

There was, however, some deep thinking "round the fountain" in those pre-War days. Many of us had too great a respect for our teachers to ignore entirely their views, and I have little doubt that someone would soon have spotted the false premises on which our thinking was based. But the intervention of the War completely upset our life ; for not only was there great interference with our mode of living, and our way of thinking, but we were under the impression that some great discovery in medicine had taken place. The great scientific advances of the War, however, were concerned largely with the killing of man, which became an art in itself. Or with the protecting of him against the oppressor ; for no matter what new device for killing was introduced, something was soon found to counter it. Now, no great discovery did take place in medicine. Consequently our position was similar to that which confronted the men of Paget's time. Their generation, coinciding with the great Victorian thinkers, threw much light upon life, the temperament, and the constitution. A perusal of their writings shows how near they came to solving the problem. But much of their work came to naught, for their views were overshadowed by the attention that was given to the achievements of science, to the theory of evolution, and

to the bacterial conception of disease. For men came to think that some discovery had been made that threw much light upon life itself. Though we now know that this view is wrong, it completely upset the centuries of thought upon life which culminated in the work of those men. As impressions once formed linger on for years, even though they are known to be wrong, some consideration will now be given to the bearing of the achievements of science upon life and the effect of the War upon the practice of medicine.

A. The Achievements of Science

The application of the exact knowledge that mathematics placed in our hands led to great advances in physics and chemistry. The control of steam put great power into our hands. The substitution of oil for coal and the introduction of the Diesel engine added enormously to this, which was furthered by our knowledge of electricity with its manufacture, control, and standardisation. The production of artificial food substances and of chemicals that fertilise the ground with improved means of communication has enabled a regular supply of food to be provided throughout the year. In engineering and in the manufacture of chemicals colossal advances have taken place. Of these the aeroplane will serve as an example. In the course of a few years flying can be carried out in any direction at a speed that a short time ago was scarcely dreamt of. Such feats are possible with absolute certainty and precision. As a result, the word science is rightly regarded as equivalent to something that denotes exact measurement. The apparatus that these advances of science have placed in our hands has revealed to us many of the phenomena that take place as life goes on. For instance, the construction of lenses provides us with high-magnifying microscopes and telescopes. Consequently, man is able to visualise minute forms of life that previously were not dreamt of and to see worlds that in the past existed only in the imagination. By the preparation of special media and the

construction of apparatus which enables an equable temperature to be maintained, we can keep life going and so watch its progress. We are now aware of the factors that are essential for the maintenance of life. For, if they are withheld, vitality is impaired and life may come to an end. Through the development of branches of science, such as biochemistry, we can ascertain the changes that take place during life. In consequence physiologists are able to tell us what functions the various organs serve. In addition, our study of the natural sciences has rendered more accurate our knowledge of certain forms of life. As a result, our knowledge of the processes that accompany life has become more exact. But often we are uncertain of what such knowledge means. For our views depend so much upon the interpretations that are placed upon observed phenomena; and though the observations may be accurate, experience has shown us again and again that our interpretations are wrong.

Now, it is upon such interpretations that many of our theories and hypotheses are based, and as a result these are at times little more than conjecture. Yet they are regarded as scientific because they relate to science and are put forward by scientists. For, as the word science etymologically means "knowledge," the term scientific can be used in many senses. At one time it is applied to knowledge such as that pertaining to chemistry and physics which is as exact as mathematics and of the meaning of which we are certain. At another time the term scientific is applied to observations of which we are certain. In this case, again, knowledge is exact, for the observations can be verified repeatedly and can be adequately controlled. At another time the term scientific is applied to views that attempt to explain what these observations mean. Such views amount at the best to no more than hypotheses, and even when put forward by most eminent scientists may be erroneous. From such observations and hypotheses we proceed to formulate laws of nature and laws of life; and, since the word law

comes in, we regard such knowledge as even more certain than that to which the term scientific is usually applied. This application of the term scientific at one time to knowledge that is exact and of the meaning of which we are certain, and at another to knowledge that is just conjecture, is responsible for much confusion in our thinking to-day.

Science has given us much knowledge about vital phenomena and about the various forms of life. We are now certain that there is no such thing as spontaneous generation of life. But beyond telling us that life comes from life and that like begets like, science has revealed to us nothing as to what life is. It is nowadays possible to visualise the union of the ovum and the spermatozoa and thus to see how life begins and how growth takes place. Some scientists go farther and say that life comes from the genes or chromosomes and that it is intimately bound up with their activity. Even if such a view is correct, it is only putting life one stage farther back. It tells us nothing as to what this is and just reveals to us the source. As yet we do not know whether life is an entity in itself or whether it is just the sum total of the functions of all the organs of the body. We only know whether life exists by the fact that something grows or moves or that some organ functions. In other words, we can perceive life only by relying upon the senses of a living person. There is no instrument that by itself can tell us that life is present. For, though we believe that the act of living is associated with electrical changes in the body, we do not know what these are nor can they be measured or demonstrated. Even when deciding as to whether life has passed away, we have to use the stethoscope, which for this purpose is somewhat crude. Nor is there any instrument by which the varying degrees of vitality can be estimated, and as yet we are unaware of what vitality really is apart from the fact that it is a manifestation of life.

Science has not given us one drug by which vitality can be directly created. Some think that the taking of caffeine and strychnine does this, but in all probability they only add to

vitality by liberating energy and do not really create it. It is true that the administration of mercury, hypophosphites, etc., at times leads to restoration of energy and vitality, but this is possible only if the cells of the body can respond. For just as life can come only from life and cannot be created, so a return of vitality is possible only when living cells can play their part by responding. The following instances will serve to illustrate what is meant :

A.—A chubby-faced boy, aged 10, was admitted to Isolation Ward at the Cardiff Royal Infirmary in November 1934, with staphylococcal septicæmia secondary to an abrasion of the knee. This localised in the parotid, both middle ears, the right humerus, the left radius, the left femur and tibia and left knee, and all cleared up with the exception of the left tibia. For months the boy lay wasted and anæmic with a want of vitality. Artificial sunlight, vitamins, etc., were tried, and the whole dispensary was at my disposal, but nothing did any good. Yet no cause could be found for the lack of response. He was sent to the convalescent home in the country, where he immediately began to pick up. The wounds started to heal, the general condition improved, the glow came back into the skin, his chubbiness returned, and there was accomplished in a couple of weeks what the whole resources of the hospital had failed to do in many months. This form of therapy was that advocated by the Greeks.

B.—After a severe time at Suvla Bay, the 4th South Wales Borderers went to Lemnos, where they were just able to complete the three-mile march to camp. Their want of vitality was so evident; and it was sad to see such fine men absolutely done. That night I pondered over whether there was anything I, their medical officer, could do to help in its restoration. The ration of rum and the cup of tea worked wonders ; but in my experience their action was temporary and was likely to be forthcoming only when the men were able to have proper rest and sleep. Apart from opium, which acted by promoting rest and sleep, there was no drug in the medical pannier which could do any good, and I am doubtful if any of the drugs that are so much advertised

nowadays would have been of the slightest use. Yet during the following week it was wonderful to note the return of vitality. The eye became clearer, the muscles improved in tone, the glow came into the cheeks, and in the course of a few days the marching power was almost normal. There was no difference in the food and the air of Gallipoli was better than many think. But for the first time since landing in July the men were able to sleep properly at night and it was probably to this that the improvement in health was due. The Greeks observed that when natural sleep returns to a patient who is seriously ill, it is often the first indication that vitality and health are about to return.

C.—A scholar, aged 46, consulted me a short time ago for urinary symptoms associated with asthenia. He told me that a few years back he had had so much vitality that he had difficulty in resting, yet nowadays, though his imagination seemed as active as ever and ideas came freely into his head, the moment he got hold of his pen his vitality seemed to disappear. He had not sufficient to concentrate or to make a prolonged effort, and he was beginning to feel worn and tired. Frequent holidays, tonics, and patent medicines brought no relief. Apart from phosphaturia, no disorder in the urinary tract could be detected. Now, this man was weary and was becoming disinterested in his work. Having lost faith and hope, he was not unlikely to fall into the hands of quacks or to become interested in cults. It was pointed out to him that he must realise that he was 46 years of age, and a man of 46 could not do the same amount of work as he did at 35. On the other hand, what he accomplished was done to better purpose, for he had greater experience ; this came only with the passing of the years, and was some compensation for age. In addition, he had probably passed through the change of life, which was seen in men as well as in women. Though not infrequently associated with loss of sexual power, this was not just a matter of sex, as some people thought. Rather should it be regarded as the time when vitality was being lowered and as a result the power to respond to effort was lessened. When it occurred suddenly, as it not infrequently did in those who were highly strung, there was often malaise and weakness which were generally temporary. More rest was necessary. He altered

his mode of living and was given small doses of mercury, opium, and magnesium. Vitality slowly returned and he again began to enjoy life. This form of therapy is as old as time.

D.—A mother, aged 35, had five children in nine years. Coli infection had developed during the last pregnancy; and since the birth of the child twelve months before, she had suffered from malaise and asthenia. She was seen by me at the Cardiff Royal Infirmary and said, "I used to enjoy the day's work and looked forward to a romp with the children; but now I hardly have sufficient vitality to carry on, and the sight of my children just adds to my weariness." Though there were a few organisms and pus cells in the urine, no definite lesion was present in the urinary tract. The infection was no doubt secondary to and not the cause of the ill-health. She was just a case of asthenia for which no cause could be found. As she had not some rare pathological condition and as no operation was needed, she was of no surgical interest. Though really a maternal morbidity, she was not a maternity mortality and therefore not a case for the interest of society or of the State. The necessity for rest and leisure was pointed out to her. But this was impossible, as she had only one young servant, on whom she could not rely. It was found that she had not had one evening off for many years. Social workers soon came forward to help. Small doses of mercury, opium, and magnesium were given, and occasionally tonic mixtures such as gentian and rhubarb were substituted. As paraldehyde was not objectionable, this was taken each night. In a few months there was a definite improvement and vitality began to return.

E.—An old lady, aged 78, told me recently: "If it is God's wish, I am prepared to go on living; but I am equally prepared to die. I know I have outlived my years and in this way have worn out my health. Though I cannot expect to have the vitality I had a few years back, I do wish I had sufficient not to feel so weary during the day. For the first time life is becoming a burden." Morphia and opium lessen this feeling of weakness. Some maintain that they tend to make people disinterested and in this way shorten life. But if the dose is small, in my experience they never do harm; and the age to which opium eaters live is proverbial. The

barbiturates and such-like drugs act in much the same way. They promote a sense of well-being by acting as sedatives and in this way relieve the feeling of weariness, but they do not create vitality.

Now, for what had any of these patients to thank modern science? Of the remedies that are advertised to restore vitality which one was withheld?

Science has provided us with easily assimilable foods and with means for keeping rooms at an equable temperature; as a result metabolism can be maintained and the onset of terminal infection avoided. It is thus possible to prolong life by preventing the approach of those maladies that are often desirable as asthenia continues or as the changes due to age become manifest. But this is quite different from saying that a food can create vitality or that we can truly add in any way to life. Now, if science is able to tell us so little as to what life is or as to what is the nature of vitality, surely scientists should hesitate a little before telling us what happens when life leaves the body. Now and again a scientist comes forward whose thoughts on life and the supernatural gain a hearing because they are reasonable and appeal to the beliefs of man. But this is entirely because he has ability to think along certain lines and not because of anything that comes to him from his profession. In the circumstances, such views should be regarded as philosophical and not as scientific. A brilliant physicist can tell us much about physics or about wireless waves and ether. But this gives him no right to speak of life beyond the grave. Again, a professor of natural science can tell us of the observations he has made upon living things and of the interpretation he places upon these. But his profession gives him no right to regard himself as an authority upon life.

B. The Effect of the War

Much of the confusion that exists to-day in regard to the discoveries that were supposed to have been made during

the War results from the failure to differentiate between diffusion of and an advance in knowledge. This is perhaps best illustrated by reference to the treatment of fractures.

Before the War surgeons took little interest unless operation were needed ; and the methods practised were those handed on from house-surgeon to house-surgeon. Consequently treatment was inefficient. I can recall a patient with a fracture of the spine and both femora who was treated by rest in bed and the long Liston splint. Union took place with six inches shortening. At the beginning of 1916 I was appointed surgical specialist to the Northern Command. Cases of gunshot wounds with fractures were common and treatment was rendered much more difficult by the extensive wounds. My lack of knowledge appalled me. In July of that year I was transferred to the Alder Hey Orthopædic Hospital, where I worked under Sir Robert Jones and was instructed in his methods. The simplicity was most convincing and my efficiency greatly increased. Simple fractures that were admitted directly to hospital united without shortening. But fractures of the femur due to gunshot wounds were rarely seen, for the majority had died from shock in France. Those who survived had been first treated in other hospitals and the shortening was on the average four inches. In 1918 I was attached to the Military Orthopædic Hospital at Newport, where there were at one time 300 cases of fracture of the femur with an average shortening of less than half an inch. Equally good results were obtained elsewhere. But the improvement was really due to more efficient treatment all along the line, due largely to the work of Major Sinclair. For the Thomas splint was applied in the trenches and the methods of the Liverpool school were carried out in all hospitals. There was little change from what I had been taught in 1916. Here there was a diffusion of rather than an advance in knowledge.

The treatment of venereal disease will serve as a further example. There is little doubt that this is nowadays more

efficient ; the end-results have certainly improved and complications such as stricture are rarely seen. But before the War surgeons paid little attention to venereal disease and few lectures were given. As a result not only was treatment inefficient, but few medical men were willing to undertake it ; and I am doubtful if there were twenty men in this country with the requisite experience. After the introduction of salvarsan interest was aroused in syphilis. But even then few hospitals made any effort to treat venereal disease and patients were left alone in their misery. During the War there was a big increase in the prevalence of venereal disease, and at one time there was a danger of our fighting strength becoming seriously affected ; and, as there was also a possibility that the looseness in morals might lead to an epidemic, the national conscience became aroused. It was soon found that men with the necessary knowledge were scarce. A pooling of experience took place, and the findings were quickly communicated to the various hospitals. After the War venereal clinics were set up by municipal bodies throughout the country and many hospitals created special departments. And nowadays not only is the student given a course of lectures but attendance in the venereal departments is insisted upon. As a result venereal disease is much more efficiently treated. But apart from the use of bismuth in syphilis and malaria in general paralysis of the insane, no new procedure has been introduced, and those of us who were trained in the treatment of venereal diseases before the War have hardly modified our methods.

There was really no great advance in surgery during the War apart perhaps from that of the thorax. Much that was regarded as new was previously carried out in many London and provincial hospitals, where the surgery practised had reached a high standard and was comparable in every way to that of Germany and America. Some surgeons with a conservative bias naturally lagged behind and preferred to rely on methods they had been taught and to which they had been accustomed. When the War came, there was an

opportunity to see the work of others and to watch the end-results. Consequently, surgical work improved and the standard of operative technique was considerably raised. But generally speaking the advances that took place were slight in comparison to the opportunities for work that arose and were not proportionate to the claims put forward. This is well illustrated by reference to gunshot wounds. Lister's work had revolutionised the treatment of compound fractures in civil practice. During the South African War most of the gunshot wounds healed by first intention even when a bone was fractured. But in the early days of the Great War practically all went septic and the sepsis was extremely virulent, for the soil, being well manured, was rich in bacteria.

The application of stronger antiseptics was at first advocated. Not only did these not prevent infection but the condition of the wounds and the general state of the patient were much worse where it was efficiently carried out, for the tissues and the natural processes of repair were impaired. At the end the practice followed was to wash the skin well with soap and water, to excise the damaged tissue, to apply weak flavine or eusol, and to drain. This was carried out as soon after the injury as possible. There was no question that many wounds that went septic in the early stages now healed by first intention. But the advance was really very slight. For at St. Bartholomew's Hospital before the War nine out of ten compound fractures healed in this way.¹

The practice was for the house-surgeon to take the patient into the operating theatre as soon as shock was overcome. Sterilised gloves and gowns would be worn, the skin would be shaved and washed with acetone and then painted with 2 per cent. iodine in spirit. The dirty skin edges and bits of torn muscle would be cut away; loose bone fragments would be removed; the whole would be washed with a solution of biniodine of mercury; sterilised gauze would be applied and splints would be fitted to the limb. The procedure differed very little from that practised at the end of the

¹ Sir Anthony Bowlby, *British Journal of Surgery*, vol. 3, 1915, p. 451.

War except that flavine and eusol were substituted for the salts of mercury. The improved results seen at the end of the War were really due to treatment being applied at an earlier stage and to the general condition of the patient receiving more attention.

There was no comparison between the efficiency of treatment in 1914 and in 1918. This was revealed by the mortality, the stay in hospital, and the subsequent disablement. The great improvement that took place was in my opinion due not to any new discovery but to the application to military surgery of certain principles which had been established in civil surgery and which were being practised in certain hospitals in 1914. Blood transfusion, it is true, was standardised and our knowledge of the causes of shock was increased. But the value of this was largely in its prevention; for the treatment of established shock is as difficult and as disappointing as ever. We were able to deal very effectively with diseases of past wars, which was shown by the success in preventing tetanus and typhoid fever. But we were unable to prevent diseases incidental to modern fighting conditions. Trench fever and nephritis were becoming epidemic and were playing havoc with the health of the troops, and the influenza epidemic of 1918 had appalling consequences.

Nervous breakdown, however, was the biggest menace towards the end of the War. There were two main types, the functional and the exhaustive. The former was most frequent in those who previously had shown signs of nervous instability. Such cases often reacted favourably to psycho-analysis and psycho-therapy. The latter occurred in some of the most reliable men. After a spell in the trenches soldiers often showed signs of exhaustion which passed off after a good night's sleep. When more severe, longer rest was required. If this was not forthcoming, the exhaustion passed on into ill-health that went on for years. The onset was first revealed by a gradual sapping of vitality and a falling off in endurance and in efficiency. But apart from a want of

tone in the muscles, a peculiar look about the eyes, and increased rapidity of pulse, nothing abnormal was to be detected. There was no instrument by which the state could be detected. Drugs did little good. If there was a reaction with a change of diet or of air, health returned. If this reaction did not take place, the ill-health became persistent.

Such cases corresponded to what was described in past years as neurasthenia. But this word, which literally means a *weakness of the nervous system*, has been so misused that for the time being it had better be abandoned ; the word asthenia, meaning weakness, here takes its place. The state of asthenia resembles the ill-health described on page 18, except that it arose in men who had previously been fit and who were often conspicuous for their energy. A battalion medical officer had an opportunity to see this type of ill-health develop. It was strange to watch men, who reacted at one time so quickly to the word of command, reach a stage in which their reaction to the ordinary routine of living seemed to be difficult ; and, though at first they reacted to rest, there came a time when even this failed to bring relief. There was a definite relation to worry, loss of sleep, and mental strain, and also to such states as influenza, trench fever, or pyrexia of unknown origin. The relation to mental strain and the fact that asthenia was more likely to arise where the central nervous system was highly developed has inclined me to the view that in the ill-health described on page 18 the nervous system is primarily at fault ; this is responsible for the failure of therapy to set up sufficient reaction.

CHAPTER II

WHAT IS LIFE ?

THE word physiology originally meant the lore of the *physis* and, as used by the Greeks, had a broad meaning, for it included reference to life, vitality, and energy. Physicians were then concerned because a man who seemed otherwise normal was not able to get that vitality of which he was in need ; and their aim was not merely to detect and to cure disease, but to restore to him the vitality he had lost. But in recent textbooks of physiology, few, if any, references are made to this aspect of medicine. Rather does it seem as if life and vitality are regarded as topics more suitable for philosophical and metaphysical discussion ; and consequently there is a danger of discussion about them ending up in a few abstract terms. As a result many come to look upon them as abstract conceptions. To overcome this no attempt is here made to take a broad conception of life, but rather to regard it as something that can be visualised. For this purpose four cases are first referred to.

Case A.—When I clerked for Sir Archibald Garrod in 1910 there was re-admitted to the wards a boy of 15 with symptoms of intestinal obstruction, who had been previously discharged with tuberculous peritonitis of the adhesive type. After a consultation with Sir Anthony Bowlby it was decided not to operate and just to give morphia to relieve symptoms. The vomiting, never violent, persisted for a time ; the eyes became dull and lustreless ; and he just wasted away. On admission he had talked of football and of home. But the cerebral functions gradually became slower and voluntary interest in such things as reading disappeared. There was, however, no change in personality. For when roused from his lethargy he would converse in his usual way. But later

he made no effort to talk, and pricking of the skin caused hardly any response. Finally the cerebral functions became so sluggish that even vomiting ceased. His breathing was shallow and the pulse rapid and weak ; and, though life was going on, it was of low degree. After this state had persisted for a few days my term of clerking then came to an end. But a few weeks later I was amazed to see him in the square smiling and full of vitality and on the way to restoration of health. The history was that one morning he passed flatus and later some fæces ; apparently the bowel above the obstruction had ulcerated into a part below. From then on improvement was rapid and marked. He started to take his food ; his muscles regained their tone ; and his interest in life increased.

Case B.—A few months previously, when I clerked for Dr. Ormerod, there was admitted to the ward a woman of 21 with what was at first believed to be lobar pneumonia, but which in the course of a few days turned out to be acute pneumonic phthisis. If ever consumption galloped it did in her case. In addition hers was the most remarkable case of *spes phthisica* I have seen ; for she had those brilliant shining eyes and that exuberance of spirit that are noted so often in this state. When about the twelfth day the bluish colour around her lips was pointed out to the clerks as a sign of impending death, we were amazed. For though it was obvious that she was acutely ill, she spoke of her wedding which was to have taken place the following week, and did not seem to anticipate any delay.¹ Yet on the following day she died. Almost up to the end there appeared to be no want of vitality ; she was so restless and talkative that it seemed as if her vitality was eating her up and as if this were in some way accelerating her death. But this vitality was only apparent ; for, though she appeared to be able to do all she wished, no sustained effort was possible. One could not help feeling that, if the patient could have relaxed and rested, she might have survived. Though the cardio-

¹ This active mental state is seen in acute streptococcal disease and at times in shock. With each of these there is, of course, severe asthenia. It is strange to see a patient who is obviously dying and yet who is desirous and capable of keeping up a perfectly rational conversation. The next stage to this is when delirium supervenes.

vascular system first gave out, the pulse, though rapid, was of good volume almost up to the end.

Case C.—In 1926 there was landed in Cardiff from a ship on its way to a foreign port, a gentleman, aged 86, with acute retention of urine secondary to enlargement of the prostate. Suprapubic cystoscopy was performed, but convalescence was delayed by a large burn over the thigh which took six months to heal. The blood-pressure was 130/80, the blood urea 45 mgms., and the urea concentration 2·7 per cent. But though the heart and lungs were normal, prostatectomy was not advised. No disease could be detected in any organ, but the vitality did not seem sufficient to stand the strain of a major operation. The healing of the burn had somehow sapped this up. In December 1928 he easily overcame an attack of influenzal pneumonia. Though the temperature became normal in three days and the signs in the lung quickly cleared up, convalescence was slow and the malaise was greater than was expected. Apart from a fall in blood-pressure 110/70, and a want of tone in the muscles, nothing abnormal could be detected. On the tenth day he complained of acute weakness which came on suddenly, for which no cause could be found. At first he took sufficient nourishment and the bowels were opened each day; but the asthenia was so profound that he was hardly able to move a limb or to keep the eyes open. The blood-pressure was unchanged; there was no increase in the pulse rate; and the amount and specific gravity of the urine were normal. He replied to questions, though it was obvious that he had much difficulty in concentrating. His only complaint up to the end was of this acute weakness, which he said was the most horrible thing he had experienced and which big doses of opium did not relieve. On the sixteenth day he died, and almost to within a few hours of death there was no change in the pulse or respiratory rate or in the secretion of urine. I have only seen one case of myasthenia gravis, and his state resembled this, if one could imagine it coming on very acutely. It was not possible to find an adequate cause for death. All that could be said was that the energy on which life depended in some way came to an end.

Case D.—J. J., a lady in whom I was much interested had been found to be suffering from arterio-sclerosis with a

probable aortic lesion at the time her breast was removed in 1913. After the operation her health was never quite the same. There were occasional attacks suggestive of cholecystitis ; but these were regarded as secondary to the ill-health and not as the cause. No operation was contemplated, for it was felt that her vitality was not sufficient to stand the strain. In August 1931, when 75 years of age, acute cholecystitis developed and expectant treatment was adopted and an abscess formed in the right hypochondrium. During this time the general condition remained surprisingly good and the heart gave rise to no anxiety. Evidently the resistance was greater than was anticipated. In the circumstances operation was advised. Cholecystostomy was indicated ; cholecystectomy was unfortunately performed and was naturally followed by much shock. She recovered from this, but the vitality was never restored and her resistance was definitely lowered, for infections such as arthritis of the spine, rheumatoid arthritis of the hands, neuritis of the shoulder, bronchitis, and colitis, from which she had never previously suffered, followed one another. An attack of influenzal pneumonia in October 1932 led to thrombosis of the femoral vein. Her condition deteriorated and by December 1932 the decline had definitely set in. She complained of great weakness and was hardly able to move a limb. The pulse became irregular and rapid for the first time since the operation ; all active therapy was stopped. Though for ten days she lay in the state betwixt life and death, mentally she was composed and clear. She quietly told me that the end, for which she was prepared, was in sight and spoke of the preparations that were to be made for the funeral. When told by her children, who were grown up, that they would like her to go on living, she merely replied that they had had her long enough and it was time they should be prepared to look after themselves. Obviously the desire to live had gone and there was nothing to do but to wait for the end. But at that time her young grandson, aged 5, said, " I am praying every night to Jesus for my Granny." The Rev. E. T. Jones, of Llanelly, who was on a visit, told her that it would be a wonderful thing for the child's faith if that prayer were answered. As I knew that it was her wish that one of her offspring would enter the Church, I quietly suggested that her recovery might lead to

this. Whether it was that the disease had run its course or whether a desire to answer the prayer of a child had some effect I do not know, but improvement now set in. The pulse became regular and her general condition improved and she lived for two years. If ever anyone came back from the dead, this was a case in point, though unfortunately there was never that recovery in vitality for which we had hoped. So often it seemed just to be returning only to be taken away.

When these four cases are reviewed, it is seen that in *A* there was a gradual poisoning from the toxæmia of all the systems and at the end only the centres serving the basal functions were active, these being maintained at a level just sufficient to preserve that vital spark we call life. Now, the stages passed through were similar to those seen when age brings life to an end and which were so well described by Sir James Paget.¹

“Now after a certain length of life, these changes accumulate into a very noticeable deterioration of all or nearly all parts of the body and they suffer a manifest loss of functional power. Thus changed, we say they are degenerates ; these accumulated changes are the signs of decay, the infirmities of age, the senile atrophy. They are the indication of defective formative power, and often speak more plainly of old age than do the years a man may have counted ; they testify that the power which prevailed over the waste of the body in childhood and youth, and maintained the balance in vigorous manhood, has now failed ; as the tide after a flood and a period rests, turns, and ebbs down.

“All the expressions usually employed about these changes imply that they are not regarded as the results of disease ; nor should they be ; they are, or may be, completely normal. For to degenerate and to die is as normal as to be developed and live ; the expansion of growth and the full strength of manhood are not more natural than the decay and feebleness of a timely old age ; not more natural, because not more in accordance with constant laws, as observed in ordinary conditions. As the development of the whole being, and of

¹ *Lectures on Surgical Pathology*, by Sir James Paget, p. 70 (Longmans, Green & Co., 1876).

every element of its tissues, is according to certain laws, so is the whole process regulated by which all that has life will, as of its own workings, cease to live. And as in healthy development and growth all parts concur in equivalent changes, so in all the natural decline of life do all parts change in equivalent degenerations, till all together cease to be capable of living. For it is natural to become feeble and infirm ; to wither and shrivel ; to have dry, dusky, wrinkled skin, and greasy, brittle bones, to have weak fatty hearts, blackened inelastic lungs, and dusky thin stomachs, and to have every function of life discharged feebly, and, as it were, wearily ; and then with powers gradually decreasing, to come to a time when all the functions of bodily life ceasing to be discharged, death, without pain or distress, ensues. But such a death as this is very rare ; no disease is rarer. I have seen only two or three such cases ; for it is very common for people to reach nearly the goal of natural life, and then by some accident, or through disease or advancing degeneration of a single organ, to fail to reach it. The definition of life that Bichat gave is in this view as untrue as it is illogical. Life is so far from being ' The sum of the functions that resist death,' that it is a constant part of the history of life that its exercise leads naturally to decay and through decay to death.

" Of the manner in which decay or degeneration of organisms ensues we know but little. Yet it could not be without interest to watch the changes of the body as life naturally ebbs ; changes by which all is undone that the formative process in development achieved ; by which all that was gathered from the inorganic world, impressed with life and fashioned to organic form, is restored to masses of dead matter."

This case of *A* was spectacular because of the rapid recovery ; for some days he was in a state where the soul seemed to hesitate whether or not to leave the body, and though some might say that life went on, others could equally well say that really he did not die.

With *B* the vitality was amazing up to the end. It seemed that the centres serving the basal functions were the first to give out, for the pulse was failing even when the

desire and the will to live seemed as active as ever. But, though an effort could be made, it could not be sustained. This case, among others, supports the view I hold that not only is there a centre for energy and centres serving the basal functions, but there are special centres serving psychical functions such as faith and hope and the will which can be stimulated by toxins even when those for energy and the basal functions are giving out and the patient is dying. In this way it is possible to account for the acute mental perception that is seen as death is taking place.

With C the only reason for not performing prostatectomy was that his vitality was not sufficiently great. Consequently it was of much interest to see which function would be the first to cease as life was coming to an end, for this was the organ that probably would have given out from the shock of the operation. The predominant symptom here was acute asthenia and the cardio-vascular system failed only at the end. May it have been that the centre for vital energy alone was picked out by the influenzal toxin and that those serving the basal functions were unaffected in the early stage, since they persisted almost unimpaired up to the end ? Dr. Samuel Gee said : ¹

“ People who are said to die of old age die nevertheless from failure of a particular organ, and not from universal decay. Still, it is sometimes difficult to say from what an old person is dying.”

By this I assume he meant that every man has a weak organ which in the long run lets him down and which in disease or as age progresses is the first to give out. This patient was a merchant whose constitution was hyposthenic, and it seemed that his energy had always been low. This suggests that the centre for energy was inherently weak. In the circumstances would it not be more likely to be picked out in toxæmia ?

D was of interest because, though the severe asthenia suggested the centre for vital energy was giving out, and the

¹ *Medical Lectures and Clinical Aphorisms*, 1915, p. 303.

irregularity of the pulse those serving the basal functions, mentally she was quite composed and talked quite rationally. When younger she had been a woman of great ability with a fine brain, which was not perhaps evident to those outside the family circle, since she preferred to devote herself to motherhood. But she was a woman who had great faith in her religion, to whom "to die is but to live"; and, when weakness came on, feeling that she had come to the end of the road, she was quite content to pass on. When it was pointed out to her that her living might have great influence on the faith of a little child, no doubt she decided to make a fresh effort. It is well known clinically that, when there is a desire to live and there is also the will, it is well worth making an effort up to the end, for a result may always be forthcoming. And when there is no desire to live, life just passes out, no matter what is done.

Life may be regarded from three points of view :

(i) That it is just a blind force resulting from the agglomeration of all the functions of the body and is not centred in one special organ.

(ii) That somewhere in the basal ganglia is a centre for life that represents the Ego. When this has run its course, life comes to an end.

(iii) That the functions of all the vital organs are devoted to the maintenance of the centre of vital energy situated in the basal ganglia. This is a return to the doctrine of vitalism that was in force a hundred years or so ago. The energy from this centre helps to maintain other centres. Those controlling the cardiac, respiratory, and vasomotor functions are demonstrable in experimental physiology ; so are those for the arm and leg. My clinical experience leads me to believe that there are also centres for faith, hope, and the will.

Is there a Centre for Life ?

The belief, that life is just evidence of the activity of a special centre and that life comes to an end when this

has run its course, has at all times appealed to man. The activity of this centre is dependent upon the function of certain organs known as vital organs being maintained. Should one of these fail, the centre ceases to function and life comes to an end. This, of course, follows if the centre itself is destroyed.¹

At one time this centre of life was supposed to be in the liver, the surface of which was thought to bear some relationship to the constitution, and consequently was believed to vary with the position of the planets and stars. This gave rise to the science of hepatoscopy which claimed that the examination of the liver during or after life would reveal the life-history of the individual. The Egyptians believed that the centre was placed in the heart. The function of the brain was regarded as of less importance, for, being cold and bloodless, it was supposed just to cool the vapour from the heart. The Greeks thought the centre was in the diaphragm, as it heaved during periods of emotion. From this came the word "frenzy." The Jews believed the centre was in the intestine. In the time of Descartes the centre was supposed to lie in the pineal gland, which was regarded as a third eye. But not infrequently in later years life came to be confused with the emotions, the soul, and the mind, and these terms came to be used as if they were interchangeable. As a result, certain states associated with living were confused with life. Anger and envy were supposed to have their seat in the spleen, and love was placed by Shakespeare in the liver. But after the discovery by Harvey of the circulation of the blood, the heart again came to be regarded as the centre of life. With the rise of experimental physiology the removal of various organs was possible and the functions they served could be better defined. It was then realised that whilst the function of certain vital organs

¹ The pituitary gland is supposed to be the seat of the sixth sense with the power to comprehend thought.

The pineal gland is supposed to be the seat of some seventh sense that is found only in the higher races.

was essential to the maintenance of life, life nevertheless is not centred in them ; for it still goes on if the organ is removed and its function is artificially maintained. As centres controlling certain functions came to be localised in the cerebral cortex, importance was attached to this. For, when certain areas are destroyed, certain functions disappear and sometimes life comes to an end. But large parts of the brain can be removed in man without any apparent ill-effect or any change in the personality. And in animals life can go on after both cerebral hemispheres have been removed. So, obviously, if there is a centre of life, it is not situated in the cortex. When the medulla oblongata is destroyed, life comes to an end ; but this is because certain centres controlling vital functions such as those of respiration and the blood-pressure are situated therein. If these are artificially maintained, life still goes on. We now have much knowledge of the functions served by the endocrine glands. But, when they are removed, life does not immediately cease. It is true that there is a change in the personality and in the state of health ; but these can be restored if preparations of the gland prepared from animals are administered. Though the modern tendency is to look upon life as an agglomeration of the various functions of the body and to regard the constitution and personality as things of chance, some men believe that there is such a thing as a centre for life, and when this centre has run its course life ceases. My own impression is that this centre is situated in the ganglia at the base of the brain, and towards its maintenance all the functions of the organs of the body are directed. Upon its nature depends the type of constitution and upon its efficiency depends the state of health. Little evidence is available to support such a theory and it must be regarded for the time being as mere conjecture. But the whole subject is in a state of confusion, for to-day many use the words life, personality, temperament, constitution, and soul with no exact meaning.

In the mining village where I was brought up, some boys

took much interest in the slaughter of animals. The stamina of pigs and the ease with which a bullock could be felled were matters for comment. The test for stamina was the length of time a pig lived after the throat was cut ; and the prowess of the slaughterman depended not merely upon his being able to fell the bullock with a single blow, but upon whether from the moment it was struck the animal ceased to breathe. With the expert death was instantaneous. In my physiological days I used to wonder whether there was not some special centre at the base of the brain that was concussed by *contre-coup*.

Though in the early days of the War fit men were chosen as recruits, they looked rather weedy after getting into uniform and taking their places by the side of regular troops. But by the spring of 1915 there was great improvement in their bearing and physique. Later in the year, at Anzac, where the dead lay so thick in front of our lines, I could not help comparing the slowness with which stamina had been gained with the ease with which life could be taken away. The former had come about by human endeavour and discipline ; the latter was brought to an end just by a piece of lead. Right through the fighting it was surprising to note the extensive injuries with which life could go on and the small injury which led to instantaneous death. For instance, one man had part of the skull shot away and, though the meninges were exposed, the brain was not injured. No one had seen him unconscious and he walked into my dressing-station. He was quite rational ; and, as he came from my mining valley, we had a chat about things of home and what he intended to do on his return. Though there was no apparent change when he left my dressing-station, I was aware that inflammation of the meninges was certain to arise and be followed by restlessness, delirium, and coma, and that eventually he would die. Another man in my regiment had the left side of the chest blown away by a shell as he stood outside the dressing-station. He quietly said, " I am afraid I am done for now, sir," then closed his eyes and died from

shock. It was so strange to watch that heart gradually cease to beat ; for, though a surgeon has many opportunities to note the state of the circulation from an examination of the pulse, rarely has he an opportunity to observe the heart. Another man had the front of the abdomen blown away by a shell and the intestine badly lacerated. No operation was possible, and it was not worth sending him down the line. Morphia was given to relieve the pain. It was surprising to note how slow the act of dying could be and what large doses of the drug were needed. On the other hand, when the bullet passed in the region of the base of the brain, death was instantaneous. Breathing ceased immediately and the man dropped with a dull thud, after which there was not the slightest movement. This thud was the strangest thing I can recall. This instantaneous death was certain to follow, and did not seem to be of the nature of a reflex. But damage to important centres such as the vasomotor, respiratory, and vagal that control vital functions could not be excluded. In civil practice I can recall one necropsy when death was stated to have occurred instantaneously at the time of an accident in which the basal ganglia were damaged and the important centres referred to were not touched. But notes of this case are unfortunately not available. It is my impression that the centre for life is situated in this region.

Is there a Centre for Vital Energy ?

Not one of the theories put forward for the onset of concussion after a blow on the head offers a satisfactory explanation. It can hardly be due to commotion of the brain as a whole or the shutting off of the blood supply ; for, when the skull is opened under local anæsthesia, palpation of the brain need not necessarily lead to unconsciousness, though the commotion and anæmia must be greater than after many injuries leading to severe concussion. When standing by the side of the boxing-ring and seeing a man knocked out, I have at times wondered whether this might not be due to

trauma to a centre controlling energy at the base of the brain. Physiology has shown that injury to a nerve may lead to temporary cessation of function. A young surgeon was operating upon an un-united fracture of the lower end of the humerus in the presence of Sir Robert Jones, and in his excitement caught hold of the musculo-spiral nerve with forceps. Sir Robert quietly said, "I have seen no more than that lead to paralysis." From that one trauma there was wrist drop that lasted six weeks. If loss of power can follow so slight an injury to a peripheral nerve, it can take place equally well if some cerebral centre is traumatised. Now, when a punch takes effect at boxing, the boxer may go down for a few seconds, or he may not be able to get both knees off the ground within ten seconds, in which case he is said to be knocked out. Though if the punch is severe consciousness may be lost and a condition resembling concussion is present, yet at times he may be conscious and may be aware of all that is going on. Though he hears the counting he may not have the power to rise or even to make a single movement. At such a time it is a curious sensation to be conscious and not to have sufficient energy to make a movement. One of the most perfect punches ever seen was that with which Carpentier knocked out Beckett at the Holborn Stadium after the War. Here the man, who was representing the British Empire in its heaviest class, left his corner mentally and physically fit with all his faculties alert. Yet, in a few seconds, as a result of a single punch on the jaw he became an inert mass on the floor with not sufficient energy to make a movement, and for a moment it seemed as if he were dead. There was at least one who asked himself this question : What has happened to the energy that was Beckett ? For the strongest man in the British Empire, whose stamina and energy were just a moment before the admiration of all, had suddenly become inert. He had now no energy and could adapt himself to nothing.

Now, it is not a mere blow on the skull that does this, for as heavy a blow may be given on the thin temporal region

without the slightest effect. For the punch to be effective, the following are essential :

1. The blow must be landed suddenly either to one side of the chin, when it is directed upwards, or just in front of the angle of the jaw, when it is directed a little downwards.

2. The muscles of the jaw must be relaxed. If the teeth can be clenched in time, the chances are the knock-out will not take place.

3. The blow must be landed sharply. Though, of course, the full force is usually put behind the blow to make more certain, if given properly a quick jab is quite sufficient. It is more effective if a slight screw is given as the fist strikes the jaw.

4. Towards the end of a round, when exhaustion is evident, less force is needed for the punch.

The whole object appears to be to direct trauma suddenly to the part of the brain overlying the supra-condylar fossa. Is it that in this region there is a centre for energy which receives the full force of the blow and a condition similar to physiological shock follows ? In this way only is it possible to account for the sudden disappearance of the energy and its quick return. Though when the knock-out is severe a condition similar to concussion may arise, my experience leads me to think that in general the knock-out in boxing is quite different from the concussion that results from a heavy tackle at rugby. With concussion there is so often loss of memory, headache, nausea, and a dazed feeling that lasts for some time. But the knock-out in boxing generally leaves no after-effects even if consciousness is lost for a few minutes. A man feels a bit of a fool for being caught off his guard and at times a certain amount of shamming goes on ; but generally the after-effects are very slight and it is possible to pick up a book and read straightaway.

A certain amount of support for this centre of vital energy at the base of the brain is forthcoming from experiments on animals. But to establish its presence with certainty it would be necessary to prove that puncture of this region is

invariably followed by complete loss of energy and yet for a time consciousness would be retained and the basal functions such as those of respiration and of the heart would continue. I have never tried to verify this, for, since so many of my friends fell on those bloody slopes at Anzac, I have never been able to pass a slaughterhouse without a shudder, much less to wander into one. Since those days I prefer not to experiment on animals.

Were the presence of such a centre established, damage to it could account for the prostration that is seen with shock and influenza. A surgeon tells me that after an operation he once experienced great shock that came on suddenly when he was unattended. Though his mental perception was acute and he was aware of all that was going on, there was complete loss of energy and he could not call out nor lift a hand to press a bell. It was almost an hour before either was possible. He now assumes that for some reason the centre for energy suddenly gave out. On another occasion he had felt very fit on going to bed. The following morning he awoke with severe prostration. Though mental perception was acute, he had not the strength to get out of bed and had to wait for assistance until someone came into the room. It was the onset of severe influenza. Is it not possible that just as the toxin of acute anterior poliomyelitis picks out the motor cells and leads to sudden paralysis, so may the toxin of influenza pick out the centre for energy and lead to prostration ?

The cases of gunshot wounds of the spine with the cord divided seemed to me the most tragic of all tragic cases of the War. For, if the man recovered, he would carry about with him for the rest of life organs of no use to him which still had to be nourished. Organs that drew their nerve supply from above the lesion had vitality, tonus, and a good resistance to infection. Those below had no apparent vitality, no tonus, and a poor resistance to infection ; and though they went on living, they could not respond in any way. Ulceration was not uncommon, but rarely did gangrene

follow and less rarely did they die. The only difference between the two sets of organs was that the former were able to obtain their energy from the main centres and the latter were deprived of this. Since those days the importance of this energy has always made a great appeal to me. It is my belief that whilst each organ has its own nerve centre there is also a centre of energy in the basal ganglia of the brain. The function of this is to distribute energy to the other nerve cells and centres as a result of which vitality, tonus, and resistance to infection can be sustained. Such a view conforms to that put forward by Erasistratus.¹ He observed that every organ is equipped with a threefold system of "vessels," vein, artery, and nerve. Blood and two kinds of pneuma are the essential sources of nourishment and movement. Air is taken in by the lungs and passed to the heart where it becomes changed into a peculiar pneuma, the *Vital Spirit*, which is sent to the various parts of the body by the arteries. This spirit is carried to the brain, in the cavities or "ventricles" of which it is further changed to a second kind of pneuma, the *Animal Spirit*, which is conveyed to different parts of the body by the nerves, which are hollow. He considered that the cerebral ventricles were filled with *Animal Spirit*. And the term vital energy as used in this book conforms in some way to Animal Spirit as used by Erasistratus and his followers, and vitality to the display of its activity.

The central representative of both the sympathetic and the parasympathetic is in the hypothalamus in close proximity to the pituitary gland, which is believed to exert a controlling influence over the other endocrine glands. There is believed to be a connection between the hypothalamus and the posterior lobe of the pituitary, the secretion of which has access to the nuclei of the sympathetic and parasympathetic systems in the adjacent hypothalamus. It may be said that I am merely transferring to the centre of energy functions that really belong to the sympathetic and para-

¹ *A Short History of Medicine*, by Charles Singer, 1928, p. 38.

sympathetic systems and which have been demonstrated in experimental physiology. A study of modern literature would give much support to this, for the functions attributed to these two systems are legion. Yet were this the case division of the sympathetic or parasympathetic should be followed by loss of such function in the organ or limb supplied. This axiom forms the basis of experimental physiology. For take a mixed cerebro-spinal nerve with motor, sensory, and trophic fibres: its division is certain to be followed by loss of power and wasting in the muscles, loss of sensation, and by trophic changes in the area supplied. Were these not to follow, our knowledge would have to be revised. In the case of the surgery of the sympathetic the amazing feature is the extensive resection that is possible with little if any impairment of function of the organ or of the limb it supplies. When, for instance, removal of the lumbar or cervical sympathetic is performed in certain pathological states, it is claimed that the function that ensues falls little short of that regarded as normal. In the circumstances it is not surprising that not a few are beginning to wonder what function is really carried out by the sympathetic and parasympathetic systems.

No attempt is made in this book to consider life in its real broad conception. For the time being I am assuming that accurate knowledge of life and vitality is beyond the ken and intellect of man; for the manifestations are legion. A short time back I was having a chat at Usk with my friends, Mr. Lionel Sweet and Mr. Harry Powell, and as was but natural our talk was upon fishing and life in the river. The life-history of the sedge fly cropped up, and they told me how a few years before the trout at Usk were rising to this fly in its natural state yet refused it on the line. No explanation was forthcoming until someone noted the flickering movement made by the fly upon the water. When this movement was transmitted to the artificial fly, the fish took it well. This one observation on life, small as it may seem, needed much thought and

careful watching through high-magnifying field-glasses by men who were great experts. Our talk went on to life in nature in general. It was obvious that many observations had been made which had been confirmed on several occasions and there was little doubt as to their accuracy. Yet none seemed certain as to what purpose they served and few of the theories put forward held good for more than a few years. For instance, certain facts about the life-history of the salmon and the migration of birds have been established, but no one knows for certain why such a course has to be run. To regard it as a phenomenon of evolution is merely to cloak ignorance in words. We agreed that in our views on life and on nature we have really not advanced much from the days of White of Selborne. As the evening wore on the divergence in our outlook was obvious. For they were regarding life with that large aspect that comes to men who know nature and who love the river. Whereas I was regarding it rather from the point of view of vitality or the driving force in life.

Just about that time I had been called out in consultation to a small country town to see a case of cancer of the bladder in which it was advisable not to operate; the kindest thing was just to give big doses of morphia. The practitioner agreed with this and quietly told me that he himself had cancer, and had decided to have nothing done and to fall back on morphia as the symptoms became severe. The situation was one of interest, for he was over 70 and seemed quite prepared to meet his end, for which he rather longed as lately he had begun to feel weary. As he was a man of learning, I put to him the following question: "As your career has been full of interest you must have learnt much about mankind. You have brought many children into the world; you have seen them pass through life; you have no doubt stood by some whilst life left the body. As your end is now in sight, would you tell me what views you have formed of life?" His reply was as follows: "Since I started in medicine great advances have been made in our power to diagnose, in which

we have become very precise. But in comparison with this, advances in therapy have been so slight. As for vitality and life, they are the great mysteries. I seem to know less about them now than when starting on my work. I have come to have great respect for the so-called common folk and as a result to have great belief in the inherent goodness of mankind. On the other hand, men can be extremely weak when facing small temptations and can be extremely petty when anything small is at stake. So far as pain and suffering are concerned, I feel quite certain that generally they are not connected with evil thinking or evil living. Rather do they come like a thief in the night and seem most inconsiderate in their choice.¹ The general purpose they serve is at first

¹ Nowadays one not infrequently hears those who are ill complain miserably of their fate. They want to know why they are afflicted and think they are being unfairly treated by the gods. This is particularly the case if previously they have had good health. They fail to realise how fortunate has been their lot in past years. For, though good health is the prerogative of man, sickness and suffering have been with him since time began, and will no doubt be with him to the end of his days. Were these people to visit hospitals or the homes of the sick poor they would complain much less.

My observations lead me definitely to believe that disease and suffering exercise no discrimination in those whom they pick out. So often no adequate cause can be found. I cannot help feeling that on the whole they are for good, since so often they bring out the best in man. These two cases recently came my way: A, aged 78, was seen in consultation with Dr. Churcher, of Rumney. He had an enlarged prostate with incipient uræmia. Owing to the condition of the heart no operation was advisable. The son told me that this was the advice he had already had, but he wished to make certain that nothing medicine could do was being withheld from his father. He then wished to know how long his father was likely to live, as he had to make certain arrangements. For in the next room a sister was dying from tuberculosis after suffering for eight years; and his wife was at death's door in a mental home. Yet he was prepared to pay a fee to make certain that everything possible was being done. Dr. Churcher then told me that a few months previously someone had died from cancer, and illness never left that house. If ever there was a house of tragedy, it was this. Yet there was not one word of complaint, not one grumble about luck being out, not one word of reproach about the little our profession could do. Even unto the end there was faith. From there I went to see a case of hæmaturia with Dr. R. V. Richards, of Newport, in a woman aged 70. Cystoscopy showed inoperable cancer of the bladder. Dr. Richards then told me how this woman had laboured for years to keep the

doubtful. Yet suffering often displays so much courage in the patient and serves to reveal so much nobility in those to whom he looks for help. It is quite wrong to think of pain and suffering as being merely evil, for when they are well borne they often serve to stir up in others genuine sympathy which when freed from emotion is extremely fine." This was no doubt his philosophy of life, and, coming from a quiet man who thought for himself, appealed very much to me. But such an outlook on life was not being contemplated by me until he opened it up by his remarks. This conversation, however, served to reveal to me how great can be the conception of life of one who works by the bedside.

Though life and vitality are really such vast subjects that they lie beyond the comprehension of mortal man, this is no reason why an attempt should not be made to deal with certain of the problems they present. Many of the views put forward in this and subsequent chapters are hardly scientific, nor are they sufficiently learned or deep in thought to be regarded as philosophical. Rather they should be looked at in the light of the practitioner who is trying to seek some clue to the problem he is daily called upon to face at

home going. One son had general paralysis of the insane and had improved sufficiently from modern therapy to be sent home to make himself a nuisance. Another had been wounded in the War, and after several operations had been sent home to waste away the rest of life. I could not help feeling from the size of the house that this family had made a great effort to get together my fee; and all that they had was advice they would have preferred not to have heard. I broke the news quietly to the husband and daughter, worthy of such a mother. Though she was going to suffer, for the time being their suffering was intense. They thanked me with a quiet dignity that one sees in the homes of the poor. There was an absence of emotion: just the sob that revealed the broken heart. Here was a British mother of whom the race should be proud, who had worked her knuckles to the bone. Yet she was going to die from a disease that was going to make living worse than hell. Yet people still say that disease is really the result of evil thinking and evil living. But such talk can come only from the absence of a want of experience of life. Such suffering serves at any rate one purpose. The man who views it is never the same again, if he has not lost his soul. For he leaves there determined that elsewhere he will do all he can to help mankind. Such impulses do tend to maintain the standard of work.

the bedside. For again and again he will wonder as to what constitutes the difference between those who have health and those to whom it is denied, yet who spend so much thought and time in its cultivation and search. Were he but able to grasp what this is, he might be able to make the living of life worth while to those who look to him for help, so often in vain. Such a one takes little interest in prolonging life where want of vitality makes living not worth while. He would, however, give much were he but able to bring some joy in living to those whose course has yet to be run.

CHAPTER III

THE REACTION OF THE TISSUES IN DISEASE

THE reaction of the tissues is probably seen in its simplest form when a wound heals by first intention, which represents a form of aseptic inflammation. Union occurs only if granulation tissue that is formed is converted into fibrous tissue. Each stage in the process of repair represents a reaction on the part of the tissues of the patient which is dependent upon the vital power they possess.

A similar reaction is seen in disease and is an attempt to localise and to overcome some harmful influence. As part of a diseased process really represents the resistance put up by the patient, the practitioner when investigating disease should ask himself the following questions :

1. How much of the reaction is advantageous to the host in that it helps him to overcome some harmful influence.
2. How much is disadvantageous in that it is set up by this harmful influence to form a soil suitable for its extension?

This theory is here illustrated by reference to inflammation, tuberculosis, syphilis, and cancer.

Inflammation due to Bacteria

Once bacteria were recognised as the cause of disease, all manifestations of this came to be regarded as harmful. Consequently, when a man has urethritis and gonococci are detected, the appearance of the discharge is regarded as a disaster. Nothing is more fallacious. The disaster was coitus a few days previously when gonococci were deposited on the urethral mucus membrane. Animal experiments show that bacteria are found in internal organs such as the kidney soon after they are deposited upon the urethral mucus membrane. Entry into the blood and internal organs

seems the ultimate object of the gonococci, if they are unimpeded in their activity ; for, when a patient has little resistance and is most ill with the disease, the organisms may be found in the blood and joints. The urethral discharge is evidence of a local inflammation, the object being to prevent invasion of the blood ; the inflammatory reaction means that the patient has sufficient powers of resistance, and the infection is becoming localised.

We are now beginning to realise that disastrous as an inflammation may appear to be, some of the factors that are regarded as harmful are really an asset in that they help to limit the spread of the bacteria and to overcome their activity. For congestion, stasis, the exudation of serous fluid, the exudation of plastic fluid, and the formation of pus and of granulation and fibrous tissue serve a definite purpose. They are harmful only if present in excessive amounts or if they persist unduly long. All are part of the reaction of the tissues in their effort to deal with bacteria, for an inflammation may be overcome just by congestion. If this fails, the tissue becomes infiltrated with serum, and leucocytes, granulation, and fibrous tissues are formed in the surrounding parts, the object in the stage of progress being to limit the disease. Or the disease may go on to ripening when pus appears and the inflammation comes to a head. The inflammatory products are now discharged or absorbed and the area is replaced first by granulation tissue and then by fibrous tissue, the object in the stage of decline being to heal the lesion. Congestion, granulation tissue, fibrous tissue, and pus serve a different purpose as the disease progresses and as it clears up.

During 1917-1918 the mortality in the American Army for the operative treatment of empyema was on the average 30 per cent., and in one camp reached 70 per cent. Such results were attributed to the sudden rush of air into the pleural cavity which, owing to the collapse of the lung and the displacement of the heart, threw a great strain upon the circulation. To prevent this, aspiration was recommended

until frank pus was present and adhesions had formed. During this time the general condition of the patient improved. Though many of the cases were due to streptococcal infection, the mortality was soon lowered to 5 per cent. Though an incision to drain the pleura might be necessary later, there was less shock and the wounds healed more rapidly ; and complications such as pericarditis, involvement of the other lung, and septicæmia were less common. This is the procedure that is now practised in civil surgery. But to allow pus to remain in the tissues cuts right across the surgical teaching of the beginning of this century, when it was taught that inflammation, being a most harmful thing, the aim of the surgeon was to let out the inflammatory products at the earliest stage. To leave pus was criminal, for this was regarded as putrid by Lord Lister. If it were allowed to remain, not only was it liable to track, but it was likely to lead to septicæmia. Now that we realise that the incision to let out pus can be more dangerous than pus itself, we are at times surprised to find how well the tissue can tolerate pus and how fit the patient remains when it is present. Thick laudable pus in gonorrhea is a favourable sign, for it denotes a good resistance. In the long run such a case does extremely well. Again, a stricture is not harmful if it is not allowed to progress and is treated before secondary changes arise in the urinary tract. In my experience the development of a stricture is a favourable sign so far as the cure of gonorrhea is concerned ; it is just evidence of an excessive reaction. The most difficult cases to cure are those where the discharge is muco-purulent from the start. Here the reaction is not sufficient. Though a stricture rarely forms there is a great danger of the disease becoming chronic.

Tuberculosis

Normally the tissues have great resistance to tubercle bacilli, which are so widespread in civilised communities that most children are infected at the age of 5. If, however, resistance is perfect, the bacilli are destroyed by the body

fluids and the children are said to have natural immunity. Though in others a tuberculous lesion develops, in only a minority does this give rise to active disease or ill-health. In the majority the lesion becomes fibrosed, or caseation takes place and calcification follows. Such lesions should be regarded as healed.

As life goes on this resistance may break down. If virulent bacilli now enter the blood-stream from some focus in the body or from some outside source, they live and grow and tuberculous septicæmia or acute miliary tuberculosis may arise. The onset of local disease should be regarded as an attempt on the part of the body to prevent the development of either of these. It is not known why a particular organ should be picked out ; the phrase *locus minoris resistentiæ* explains nothing. The miliary tubercle should be regarded as the primary lesion resulting from the activity of bacilli and the resistance of the tissues. The tuberculous nodule, an agglomeration of tubercles, means that the progress of the disease is being resisted locally, for a nodule is not formed in acute miliary tuberculosis. If the nodule is composed of fibrous tissue, the resistance is good, the disease is being controlled, and a cure may follow ; if composed of caseous matter, the outlook is not so good ; if composed of pus, the resistance is low and the disease is extending. But even pus is less serious to the patient than the rapid miliary spread of disease or extensive infiltration. In addition, pus undoubtedly serves some purpose in building up resistance ; for, if pus is not evacuated and the patient is treated efficiently by rest, it may be absorbed, and the end-result is often better than when none is formed. Whilst the disease is being localised, certain products of bacterial activity which stimulate the antibacterial powers of the tissues generally are absorbed. As a result the resistance factor is restored, the tissues can deal with bacteria that enter, and the disease becomes quiescent. The fibrous tissue, the caseation and calcification, and the formation of pus, whilst evidence of the extent of the disease, are equally an indication of resistance.

In tuberculosis more probably than in any other disease does it become manifest that pathological changes that are so valuable at one stage may be harmful at a later. For instance, fibrous tissue, that is so important in localising the lesion during the stage of progress, may by becoming adherent to surrounding structures prevent a cavity from collapsing and, should a secondary infection develop, the cavity will cause this to persist and may be the only obstacle to restoration of health. This was well seen in the case of the lung before pneumothorax and similar operations were performed.

Syphilis

The appearance of the chancre shows that a patient has syphilis. The chancre is therefore regarded as a disaster, but it is really the inflammatory reaction of the tissue in its effort to localise and to overcome infection with the spirochæte that took place during coitus some weeks before. If this reaction did not take place the spirochæte would enter the blood-stream and lead to septicæmia. The hardness is due to fibrosis and is evidence of good resistance. Hutchinson and other syphilologists had no doubt that a definite chancre might never be followed by secondary or tertiary lesions ; this was more noticeable if phagadæna had developed in the sore. Subsequent investigations have shown that in such cases it is rare for the Wassermann to become positive. So that it seems that if a sufficiently great reaction is set up, the spirochætes may be destroyed. But the early routine treatment now carried out gives no opportunity to observe the natural course of syphilis uninfluenced by therapy. In my experience, however, tabes, G.P.I., or cardio-vascular lesions rarely follow the hard chancres, particularly if this caused much destruction of tissue. This again suggests that an extensive local reaction leads to a cure.

Some hold that secondary eruptions and gummata merely denote the curative effort of nature and that, if they are allowed to run their course, other sequelæ are less common.

Cæsar Boeck, of Christiania, believed that all stages of syphilis served some purpose in building up the resistance. Mercury he regarded as a "devilish remedy," and like potassium iodide, was injurious; for not only did it fail to eradicate the disease, but forced it into unnatural channels and provoked G.P.I. and tabes. Consequently he considered it unwise to carry out treatment and advocated "syphilisation" by allowing the disease to run its natural course. Recent investigations of his cases suggests that the end-results are almost as good as those seen with active treatment.¹ Such a view is no doubt extreme, yet when gummata of the skin or superficial organs develop, G.P.I., tabes, and cardio-vascular syphilis are less common. Here, again, it seems as if the lesion serves some purpose in building up resistance. But the risk to others in the primary and secondary stages is too great to allow syphilis to remain untreated for any length of time. However, my impression is that the cases that do best and that show little tendency to recur at a later date are hard chancres that have been present for a couple of weeks before treatment is instituted, or gummata that have existed untreated for some time. When salvarsan is given in such cases the lesions clear up straight away and recurrences are exceedingly rare.

Cancer

When cancer starts in an organ, its presence is shown by the activity of the epithelial cells; the more actively they divide, the more highly malignant is the growth. But immediately the cells divide a reaction occurs in the tissues, resulting in the formation of fibrous tissue, the object of this being to limit the spread of the cancer and to kill the cells. Later a palpable nodule is formed and the cancer is appreciable clinically. The rate at which cancer grows and extends into the surrounding tissue is dependent upon the amount of fibrous tissue that is produced, which is shown clinically by the hardness of the tumour; the harder the tumour the

E. Bruusgaard, epitome *British Medical Journal*, February 2nd, 1929.

slower will be its growth. Even when cancer has extended beyond the primary seat and has involved the glands, this fibrosis continues.

When pondering over the subject of cancer, I keep in mind three cases. Two of these were lying side by side in the post-mortem room in 1913. One was a young woman, aged 32, who had had the breast removed for very early cancer and yet had died of general metastases within three months. At the time it was assumed that the operation had led to general dissemination ; but there was no question of this, for the surgeon was one of the most careful and skilful I have known. Probably the patient had no resistance, and general dissemination in the viscera was present almost from the start. The other was a woman of 75 who had cancer of the breast that had been diagnosed as such by Sir Henry Butlin thirty years before. The growth was limited to the breast ; there were no metastases in the glands or the internal viscera, death being due to senile changes. The third case was a man, aged 35, whom I operated upon years ago for cancer of the bladder. The growth was on the base and inoperable ; a small portion was removed and the diagnosis was confirmed microscopically. The wound in the bladder was allowed to heal. Nine months later the symptoms cleared up and cystoscopy showed no growth. The patient was well two years later. The case appeared so singular that I thought of publishing an account. But recoveries from cancer without operation were often referred to in the literature at the beginning of this century. Nowadays they are put down to radium or to X-rays. The last two cases serve to show that there is a natural resistance to cancer, which may be sufficient to prevent extension ; as a result the growth remains stationary or is overcome and a cure follows.

Three types of cancer are recognisable clinically :

(a) *The acute fulminating type* that resembles acute inflammation in onset and spreads and leads to death in a few months. Here the local resistance is very poor.

(b) *The disseminating type*, where, though the primary

growth is small, general metastases are present almost from the start. Here there is no general resistance to cancer. It is most commonly seen in encapsuled organs such as the kidney, thyroid, and prostate.

(c) *The scirrhus type*, where the growth remains localised for long, and dissemination to the glands and to the viscera occurs late.

We do not know why marked fibrosis occurs in one patient and so little in another. It is more marked after 45 and in those who are thin, who have poor health, or who have arteriosclerosis. In young people, in those who are fat, in those who have robust health, and in those with a high blood-pressure, cancer is apt to grow rapidly and to disseminate into the internal organs. It is rather in the old that nodules are found to disappear, though the disease is elsewhere advancing. Fibrosis is to some extent dependent upon the organ in which the growth is found. In cancer of the tongue fibrosis is not marked, whilst in the breast the scirrhus type of growth is common. In the prostate the presence of cancer is apt to lead to marked fibrosis. In organs that are encapsuled cancer tends to remain localised for a long time, provided that at no spot does it penetrate the capsule, in which case the tumour may remain stationary for years and the growth appears to become quiescent. This is shown by the following case.

J. B., aged 57, was sent to me in 1927 by Dr. Loudon for slight difficulty that had been present for three years. There was no general enlargement of the prostate, but induration was present in the right lobe. Later it extended throughout the whole prostate, which became fixed. He died in 1934. For the four preceding years he had noticed a swelling in the abdomen, which was the distended bladder and which he was able to empty by applying slight pressure with the hand. This was a strange case, for this man had a cancer of the prostate which was diagnosed clinically seven years before and dated back ten years, if the onset of bladder symptoms were regarded as its commencement. It grew slowly and steadily but no aggravation in the symptoms took place until

the last few months, when slight nocturnal incontinence came on. He felt quite well and was able to carry on work almost up to the end. There was no wasting nor was there a single symptom of uræmia, until catheterisation was necessary during the last two months.

In such a case all that can be said is that growth was slow because resistance to the disease that was leading to death was good.

The Nature of the Reaction

Healing is a vital process that is seen in all living tissues. So is the power to react to disease. Paget wrote : ¹

“ The power to repair belongs to the subject of injury in the same sense and degree as does the power to develop and grow and live. The wonder of repair is that this indwelling power is, by the injury or disease, diverted from its usual method into another : though determined by an ‘ accident ’ this is as purposive and well-designed as is any process of habitual life.”

The power to heal seems to be inherent in life being one of the last functions to disappear. It goes on so long as life exists and ceases only when life comes to an end. Though a patient is dying, a wound may still go on healing. The power to heal is essentially basal, and goes on in a tissue deprived of its nerve supply.

Reaction to disease is merely an attempt to heal, being the effort of nature to produce a cure. It also goes on so long as there is life. It is strange to watch a cancerous nodule disappearing, while the patient is being killed by changes in the body due to the extension of cancer elsewhere. The bearing of vitality upon the reaction is obvious in inflammation : for this cannot arise in dead tissue and only to a certain extent in tissue whose vital power is impaired.

On what does the Reaction Depend

Once bacteria came to be recognised as the cause of disease, research was concentrated on attempting to link up the type of inflammation with the variety of bacteria ; as a

¹ *Lectures on Surgical Pathology*, p. 175.

result the manifestation of disease became attributed to their activity. This view received much support from clinical observations, for the lesions produced by the tubercle bacillus, the bacillus of leprosy, the gonococcus, etc., differed materially from one another and a diagnosis was often possible from the clinical examination alone. When, however, the lesion due to a single organism was examined in a series of patients, marked differences were to be detected. This could hardly be due to changes in the organism ; for when cultures were made, these conformed to type provided the medium remained the same. Yet changes in the latter materially affected the growth. This can be illustrated by a reference to organisms of the coli-typhoid group. With McConkey's medium the bacillus coli gives rise to red colonies whilst the medium does not change colour with the bacillus typhosus. With Wilson and Blair's medium the former gives rise to flat thick colonies whilst the latter is inhibited or forms colourless colonies. At times the culture depends as much upon the medium as upon the organism.

When patients infected with the same type of organism react differently, this must be due to some individual peculiarity. It is found that the type of inflammation bears some relationship to local conditions, for, when certain pathological states are present, the inflammation is more persistent. Anything that lowers the vital power of a tissue not only predisposes to inflammation but causes it to persist. The reaction to overcome this cannot now be set up. During the War the difference between inflammation arising in normal tissue and that deprived of its nerve supply was evident. The type of inflammation also bears some relation to the general state of vitality. For where this is marked, as in the young, the healthy, the strong, and the highly strung, a sthenic reaction is to be expected. When vitality is low, as in malnutrition or when health is poor, the reaction tends to be asthenic. This bearing of the constitution formerly received much attention. Sir Thomas Watson wrote :¹

¹ *Lectures on the Principles and Practice of Physic*, 1871, p. 172.

“ The condition of the blood, you see, is sensibly modified by the occurrences of serious local inflammation in the body. Conversely, the aspect and character of the local inflammation are as surely influenced and modified by the pre-existing and co-existing qualities of the blood. Unhealthy blood produces unhealthiness of the inflammatory processes. . . . Ulcers, or open sores, of like origin and kind, differ remarkably according to the state of the patient's general health . . . whether he is labouring under a specific fever, or some chronic disorder, or some constitutional disturbance on the one hand, or whether on the other, he is, the ulcer excepted, in sound health. It is John Hunter's observation that ‘ inflammation produced in any part by violence will always be as the constitution. If a man has fever, a cut will partake of the disease, and the inflammation will be erysipelas or so on.’ Even in the same person a sore, an unhealed stump after amputation, for example, will vary in its appearance from day to day under slight external influences ; slight but sufficient to modify temporarily the condition of the circulating blood. Dr. William Addison observes that a discharging issue (which I shall have to tell you hereafter is one of our remedial inflictions) may serve as a kind of bodily barometer. On some days, if the patient has been imprudent in his diet or otherwise partaking of unwholesome things, the sore becomes painful, and the surrounding edges are red and angry. There are changes in the appearance of the granulation, and in the qualities of the pus. Over many parts of the sore, granulations are fading away into ulceration, and the purulent discharge assumes morbid characters ; but a more careful regimen, a brisk purge, and appropriate medicines soon brings matters to the former state. You may expect then to find, and you will find, that the march of inflammation differs considerably according as it may occur in healthy persons, in persons stamped by certain constitutional peculiarities or diathesis, in persons affected with some chronic disease and in persons suffering under fevers and whose blood is therefore poisoned or impure.”

What applies to inflammation applies also to reaction to disease in general. Little advance has, however, been made in this line of work, for the difficulties are extremely great. They are so well described by Paget :

"Every pathologist must have felt that the greatest difficulty in his study is the manifold complexity of the body in which it is pursued. The living human body is, surely, the most complex mass of matter in the known world. In composition it surpasses the highest powers of chemical analysis ; in mechanism it is as far beyond the calculations of the physicist ; its structures are but dimly seen with even the most perfect microscope ; all the known forces of nature are constantly and coincidently at work within it ; through circulating blood and a nervous system every part is in swift communication with all the rest ; and it includes the apparatus of a mind from whose influence no portion of its matter is distantly removed. And in this body the pathologist has to study, not that which is fixed, orderly, and natural, but that which is in disorder and unsettled."

In his *Essays on Some Constitutional Diseases* he wrote : ¹

"I often wished to give some clinical lectures on constitutional disease, especially on those which are inherited, and through inheritance subject to many and wide variations from what are regarded as their typical forms. These notes are the collected fragments and failures of many attempts, so to express what I believe on parts of the subject that it might be possible for students to listen to for an hour at a time I convinced myself of my inability to teach the subject orally ; and I am doubtful whether, even after many revisions, I have written anything worth reading.

"The subject is beset with much greater difficulties than at first thought appear. The sufficient materials for it exist only among patients whose health can be observed through many years, and whose family histories can be learned, not only from hearsay, but from the study of many members in different branches and generations of the same family. Of such patients, a sufficient number and variety can be found only in some large general practice among the richer classes of society ; but the few who obtain such a practice soon find, or imagine, that its duties are too laborious to allow time for any careful record of the facts they learn. In the incomplete study of the subject in surgical practice one can gain only very incomplete knowledge."

¹ *Clinical Lectures and Essays*, p. 401.

Many of us are well aware of the gulf that separates us from the wisdom of the master. His work was, however; done when he had to rely largely on experience and acumen; and few outside aids were available. The clinical thermometer was only coming in and men were unaware that there were bacteria. For his first piece of research work it was with difficulty that he found a microscope. Even in regard to diagnosis much uncertainty prevailed. He had to rely entirely on his experience and acumen. Our age has made diagnosis precise and accurate. Not only is it comparatively easy to be certain of the nature of the disease, but we are able to ascertain its extent and to watch its progress. For this reason the practice of medicine is much easier to-day than it was fifty years ago. On account of this it is possible that difficulties that previously were unsurmountable can be overcome.

I cannot help feeling that much helpful advice will come from practitioners, and particularly those who, living in country places, spend so much of their time studying life and nature. For not only have they opportunities for observing mankind through the years, but they have the advantage in that their parents and children are also known. For so often it is only when a man has gone through life that his constitution and any diathesis or idiosyncrasy becomes evident. And in the naivety of children the temperament and outlook on life are more easily observed. Working from both aspects, it is possible to form some conclusions about the individual himself. Otherwise the difficulties are immense. For even when a patient is sincere and open, he may not be able to express clearly what he feels; or his views about himself are much influenced by what he reads and hopes.

The constitution, temperament, diathesis, and idiosyncrasy are not just abstract conceptions. So far as the individual is concerned, they are something very definite and very concrete. Our difficulty to-day is that we have no method for assessing one, and the wisest can easily go astray in their deductions.

CHAPTER IV

THE BEARING OF THE CONSTITUTION UPON DISEASE

THE Greeks looked upon health as just abundant life and joy in living ; and sickness meant not necessarily that there was evidence of disease, but merely a want of ease that prevented a man from having zest in living. They held that as the world at large consisted of four elements, fire, air, earth, and water, man's body also consisted of four elements or humours, blood, phlegm, yellow bile (or choler), and black bile (or melancholy), which corresponded to the four qualities of matter, heat, cold, dryness, and moisture. The constitution resulted from the mingling of these, its type being dependent upon the one that was predominant. So long as the proportion peculiar to each individual was maintained, he remained healthy ; but, when one humour was out of proportion, being unduly diminished or increased or separated from the others, malaise and ill-health followed. Should this persist for any length of time, the disordered humour would act as an irritant to the body, which would make an attempt to expel it and disease would arise. To overcome this the *vis medicatrix naturæ*, or the natural process of repair, was brought into play. At one time there was a general, and at another a local, reaction. When this took place suddenly, disease was acute ; and when slowly, chronic. The local disease was not regarded as a thing in itself, but as the manifestation of some general disorder of the constitution. The restoration of the former state of the constitution being the aim of the *vis medicatrix naturæ*, therapy should aim at supporting this. Sometimes restoration took place suddenly, when it was known as a crisis, and was accompanied by profuse discharge and a fall in tem-

perature. In this way the superabundant humour was discharged. Sometimes it took place more slowly and discharged in one place, and chronic disease was the result. This cleared up when the constitution was restored to the normal. Generally this took place slowly and was shown by improvement in health and by the local lesion clearing up. In the circumstances the lesion received little consideration. The aim of the physician being merely to assist nature, drastic treatment was rarely advisable. He merely tried to increase or decrease the humour according to its state; dryness being expelled by moisture, heat by cold, etc. This humoral pathology, according to which it was believed that all diseases, no matter how local they appeared to be, resulted from some change in the relationship of the humours, held sway until the eighteenth century. Though men like Galen laid stress upon the healing powers of nature, generally speaking, the Romans paid less attention to the impairment of the constitution than to disease as a local state.

In the darkness of the Middle Ages, medicine, like science in general, became lost in folk-lore, superstition, and charlatanry. The time was not one of great constructive activity and man had to fall back on his own powers. This particularly applied to recreation and leisure. Rather than discipline himself and alter his way of living, he looked everywhere for support; and, just like the time through which we are now passing, neuroses and disorders of the imagination were common. Disease and ill-health were regarded as disorders of temperament, and the sanguine, phlegmatic, melancholic, and the lymphatic temperaments were spoken of. Theorising became the order of the day, and in the training of students practical work was abandoned and a course of lectures was preferred to teaching at the bedside.¹ It is not surprising that astrology and divination

¹ A greater change has taken place in one generation than many realise. I am constantly advised by practitioners to put before students my views upon the constitution and the temperament. I point out that nowadays I see so little of students. Even when they do their ward work they come from one lecture to the wards, from which they are in a hurry to get away

became popular and were eventually taken up by the medical profession. Planets and stars were supposed to modify the constitution by causing some changes in the humours. They were also believed to have some direct influence upon the temperament. Consequently, the state of health was thought to vary with their position. Man came under the influence of Jupiter, Saturn, Mercury, Mars, or Venus. His mental state was affected and the jovial, saturnine, mercurial, martial, and venereal temperaments might result. Now this doctrine received the support of eminent men such as Bacon, but it was beloved by the charlatan and quack, for it was so easy to prey on the credulity of man. The subject became one of popular interest, and the charlatan and the fashionable physician outshone one another in the cures that were claimed. So it was not long before astrology became lost in a maze of extravagant claims. Few nowadays seem inclined to investigate these, but there is probably more in the relation between the planets and stars and the state of health than some think; for physicians in those days were careful observers, whose minds were not confused by much that now takes up our time. The sun and moon were then regarded as planets. There is little doubt that certain mental disorders vary with the state of the moon, and the health-giving power of the sun has been established.

At the Renaissance Greek works were translated and importance was again attached to the constitution. But later on greater attention was paid to anatomy as bodies were dissected, and post-mortem examinations were carried to another. Clinical work is just incidental to training in medicine. It is now considered that the more complete the system of lectures the better the student will be. How different from the pre-War days, when it was pointed out to a student that the only way to learn medicine was by attending the wards, and the out-patient and casualty departments. He was allowed to leave these to attend a lecture only when his work permitted. In such an atmosphere he was more likely to acquire a clinical sense. That some of us failed to do so was not the fault of the system. The fault was rather in ourselves, that we were not that perfect product who listens to and appreciates all he is told.

out. Not infrequently, during life no disease could be detected and no explanation for death was forthcoming, yet some cause was often found at the necropsy. It was therefore believed that some change was always to be detected in disease were the examination sufficiently careful. In the circumstances the humoral pathology was gradually abandoned and the theory of solidism took its place. With the humoral theory went the belief that disease was overcome by some reaction on the part of the patient, and that therapy should be directed towards this and would be effective only if the patient had sufficient vitality to respond. Vitality was the factor that really counted and received some prominence in most of the theories. The theory of solidism suggested that something concrete was to be found in every case of ill-health. Every effort should be made to seek and to treat this. All that was necessary to cure the patient was to dissolve the lesion or to remove it by operation. If this were possible, health would return and vitality would be restored. The latter played little if any part in the cure. Its presence meant that the remedy was working. Its increase was due to the understanding of the physician.

Teachers, who laid great stress upon the study of the patient, now and again came to the front. Paracelsus had great belief in the health-giving powers of nature, which he called "mumia." This, though inherent in everyone, was greater in some than in others. It was of the nature of magnetic force, and he supposed some men might be able to transfer it to the sick and so cure them. Upon this the sympathetic cure of disease was based. He had some confidence in alchemy and believed that the nature of man was composed of three basic substances, mercury, sulphur, and salt. When disorder was present the aim of the physician was to restore equilibrium. Instead of treating the disorder of the constitution by something that had an opposite action, as was the practice of the Greeks, Paracelsus at times preferred to increase the reaction and the theory of "similar" arose. This in later years became the basis of

homœopathy. Sydenham also had great faith in Nature and paid much attention to the Hippocratic writings. He also believed to some extent in the sympathetic transference of vitality. For in records of his cases it is not infrequently stated that when elderly people were severely ill he advised the placing of a kitten, or puppy, or even a young child in the bed with them under the supposition that a conveyance of vitality did take place.¹ He stressed the danger to medicine of leaving the bedside of the patient to concentrate on anatomy and physiology. Much attention has since been given to his writings, and their study has had considerable influence upon medicine to the present day. Now, though anatomy has been of much help in the development of operative surgery and in the diagnosis of disease, and though physiology has demonstrated to us the functions of the various organs, neither anatomy nor physiology has given the assistance in therapy that was anticipated. This is perhaps best exemplified by Harvey's discovery of the circulation of the blood. Though this revolutionised medical thought and has since had much influence upon our conception of physiology, its practical bearing on therapy is negligible. Neither physiology nor anatomy has taught us anything about the constitution. Later there was an attempt to correlate clinical symptoms with morbid appearances, which gave rise to the study of pathological anatomy, and of clinical pathology. As a study of diseased organs did not lead to all that was expected, the tissues were studied, then the cells, and finally the body fluids. The tendency during this and last century is to concentrate more and more upon the study of the diseased process and to regard it as a thing in itself. And less and less attention has been given to the patient. Some medical writers did lay stress on the fact that disease was not to be studied as a thing in itself but in

¹ This view is commonly held among lay people. Recently a patient, aged 43, told me that last winter his health had been worse than for many years. His mother had died the previous summer, from which time on he slept with his father, aged 82. Neighbours told him it was unwise to do this, as the aged sapped the vitality of those who were younger.

relation to the soil in which it arose ; for the latter would influence its progress. Paget wrote :¹

“ It is among the first necessities for success in practice that, in the several phenomena of a disease observed in any patient, you should be able to estimate what belongs to the disease and what to the man. A farmer may as well expect success if he sows his fields without regard to their soil or to the weeds that may ‘ of themselves ’ come up in them, as one of us may expect it, if we treat disease without exactly studying the constitution of those in whom they occur.”

In his day it was felt that there was at times a predisposition to disease which might be inherited or acquired and which might be revealed from the appearance of the patient or from the family history. Such a predisposition came to be known as a habit of body or a diathesis, and the bilious, the scrofulous or lymphatic, the nervous and the arthritic diatheses were spoken of, disease being likely to arise when such a patient was subjected to undue strain. Now such a doctrine had considerable influence on therapy. For whilst much attention was paid to the local manifestation, as much was given to the disorder of the constitution that predisposed to it and allowed it to develop. If this disorder could be overcome, the patient would get well. If it could be prevented, disease would not arise.

In the hands of men like Paget and Hutchinson, the treatment of the individual patient became a great art. They pointed out that in therapy the reaction of the patient was the thing that counted ; for therapy did not depend upon the direct action of a drug but upon whether its introduction led to some change in the constitution that furthered the work of nature.

But much of their teaching and influence was lost ; for in the middle of the nineteenth century the bacterial conception of disease and the rise of operative surgery obscured their line of thought. The achievements from these were colossal. Wounds healed by first intention when antiseptics were

¹ *Selected Essays and Addresses*, p. 70.

employed to destroy bacteria ; and, as later work by Koch proved that many diseases were due to bacteria, attention came to be concentrated on their destruction. Reasoning from the bearing of antiseptics upon operative surgery, it was felt that the earlier the stage at which diagnosis was made the more effective would therapy become. As failure was attributed to delay in diagnosis, much attention was given to the early detection of disease. This was regarded as due to the entrance of bacteria, and the bearing of the constitution and of the reaction of the individual received little attention. But the work that culminated in Paget and Hutchinson was the product of centuries of thought and was based on respect for vitality and the work of nature. As life and nature do not change and as we have really learnt so little about these and know even less of their bearing, the break was too complete.

In recent years men are again returning to the study of the soil. For it is realised that, if this is sound, bacteria introduced from outside will be destroyed, and disease will not arise. Only in so far as the soil is too rich or is not sufficiently rich is there any predisposition to disease. Sir Archibald Garrod writes as follows : ¹

“ Indeed in all diseases there are both internal and external factors. Sometimes the one and sometimes the other is the more conspicuous. . . . In the infective diseases a morbidic agent, a bacterion, a virus, or a protozoon, enters the body from without, and in so doing gives rise to trouble. In such cases the external factor is something concrete, which may be studied outside the body, but daily experience teaches that there are also internal factors at work, that there is such a thing as a natural liability to, and a natural immunity against infective disease. Moreover, it is the human subject rather than the specific micro-organisms which shapes the syndromes or clinical pictures by which such diseases are recognised, although a similar response follows a specific bacterial infection in different subjects. The severity of the attack, although in part controlled by the virulence of the invading

¹ *The Inborn Factors in Disease*, 1931, p. 30.

germ, is also a measure of the resisting power of the organism, its natural or acquired immunity ; in other words, by the efficiency of its defensive mechanism."

Our views to-day, which have culminated in the study of the hypersthenic and hyposthenic constitutions, have been much influenced by the teaching of Sir Archibald Garrod, Dr. A. F. Hurst, and Professor J. A. Ryle. Now and again some help is forthcoming from surgical writings of past years.

Since disease may arise after the slightest strain when a predisposition exists, it is not surprising that a diathesis has at times much bearing upon prognosis in operative surgery. This was particularly noticeable in pre-antiseptic days when the healing of septic wounds was such a big strain that any constitutional weakness was likely to become evident. Whether a patient did well depended so often upon the absence of a diathesis. Consequently, it is not surprising that many papers that dealt with this problem were written by surgeons. But once the importance of antiseptics was realised and wounds healed by first intention, and better methods of anæsthesia and modern nursing diminished the risk, the constitutional factor became of less importance. Consequently, less attention was paid to it and more to removal of the disease. But now and again it was realised that removal of the disease alone was rarely justifiable. This was seen so well in tuberculosis. For soon it became evident that the local lesion was merely the manifestation of a lowered general resistance to the tubercle bacillus. And, unless this was overcome by sanatorium treatment, the disease broke out elsewhere. In other words, it was necessary to pay as much attention to the constitutional defect as to the local lesion. Unfortunately the terms constitution and diathesis came to be regarded as archaic. Men preferred to speak of the building up of resistance which was felt to be more in accordance with the bacterial conception of disease. But building up resistance and overcoming a diathesis amount almost to the same thing, and, as we were later to find, the giving of a new name is not the same as an advance

and often serves to impede the search for truth. With many operations, however, the results that followed removal of the disease were most spectacular, and in the circumstances it was not unnatural that surgeons concentrated on local treatment. And, when results were not satisfactory, failure was attributed to the diagnosis not having been made sufficiently early or to some error in technique. Attention was then given to remedying these. There was little risk in the majority of operations, so that the bearing of the constitution and of the diathesis came to be regarded as of little importance ; and as a result references to them gradually disappeared from literature.

When, however, the operation was severe and much shock was anticipated, the state of the general health was always taken into account ; so was the presence of other factors such as myocarditis, diabetes, etc. Cases were spoken of as good or bad risks according to the immediate or remote prognosis. This change in terminology and in outlook meant that surgeons were now more content to speak of the risk associated with the presence of a certain disease. The great medical advance of this century, precision in diagnosis, was obviously playing its part. With certain operations, however, the type of constitution was still taken into account and certain of the tests used to investigate diseased states did unwittingly reveal certain aspects of the constitution. The removal of the enlarged prostate and the bearing of the renal function test will serve as an example.

This operation is usually associated with much hæmorrhage and shock ; and, as it is usually performed in those of advancing years, when degenerative changes in the cardiovascular system are likely, the strain is great. If symptoms have been present for some time, some back-pressure upon the kidneys is certain and each patient should be regarded as a potential nephritic. The danger of operating if the patient has nephritis is well known.

Fortunately, with the enlarged prostate the state of the kidneys can be improved by preliminary drainage of the

bladder and prostatectomy can be delayed until this improvement is established. Many tests have been introduced to ascertain the function of the kidneys, of which the most reliable are the blood urea, the urea concentration, and the water-dilution test. Normal kidneys can concentrate urea to 4 per cent. or higher. With back-pressure this power to concentrate is adversely affected at any early stage. If, however, urea can be concentrated to 2·5 per cent. or higher the outlook is good. A concentration below 2 per cent. indicates great impairment of the kidneys and the outlook is poor. But in some cases where the concentration is less than 2 per cent., the patient does well and no signs of uræmia appear during convalescence. In others the concentration is very high, reaching 3·5 per cent. or more, and yet the patient does badly after the operation. Now, in the former the blood-pressure remains low; and, even if the patient cannot concentrate his urine, the blood urea is not raised, for he can excrete water with ease. In the latter, dilution of the urine does not readily take place and there is a tendency for the blood-pressure to rise. The latter leave the theatre in good condition and yet die after a couple of days from a cerebral lesion, from an acute flare-up in the kidney, or from some septic state such as pneumonia. Whilst the former often do well in the long run and the wounds heal with little trouble, the immediate shock is sometimes greater than was expected; at times progress is not too satisfactory and they gradually fade out in a week or ten days. Though sepsis in the urinary tract plays some rôle, it is often difficult to be certain from what the patient died. In both types of case changes in the kidney undoubtedly play their part, yet the manner of dying does not resemble that usually associated with renal failure. It seems to me that the renal function tests give evidence not only of the state of the kidneys, but also of the degree of vitality and of the type of constitution. They thus give some indication of his power to react. Probably in both types of patient the failing is not primarily in the kidney, but in the constitution, which is hyposthenic

when there is difficulty in concentrating, and hypersthenic when the concentration is good.¹ This constitutional factor also comes into play in bacterial disease and other illnesses, and full allowance must be made for it in prognosis and treatment.

The Hypersthenic and Hyposthenic Constitution

Whilst the temperament and constitution are peculiar to each man, and differ, even if only to a slight extent, from those of his neighbour, the majority will be found to conform to that large and happy class, "the average man." Though he is perhaps never prominent in the mental or physical spheres, he possesses that greatest of all combinations, an equable temperament and a constitution that enables him to adapt himself to anything he may reasonably be called upon to face without suffering any ill-effect or being upset. Even should a period of strain ensue, he has sufficient reserve power to meet this and to emerge unsubdued with his equanimity unshaken. As a result his passage through life seems so easy. He is rarely worried and less rarely disturbed. Though the majority conform to this class, at one end a number are hypersthenic where vitality, tonus, and energy are in excess; and at the other, hyposthenic where these are deficient.

The Hypersthenic Constitution

The muscles are firm and full of tone, the physique is good, the chest well formed, and the epigastric angle wide. The excess of vitality usually becomes evident at puberty. In their passage through life the health and energy are the admiration of all. There seems to be so much in reserve. If the nervous system is normal, the temperament is sanguine

¹ A difference is also noticeable in the way smooth muscle reacts. With the hypersthenic there is likely to be hypertrophy, and with the hyposthenic atony. The bearing of this on prognosis is well known, particularly when symptoms arise suddenly. If there is acute retention with much pain, the prognosis is good; for pain denotes good reactive power on the part of the muscle. And when there is retention with overflow, the absence of pain means that the reactive power is impaired. If this is just a manifestation of uræmia, it can be overcome; if part of some constitutional factor, the prognosis should be guarded.

and equable and there is great mental and physical activity. If the nervous system is over-sensitive, the temperament is highly strung and may be artistic. Such a one is always on the move ; he has difficulty in relaxing and his energy seems to wear him out. The excess of energy may be predominant in the muscular system, when it leads to good muscular development ; in the blood, when it leads to plethora ; in the cardio-vascular system, when it leads to hyperpiesia ; in metabolism, when it is associated with obesity, the formation of good firm fat and a jolly temperament. As he goes through life this excess of energy may ultimately work to his detriment. For in spite of good health, the hypersthenic seems particularly liable to certain diseases, such as duodenal ulcer, hyperthyroidism, and the gouty diathesis, and it is not uncommon to hear of his health breaking up after 50, when sudden death from heart failure or cerebral hæmorrhage may occur. It seems likely that round 45 to 50 man, like woman, goes through a menopause ; this is not just a matter of sex, as some suppose, but is associated with marked changes in mind and body. A certain amount of rest and the taking of life quietly is advisable at this time. But though able to work to advantage, the hypersthenic seems unable to rest. Relaxation for him is a strain. His energy now wears him out ; for as he passes through the change of life rest is essential.

The Hyposthenic Constitution

The muscles are small and lack tone, the limbs are long, the chest is narrow, and so also is the epigastric angle. The energy and vitality are deficient. This may be evident for the first time at puberty, but is very noticeable if any period of strain has to be faced. He may be fat or wasted, but the fat, like the tissues in general, is soft and flabby and not firm as in the hypersthenic. There is instability of the nervous system and undue rapidity of the pulse. The blood-pressure is low, the circulation is poor, and the hands and feet are cold. There is a want of tone in all the muscles.

They are liable to ptosis of the viscera and to a low-grade inflammation of the mucous membranes throughout the body which ultimately become localised in one. This is more noticeable if the weather is bad and the north-easter blows. Gastritis and cholecystitis are not infrequent. Once 50 is passed the health improves and now and again a fresh lease on life is given. This type of patient is in his early years a source of income to the doctor, for his constitution is upset by the slightest strain and even from such small things as a change in weather. But after 50 nothing upsets him. It now seems as if he can go on for ever. This he may attribute to some quack cure he has taken up. Really it is due to his having passed through the change in life, after which certain factors in his constitution that were previously harmful become an asset.

The constitution has some bearing upon the type of bacterial disease that arises and also upon its course. For instance, the hypersthenic is more likely to develop staphylococcal or streptococcal infection; the hyposthenic, a coli infection. With the hypersthenic there is likely to be an acute sthenic reaction with much pain, congestion, and the formation of laudable pus and of much fibrous tissue. Once inflammation ceases to progress, it is quickly overcome. But notwithstanding a good immediate response, it is at times strange to see inflammation go ahead and develop into septicæmia in one so strong and healthy. In the hyposthenic an asthenic type of inflammation is more likely. Congestion and pain are not marked, and pus does not tend to be thick and laudable. It is strange to see one whose health was never good overcoming an inflammation, such as pneumonia, that lays out his more robust brother. On the other hand, in him coli infection tends to persist and to lead to much ill-health.

For years I pondered over the varying reactions seen in bacterial disease, and at one time felt there must be two distinct types of bacteria for each; but now I realise that the nature of the constitution, which plays such a vital part

in the reaction, was not taken into account. Whilst in general the reaction to disease runs a certain course, in some it is too great and leads to much proliferation of tissue with a tendency to the formation of fibrous tissue. In others, it is too little and leads to ulceration and a tendency to the formation of pus. This is seen in tuberculosis, where one type of patient forms fibrous tissue and another pus. In syphilis, where one patient has much proliferation of the tissues, another has a tendency to ulceration. In gonorrhea, where in one there may be much congestion, pain, and formation of thick laudable pus, in another, little reaction and profuse thin pus. As the disease clears up, in the former there may follow a stricture or a wart; in the latter, a relaxed condition of the mucous membrane with a persistent mucoid discharge. In leprosy, there is the nodular type with proliferation of tissue, and the maculo-anæsthetic type with atrophy and ulceration. It is now my impression that this varying reaction is largely a matter of the constitution. In the hypersthenic is found the tendency to proliferation of tissue; in the hyposthenic the tendency is ulceration and the formation of pus.

Changes take place according to the stage of life at which the disease arises; those between 15 and 20 and 40 and 50 that are incidental to puberty and the menopause have long been recognised. But minor changes occur. The constitution can be assessed only as the individual passes through life, and the practitioner, having to fall back on his powers of observation and on his clinical acumen, is faced with great difficulties. He realises that in one there is too much tonus, vitality, and energy, and in another too little. But there is no instrument by which these can be estimated. When daily variations have to be considered, he is all at sea. As he ponders over the subject, he will repeatedly put to himself these questions: Are tonus, vitality, and energy just abstract phenomena that are merely expressions of life or are they not something that can be estimated if only we would give the subject some thought?

CHAPTER V

VITALITY ¹

THE house where I lived as a young man, about 700 feet above sea-level with a view of four counties, was exposed to all the winds except the north. At times these were so strong that they would twist the iron railings around the fields and cause even concrete posts to snap. On the other hand, posts made from trees would last for years until some fungus caused them to rot. Even the bleached bones of sheep that had died on the mountains would remain whole until crushed by the foot of man. Anything that acted as the scaffolding of the body during life lasted as long, if not longer, than anything man himself could construct. Out of doors the ferns, saplings, and shrubs maintained themselves in all weathers, and with the first touch of warm weather they would brighten into life and all their vitality would be restored. Though a touch of frost would lay them low, only when they had died and had lost their vitality did they become a prey to the winds and were rooted up. My constitution being such that I was driven indoors when the north-easter blew, I used to wonder why man was so frail. Why was it his vitality could be lowered by so slight a thing?

Now, the word vitality can be used in many senses. Sometimes it is regarded as if it were synonymous with life; for in the simplest form, such as the *amœba*, it is equivalent to activity, and is just a manifestation of life. But in this chapter, vitality means something more than just living, and implies the power to do and to endure and to accomplish

¹ Vitality is here intended to include vitality and vital energy. For the distinction between these the reader is referred to the footnote on p. 158.

that for which life is intended. When vitality is adequate there is a zest for living, and the power to accomplish all that is wished.

Probably nothing makes so big a demand upon vitality as three minutes in the boxing-ring ; and to go through twenty rounds a man's condition must be perfect. Now, boxing is not mere slogging, as some think. For a boxer has to think quickly, to act quickly, and to hit quickly ; and few things are so exhausting as three minutes in the ring. From the moment the gong goes, the eyes never leave those of the other man and concentration is intense. When anything is at stake, the strain is known only to one who has had experience ; and even if no blow is struck, a man may feel exhausted at the end of three minutes. Whilst generally the appearance and the physical condition give some clue, it is by no means easy to differentiate between the fitness of men. There is no scientific instrument by which it can be done and we have to depend on our powers of observation. Unfortunately our senses are not sufficiently accurate. When standing by the side of the boxing-ring, I have often wondered as to what is this thing called stamina, as to what is this thing called strength ; for these after all are just manifestations of vitality. But how inadequate are our methods for assessing this was brought home to me when soon after qualifying I watched Jimmy Wilde training for his fight with Tancy Lee. For, had he been presented as an examination case, he would have been described as pale, looking ill, and as if the decline had set in. Yet his vitality was perfect, and none doubted that he would last twenty rounds. When I asked his trainer how he judged whether a man was fit to enter the ring, he replied that he was guided by the clearness of the eye.

The assessing of vitality came into play in the selection of men for the Army. Physique was of importance owing to the necessity for carrying heavy equipment ; but those of us who did recruiting in the early days of the War soon realised that something more counted ; for the strain of training caused quite a number of those in whom this

seemed perfect to crack up in an unexpected way. This took place even in those who had completed their training when the march was a few miles longer than the average, or if a little extra speed were needed. Battalion medical officers, as they gained in experience, became quite expert at spotting these minor differences between man and man ; but there were few who would not have a little chat with the company commander when important manœuvres were about to take place. Even then it was surprising how often one's judgment let one down. But in the firing line something more came into play. So often the frail would appear fresh and alert after a day of intense fighting, whilst the strong would have those dark lines under the eyes that denoted that their vitality was giving out. Company commanders were often able to give good advice about the fitness of the men. So often they realised by instinct or intuition what their men could do. For instance, just before the evacuation of Suvla Bay the battalion medical officers were questioned about the fitness of the men and the length of time it was anticipated they could go on fighting. My own view was that they would last at least a week. But the adjutant told me that so long as the fighting was stationary, they would go on until they dropped ; were it, however, going to be a question of attack and counter-attack, exhaustion would rapidly set in. He doubted if the men were capable of marching three miles. Though the majority had dysentery and jaundice and many still had slight colitis or some chronic infection, and would be all the better for a long rest, their condition was not too bad ; and at a medical inspection a few days previously, when all were examined and those who were really unfit could be evacuated, no signs of disease were detected. In the circumstances I could not agree with his views. After the evacuation we were taken to Lemnos, where we had to march about three miles up a slight incline. Though all the kit was dumped and we had several rests, the men had just sufficient vitality to complete the march. Obviously the adjutant knew much about vitality and the

power to endure. I was too concerned about disease and its detection, and worked from this to the state of health, whilst he, as a practical soldier, looked upon his men with a view to what they were capable of doing, if called upon to face an emergency.

Much of the weariness that is seen among ex-service men to-day is no doubt due to the sapping of the vitality that then took place. After the War I had chats on this point with my father, who had two small collieries. He was a close observer and his men and their fathers had been known to him for many years. He was convinced that there was a falling off in the power to work of those who returned from the fighting line, which he at first attributed to their being out of practice. But later he came to the conclusion that the falling off could not be explained in this way. He felt that even when anxious to work they had not the power. Their stamina was soon exhausted. Men who had previously been good workers and quite happy were inclined to be morose and rarely smiled. The strain of fighting had sapped their vitality; and he drew my attention to the peculiar look that was often seen in their eyes.

In compensation claims that are heard in County Courts it is not infrequently stated that a want of vitality followed an accident. Though it frequently crops up in general practice, the expression is rarely used in hospital practice. Such terms as vitality and vital power are not infrequent in the writings of Paget and Watson, but few references are to be found in modern textbooks and in current medical literature; and rarely are they referred to in lectures. To prevent the subject wandering into realms of philosophy, the case of X, a patient of mine, is dealt with here.

All his life he had a passion for mental work and for games, and in his early years was really good at rugby and boxing. At puberty a crack appeared in the constitution which was associated with a lowering of the resistance. After this his stamina was never quite the same; there was a want of staying power and from then on the common cold

and gastro-intestinal disorders frequently arose. To regain health everything was done to harden himself. Cold baths were taken each morning ; no window was ever closed ; thin underclothing was worn summer and winter. As a focus of infection might be the cause, the appendix and the tonsils were removed. Apart from a brief period at 21, when he was again able to play in first-class company, the promise he displayed early in life never returned. His want of stamina was evident, if a little extra speed or endurance was called for. For instance, if the game of rugby was fast, or rough, he would find difficulty in lasting ; and whilst he could box four two-minute rounds, two three-minute rounds were too much. The difference between his parents and himself was noticeable. His father had perfect physique and health and his mother was the personification of household activity. They did everything they wished and could adapt themselves to anything that might arise. They had so much in reserve.

Most of his friends were good athletes. When out for a walk, they did not worry whether this was ten or twenty miles or whether the last few miles had to be rushed ; they always ended up fresh. Whereas X could walk twenty miles at his own time without any ill-effect, in their company ten miles was enough ; for the extra few miles or the sudden spurt was too much of a strain. As the walk was coming to an end, they would be looking forward to the meal. Whatever food was provided, they ate and enjoyed ; and no matter how quickly it disappeared, no discomfort ever arose. When the meal was over, they would look forward to sleep, from which they would wake up refreshed. X rarely had an appetite, no matter how long the walk. He had to be careful that the food was not too rich and above all that it was not eaten too quickly. As the night wore on, his vitality increased ; and there was little desire for sleep, which was never deep. On getting up he would feel tired ; it was only as the day wore on that his vitality returned. The difference between him and healthy people was the ease with which the latter could adapt themselves to circumstances that might reasonably arise. They had such a reserve of power. On the other hand, with mental work he could go on to the early hours of the morning without fatigue. Whilst his friends might now and again make a spectacular effort, when prolonged mental work was needed they tired easily and fell

asleep. Then came the War and service in the trenches. Though as many opportunities as a young man could wish came his way after the War, he was never quite able to stand the strain. Some infection would arise and impair the health. He tried hardening himself by taking exercise in all weathers. Some focus was sought to account for the infection. In December 1929 the gall-bladder, containing forty stones, was removed. Good health was now expected; but when convalescing the gums began to bleed, and he had sunstroke on taking a sea trip out East. When convalescing from this in May 1930 he developed streptococcal septicæmia and later nephritis and uræmia. The teeth were regarded as the focus and were removed. The colon then gave trouble, which was particularly noticeable when health became impaired. One infection just followed another.

Life was becoming difficult, for long periods of rest were necessary and no great work could be done. Reading by chance an article on the constitution, he felt that his state had all along conformed to the bilious diathesis for which mercury was specific. The taking of this was followed by improvement in health and a sense of well-being that he could not recall. During this time he was able to investigate factors that modified the health. Much exercise and exposure to the sun were harmful. The health became impaired when the weather was cold and particularly if the north-easter blew. In May 1931 he had influenza of two days' duration which was followed by severe asthenia that lasted three months. During this time his vitality just disappeared. The slightest mental or physical effort was followed by much fatigue; disordered function was evident in many organs. He was not able to work, to relax, or to sleep; for the time being adaptability disappeared. No improvement followed treatment and holidays gave no relief. Drugs had no influence, and champagne and brandy brought no ease. Though the taking of hypnotics led to sleep, there was not that sense of well-being that comes when it is natural. Sitting one summer evening on the bank of a river, he watched the trout in the water, so restful and yet so alert; and at a time when neither sleep nor leisure brought ease, he could not help envying them their great power to relax. The vitality of the swallows and swifts as they darted through the sky was amazing. A month later he sat by the

seashore and watched them congregate together so quietly, as if their energy were spent. Yet on the following morning they were gone on their long journey to Africa. It was impossible to comprehend the vitality their small bodies would need for this long flight.

Here was a man who just because of a want of vitality was sick and weary and becoming disinterested in life. His observations of nature were leading him to wonder of what advantage to man were recent achievements of science, for nothing she offered had brought him relief. Though as a young man he had believed in her claims and in his effort to increase vitality had utilised all she could give, the only benefit had come from mercury, a remedy almost as old as time. As the asthenia which had developed so suddenly would come to an end only as health improved, he could not help putting to himself these questions : What after all are the achievements of Science ? What drug has she given that restores vitality and that helps a man in his fight ? In days of great scientific conquests and achievements, it is little satisfaction to the sick to know that they will get well if they are able to react, and that for the time being they must turn to literature and to nature for solace and peace. How much have we advanced in the treatment of asthenia since Jefferies wrote :

“ These are the only hours that are not wasted . . . these hours that absorb the soul and fill it with beauty. This is real life and all else is illusion, or mere endurance. Does this reverie of flowers and waterfall and song form an ideal, a human ideal, in the mind ? It does ; much the same ideal that Phidias sculptured of man and woman filled with god-like sense of the violet fields of Greece, beautiful beyond thought, calm as my turtle-dove before the lurid lightning of the unknown. To be beautiful and to be calm, without mental fear, is the ideal of nature. If I cannot achieve it, at least I can think it.”

What is Vitality ?

In the light of our present knowledge this term can have no exact meaning and must be taken as denoting the power

of the organism to react to any environment in which it is placed. Vitality is in some way linked up with stamina and health, since it is usually abundant when these are good. In the case of X there was a definite want of vitality. This was shown as follows :

1. The weak link in the constitution that prevented his excelling at games.

2. The weak link in the constitution that prevented his taking part in life in the post-War period.

3. The weak link that led to disease which was seen so markedly in 1930.

4. The weakness that persisted after the influenza in 1931.

1. The want of vitality in early life was apparent rather than real ; for he had any amount when he confined himself to mental work and was content to take exercise merely to maintain health. Had he followed the quiet life of the scholar, for which his constitution was suitable, his health would probably have been perfect. Now those who tend to be hypersthenic, particularly if there is also a tendency to muscularity, are likely to excel at games ; those who tend to be hyposthenic, at mental work. It is problematical whether the latter should devote much time to those games where physique counts so much. For, even should the muscles develop, that health and vitality so necessary to face the strain of living may be used up. It is possible that the cultivation of physique undermines the health in those who are not really strong. Some of the finest boys at our public schools are good at games and work ; and the health they possess is generally attributed to the life they lead. But it is probable that their constitution has been perfect from birth ; and it is doubtful if this can be acquired. Scholars in years gone by, though taking little exercise and paying little attention to health, lived to a ripe age, and did their work extremely well. When the health of a few broke down, it was assumed that this would not have taken place had they paid more attention to the mode of living.

It was felt that had the remainder paid more attention to the rules of living, they would have been healthier and would have worked to better purpose. But ill-health is seen among those who take every care ; and no one has proved that developing the physique does increase the power to do mental work. After all, man is something more than an animal and is intended for more than manual work. The cult of health that is going on nowadays has been carried out for too short a time for us to be certain that in the long run it is advantageous. It may still be proved that it does harm to not a few. Trainers of horses pay much attention to their stamina, and do not try to bring up a race-horse in the same way as they do a cart-horse. A trainer in a small way points out to me how easily a race-horse is affected. An extra few pounds is sufficient to prevent his winning over six furlongs ; and attention is given to small details such as this when training horses. Are we therefore right in treating all boys alike and assuming that the playing of games does them no harm ? As the constitution is something that is easily upset, it would be wise if more consideration were given to each individual. Just as the health of one may be upset by the north-easter, so may that of another by excessive exercise. Looking back on life, X feels that much of his ill-health was due to his desire to excel at games. Really he was one who was intended for the life of the cloister.

2. Here again the want of vitality was apparent rather than real. X could easily have lasted had he realised how essential rest was for his constitution. At the time he thought the best way to prevent infection was to harden himself by taking exercise in all weathers. He now realises that exercise in moderation does good to him only during certain seasons and in certain weather. When the weather is cold and the north-easter blows, he is better if he remains indoors and keeps the windows closed. This is particularly the case from late November until early February. Rest for one hour after lunch and for half an hour at six o'clock is extremely beneficial ; any sense of weariness disappears

and he is able to do work to better purpose. The infected gall-bladder really played little part in the production of ill-health and was not the focus of infection as he assumed ; for, as he was not fit to undergo a major operation in 1929, he went on a tramp steamer to the East to recuperate. By the time he returned his health was perfect and he had any amount of vitality. This resulted just from altering his way of living and his giving more time to sleep and rest. He is now convinced that apart from occasional colic the gall-stones gave trouble only when health was poor. The aggravation of the inflammation was generally the result of this and not the cause.

3. The diseased states in 1930 were extremely serious, but X easily overcame them. Though the sunstroke or even the removal of a focus of infection may have lowered resistance, X is rather inclined to regard this latter as being partly due to want of care on his part after the operation ; for he did not rest sufficiently long and rushed convalescence. His recuperative powers were always good ; for, when the teeth were removed after the uræmia subsided, the gums healed straightaway. His trouble was that he was not able to prevent diseased states recurring.

4. The asthenia that came on after the influenza in 1931 is characteristic of ill-health in general. The outstanding feature was a want of vitality ; as a result, work that was previously done with ease now caused fatigue. It seemed that the power of adaptability had been largely lost, and as a result disordered function was evident after the slightest effort. This state was totally different from that represented in 1 and 2, where a want of vitality was evident only when a severe or sustained effort was needed.

The aspects of vitality that are discussed under 1, 2, and 3 are too complicated to be dealt with here. On the other hand, by studying adaptability referred to in 4, it might be possible to have a physiological conception of vitality, and as a result the laboratory might give us help in the study of the constitution.

Adaptability

By this is meant, in a physiological sense, the power of an organ to respond to demands that can reasonably be made upon it ; when these cease it can resume its rest. Adaptability is here illustrated by reference to the kidney, the bladder, the stomach, and the heart.

The Kidney.—The secretion of urine maintains the blood in the state that is best for the nutrition of the tissues. If much fluid is drunk, much urine is secreted and the specific gravity can be lowered to 1,005. If little fluid is drunk, little urine is secreted and the specific gravity can rise to 1,040 or higher. This power of the renal cells to adapt themselves to changes that they have to face is characteristic of a normal organ in health. One of the earliest signs of impairment is a failure to do this. The kidneys may now be able to secrete urine of low specific gravity or of high specific gravity. They cannot now do both. In other words, adaptability is affected.

The Bladder.—The function of this is to act as a reservoir until facilities exist for urine to be passed. When the intravesical pressure rises, there is a desire to pass urine. In order that a man should not constantly have this desire, it is essential that, as the bladder becomes filled, the pressure should not increase proportionately to the contents as with a rubber ball. Owing to the property of relaxation the muscle fibres can increase in length without giving rise to tension. As a result, only when the bladder contains a certain volume does a rise of pressure occur and there is a desire for urine to be passed. If it is not convenient, further relaxation of the muscle is possible, the rise of pressure passes off, and micturition may be deferred. This constitutes adaptability for a hollow muscular organ. In this function of the bladder are seen the phases of relaxation, contraction, and rest in their simplest form.

The Stomach.—The function of this is to take food that is swallowed and to prepare it for digestion, for which purpose the muscle must be able to relax, to contract, and to rest.

Relaxation is not just a rebound from contraction. As with the bladder, it is a graduated purposive movement by which the stomach can adapt itself to sudden or gradual changes in volume without any increase in pressure within. As a result, man is able to eat most foods and to swallow them moderately quickly without discomfort. Whilst the stomach is contracting, no stimuli come through to consciousness. When the stomach is empty and at rest, there is no sensation apart from that of hunger, and a man can feel at ease. The power to be distended, to contract, and to rest without causing discomfort constitutes adaptability.

The Heart.—The function of this is to maintain the blood-pressure so that the organs can be supplied with sufficient blood and the products of metabolism removed. There is systole or contraction, diastole or relaxation and rest. With the body at rest the heart beats with a certain force and at a certain rate. On standing up both are slightly increased but soon return to normal. With exercise, such as going upstairs, the rate rises 10 to 20 beats ; but after a short rest the former rate is resumed. This is the basis of the exercise tolerance test. This power of the heart to meet the need for more blood constitutes its adaptability.

Adaptability is characteristic of healthy organs. As a result, any sudden or prolonged increase of function or long periods of rest are possible without leading to discomfort ; and an organ makes its presence felt only when worked to excess. Adaptability is one aspect of vitality and is probably the simplest way in which it can be demonstrated physiologically. It is in some way linked up with the state of the central nervous system, and particularly with that rather elusive phenomenon, tonus. In the asthenic state, from which X suffered and which was characterised by a want of vitality, the impairment of adaptability was evident in most of the organs. As a result they gave rise to discomfort when they were subjected to the slightest strain. Nor could they adapt themselves to rest ; and consequently

even when resting he would be disturbed by sensations from them coming through to consciousness.

On what is Vitality Dependent?

The constitution a man inherits plays a big part, and so does the state of health. But vitality can be considerably modified by certain factors that can be controlled experimentally.

A. The Endocrines.—The bearing of the endocrine glands on vitality is established. The asthenia associated with Addison's disease is now known to be due to a lesion of the suprarenal glands, and that associated with myxoedema disappears when thyroid extract is taken. Though when endocrine disorders are present this want of vitality is demonstrable in many of the internal organs, endocrine therapy has little, if any, effect on the want of vitality that is associated with asthenia. X derived no benefit from any endocrine product.

B. The Blood.—Though life can go on when the blood-supply is much impaired, any appreciable degree of anæmia or a fall in blood-pressure seriously modifies vitality. It is like a miracle to watch a person who lies almost lifeless from bleeding revive after a transfusion. But in the want of vitality associated with asthenia, the blood-pressure is often normal and blood transfusion leads to no appreciable or lasting benefit. X for his asthenia took one large and several small transfusions, but these brought no relief.

C. Vitamins.—When vitamin A or B is withheld from rabbits they become listless and lack vitality; as soon as the vitamin is given, vitality returns. Though now and again a patient is quite definite about the improvement that follows the taking of cod-liver oil or yeast, vitamins have little action in restoring the impaired vitality seen in ill-health. X derived no benefit from any.

D. Essential Foods.—If these are withheld the health is affected and vitality is impaired. This is particularly noticeable with oxygen and sugar. Anyone who wishes to

know what acute asthenia feels like has just to take an overdose of insulin. Though X took plenty of nourishing food he derived no benefit ; he felt that 4 units of insulin night and morning led to some improvement.

E. Relation to the Blood-pressure.—For vitality to be maintained it is essential that nutritive material should be supplied and that the products of metabolism should be excreted. During an operation a systolic pressure of 80 mm. is dangerous : should it fall much below this, life comes to an end. Though a man can live with a systolic pressure of 80 mm. his vitality is low and the function of all organs is impaired. There is a big difference between just living and the power to do and to endure. The power of some organs, such as the kidney, bears a more definite relation to the blood-pressure than to the central nervous system. Its power to secrete urine is little affected, if its connection with the latter is interrupted ; but a fall of blood-pressure is followed both by a diminution in the power to concentrate and in the amount of urine that is secreted.

F. The Relation to the Nervous System.—When a nerve to a limb is divided there is loss of vitality in the part it supplies. But though there are trophic changes and there may be superficial ulceration, the part does not die. Life still goes on ; if an operation is performed and the nerve regenerates, vitality returns even if two years have elapsed since the time of the injury. When the spinal cord is completely divided, above the lesion there is life and vitality, and below just life but no vitality. Now the parts above and below the lesion have the same blood and endocrine supply. The only difference is that one has vital energy and the other has none. Though life goes on in both one has great adaptability, the other has none.

With all life there is a certain amount of activity which in its simplest form is probably associated with rhythmic motion corresponding to contraction, relaxation, and rest. This is established in cells that have movement, but it has to be assumed for the others since our power to visualise their

activity is limited. Now, vitality is rather the power to adapt this activity towards some purposive end. Whilst in the case of such an organ as the kidney function is so dependent upon changes in the quality of the blood and on the blood-pressure that adaptability seems possible even when the connection with the central nervous system is interrupted, in general it can be said that with most organs, and certainly those containing muscle, adaptability is possible in the true sense only when the connection with the central nervous system is maintained.

N.B.—In this chapter certain aspects of adaptability are regarded as manifestations of vitality, yet in the next chapter they are again spoken of as if they are manifestations of tonus. We have as yet no instrument by which vitality and tonus can be demonstrated and we are dependent for our knowledge of them upon certain clinical observations and our reasoning. It is possible that eventually they will be found to represent the same thing. But, as tonus is regarded as something pertaining to the muscular system, for the time being it is perhaps better to regard tonus and vitality as separate functions. Consequently, though this and the next chapter contain much in common, they should be read as if each represents a definite clinical entity.

CHAPTER VI

TONUS

THE balance and poise of the good athlete make a general appeal. So do the ease and grace with which he carries out movement. The co-ordination of his muscles is so wonderful. In comparison with the man with ordinary health the athlete can do so much without showing evidence of strain. As he has so much in reserve, he is able to adapt himself to conditions as they arise without feeling much effect. This reserve of energy that is so outstanding is easily demonstrated in the cardio-vascular system. When a person in average health takes exercise, an appreciable rise in the pulse rate takes place; there is shortness of breath; and the normal rate is attained only after long rest. With the trained athlete there is a rise in the pulse rate only after severe exercise. And, even then, the original rate is restored after a short rest.

It is difficult to name a clinical feature common to all athletes. A healthy appearance comes to mind; and this undoubtedly applies, if exercise is taken in the open air. Yet many athletes do not look healthy. Nor are they necessarily so, if the test of health is the power to prevent the onset of disease and to overcome it once it arises. On the other hand, good tonus is found in all. But unfortunately no satisfactory definition of tonus is yet forthcoming and the expression has to be used in rather a vague sense.

When healthy muscle is cut across, retraction of the ends takes place because a slight tension is present that tends to approximate the point of origin to the point of insertion. To this tension, which is due to a state of persistent excitation from the central nervous system, the term tonus is applied. Physiologists have devoted much time to its study

and experimental work has been done on its bearing upon posture. Too often, however, the subject is left in the air ; and in recent physiological periodicals, few references to tonus occur. Some regard it as too vast for our comprehension and are content to fall back upon Mosso's remark, " Ah, tonus ! What is tonus ? " But such an attitude spells defeat.

Though a want of tone is an expression not infrequently found in medical writings at the end of last century, few references to the subject are found in current medical literature. The clinical conception of tonus is somewhat different. Unfortunately there is no instrument by which tonus can be estimated in man or in the experimental animal, and each clinician has to rely on his own observations. In the circumstances, it is not surprising that the deductions of any two are rarely the same. It is this lack of precise knowledge of tonus that is a serious hindrance to work upon vitality and energy. A good clinician has little doubt as to when tonus is good or poor ; it is the intervening stages that are so difficult to assess. Now when tonus is good, the muscles are firm and elastic and the knee jerk is brisk. The power of contraction of the muscles is good and their activity can be maintained over a period without fatigue. Generally there is a look of peace and contentment upon the face. When tonus is poor the muscles are flabby and the knee jerk is sluggish. Fatigue occurs easily. Generally the look upon the face is one of lethargy or strain. For clinical purposes tonus is regarded as a state that is estimated by the general bearing and activity of the person or by the activity of an organ. The difference between good tone and hypotonia is best seen when a person in health is compared with one who has *tabes dorsalis*. With the former the muscles feel firm, the posture is easy and natural, and the muscular movement is well co-ordinated. With the latter the muscles feel flabby, the posture is somewhat strained, and movement is inco-ordinated and jerky and lacks force. The difference between tone and atonia is evident when the parts that derive their nerve supply from above and below the lesion in

a case of paraplegia are compared. Below the lesion there is complete loss of power and the muscles are wasted and atrophied. Above there is tonus, vitality, and adaptability.

The Nature of Tonus

Sir Charles Sherrington has shown that two functions are observable in muscle. One a sharp transitory contraction associated with electrical variations and much expenditure of energy and soon leading to fatigue. The purpose of this is obvious since from it arises ordinary muscular activity. The other, a sustained steady contraction that is associated with no electrical changes and that leads, even when maintained for long periods, to little expenditure of energy and little fatigue. The purpose of this sustained contraction which represents tonus is not at first obvious. Through its possession the muscle fibres can take up varying lengths without any increase of tension. As the function of skeletal muscle differs so markedly from that of smooth, the bearing of tonus in each will be separately described.

A. The Skeletal Muscle

This serves many functions. It keeps the structures of the body together, helps to maintain posture, and carries out the contractions that constitute muscular activity. Tonus plays some part in all three, and for descriptive purposes is divided into the tonus of rest, the tonus of posture, and the tonus of contraction.

(a) *Tonus of Rest*.—When the body is at rest certain positions are adopted in which all muscles, tendons, and ligaments are relaxed.¹ These conform to a certain standard, the position of rest (Fig. 1), which is assumed during ease and sleep and from which movement in any direction can be most easily started. Though varying somewhat in each individual, for practical purposes the position of rest may be described as follows: In the erect attitude, when no

¹ *The Lancet*, 1926, p. 728.

accessory means of support are available, the forearm rests on the prominence formed by the great trochanter, which by taking part of the weight relieves the strain upon muscles and ligaments. The upper arm is abducted 30° at the shoulder and is rotated inwards; the elbow is flexed to 120° ; and the wrist is dorsiflexed 30° with the hand midway between pronation and supination. In the hand (Fig. 2), the fingers are flexed 30° at the metacarpo- and inter-phalangeal joints. The thumb is abducted 30° in a plane at right angles to the palm and is flexed 30° at both joints. Four main arches are present—a proximal and a distal transverse, and an inner and an outward longitudinal. The proximal arch is formed by the carpus and bases of the metacarpals. The distal arch, formed by the heads of the metacarpals, is continued forwards to the tips of the fingers. With flattening of the

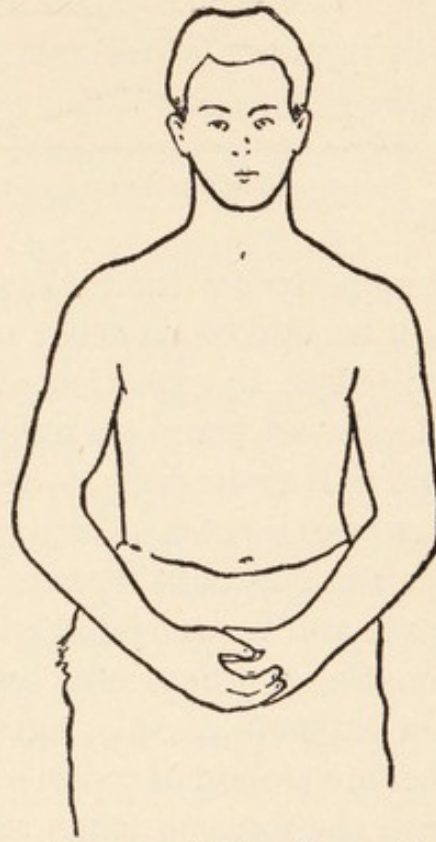


FIG. 1.—This shows the position of rest. It is taken up by the body immediately after birth and is resumed right through life when the body is at ease.



FIG. 2.—The position of rest for the hand.

latter arch the power of flexion of the fingers is lessened, with flattening of the former that of the thumb. The outer arch is formed by the outer portion of the carpus and thumb. The inner arch is formed by the metacarpals and the phalanges of the fingers. In the lower limb (Fig. 3), the hip is flexed 30° and is slightly ab-

ducted and everted, the knee is flexed 30° , and the ankle is dorsiflexed to a right angle. In the chest the obliquity of

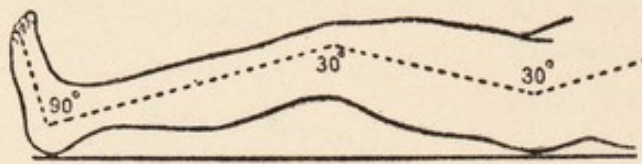


FIG. 3.—The position of rest for the lower limb.

the ribs is maintained, so are the cervical, dorsal, and lumbar curves in the spine.

The position of rest can be assumed for

long periods without the slightest discomfort or fatigue. This can be said of no other posture. When the hand is immobilised in the position of rest for several weeks, there is no discomfort; and on removal of the splint full forcible contraction of the muscles can take place, showing that no strain has been thrown on any structure. Any other posture can be maintained only by contraction of the muscles or by passive force and is associated with hyper-relaxation of one group of muscles and ligaments and stretching of the opposing group. On account of this, extension of the fingers causes an ill-defined feeling of strain over the palmar surface which passes into the forearm when the wrist is dorsiflexed, and which is relieved when the position of rest is resumed. It is also felt to a lesser degree over the dorsum when the wrist and fingers are flexed. Were the hand to be immobilised in either position for some weeks, a dull pain would be present; and, when the splint is removed, there is a slight temporary weakness due to continued tension on the muscles and ligaments. The knee may be taken as an example of the larger joints. When immobilised in the fully extended position, there is a feeling of discomfort over the back of the joint which passes off when it is slightly flexed. In the former the knee has been placed at rest, and in the latter in its position of rest, the essential difference being that whilst the latter includes the former, it also means that no strain is thrown on any structure round the joint.

In the maintenance of the position of rest, bones, ligaments, and muscles all play a part. But important as are the bones, they serve merely as scaffolding, so that other

structures can function. If one is missing, the limb becomes distorted and its function lost. Yet all can be restored if a graft or some mechanical contraption is substituted. The relative importance of muscles and ligaments was well displayed in gunshot wounds of the knee. If the internal lateral ligament was ruptured, there was lateral mobility. If the crucials were ruptured, it was surprising to note what little disablement there was, provided the quadriceps did not atrophy. Again, in cases where the patella was removed, little disablement followed ; and, if the quadriceps was not damaged, many men were able to carry on without support to the knee. So that, whilst the ligaments give stability to the joint, they are not essential for function ; if they are destroyed, a fascial graft substituted in their place is often quite efficient. When the quadriceps was destroyed, conditions were quite different. Even when a knee cage was worn, the ligaments would stretch and the joint would become flail. The loss of muscular power can to some extent be remedied by transplantation of muscles and tendons ; but operative treatment is now successful only if similar structures with their nerve supply intact are substituted. The transplantation of some other structure, that is so serviceable when a bone or ligament is damaged, is useless. It is thus obvious that, essential as are bones and ligaments to give shape and stability, the muscles are the most important structures. For once they are destroyed, ligaments stretch and joints become flail. Yet for muscles to function properly, they must receive impulses from the spinal cord. In anterior poliomyelitis only the cells of the anterior horn and those supplying tonus are damaged. If those supplying the lower limb are affected, the knee joint becomes flail. Here the muscles, bones, and ligaments are not damaged. It is evident therefore that, no matter how perfect are the structures in a limb, their function is possible only if a supply of energy is available from the central nervous system.

The bearing of tonus upon the position of rest is illustrated

by the following: When the musculo-spiral nerve is injured the wrist is dropped (Fig. 4) owing to gravity being unopposed by the tonus in the

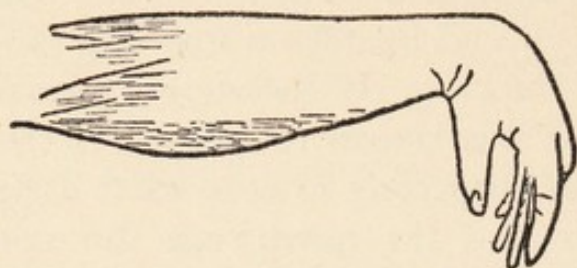


FIG. 4.—Wrist-drop following a lesion of the musculo-spiral nerve. The bones and ligaments are not damaged. All that is wanting is tonus in the extensor muscles. The dropping of the wrist is usually attributed to the action of gravity not being countered by tonus of the extensor muscles.

posed by the tonus in the extensor muscles. When the median and ulnar nerves are injured, the claw-hand deformity is taken up (Fig. 5), the wrist becoming hyper-extended and the fingers hyper-extended at the metacarpo-phalangeal and slightly flexed at the inter-phalangeal joint. This is due to the tonus in the

extensor muscle no longer being countered by the tonus of the flexor muscles. Once one of these nerves is injured, the position of rest is not again resumed until regeneration takes place. Yet the bones and ligaments are unchanged. The power of contraction is lost in the muscles, but this takes no part in maintaining the position of rest. Tonus is wanting.

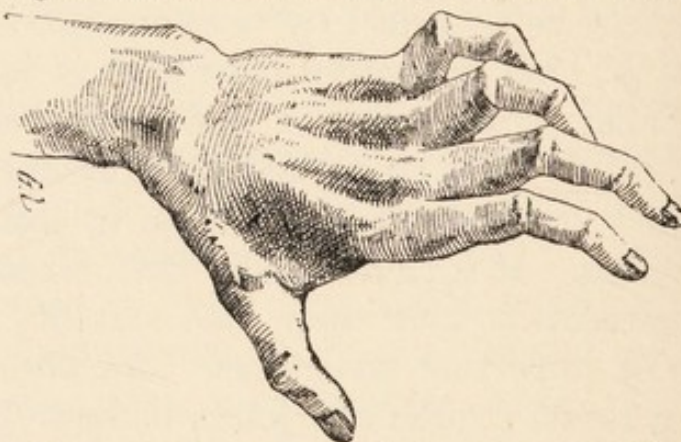


FIG. 5.—Claw-hand following a lesion of the median and ulnar nerves. Here the bones and ligaments are not damaged. All that is wanting is tonus in the flexor muscles and the small muscles of the hand. The deformity is entirely due to the tonus of the extensor muscles not being countered by that normally present in the flexor muscles. Gravity takes no part.

(b) *Tonus of Posture.* — Voluntary power is present in many muscles at birth and is acquired to

(Rose and Carless' *Surgery*. 10th edition. (Baillière, Tindall & Cox).

a greater degree as the intellect develops. At the same time tonus is also increased and the muscles become bulkier.

Early on the erect posture is attained only with difficulty and considerable voluntary effort is needed to maintain it. As the child grows older and stronger these movements are performed with little voluntary effort and are maintained entirely by reflex contraction. Though this passes so imperceptibly into voluntary contraction that there appears to be no dividing line, they are not the same. For, when the crura cerebri are cut through in cats, a state of rigidity of the muscles known as decerebrate rigidity arises. Though tonus persists, voluntary contraction is no longer possible ; yet reflex contraction can still be carried out and the postures normal to that animal can be taken up.

(c) *Tonus of Active Contraction*.—Active contraction and tonus are separate functions of muscles. But if the power of the former is to be maintained and if movement is to be co-ordinated, tonus is essential. There is a big difference to be noted between the function of the muscles in the healthy, where tonus is good, and in the unhealthy, where tonus is poor ; for with the latter the power of contraction is so quickly lost if a sustained effort is necessary. This is very evident in tabes where hypotonia prevails, the loss of power and the jerky inco-ordinated nature of the movement now being so conspicuous.

B. Smooth Muscle

With the internal organs it is essential for man's peace of mind that stimuli should not constantly come through to consciousness. As a result of the muscle fibre being able to increase in length without any increase in tension, a smooth muscular organ can adapt itself to varying volumes without any rise of pressure within. This power to increase in length without giving rise to tension is due to tonus. This also seems to play a part in that active contraction which is essential if the organ is to function. For, when tonus is good, the muscle contracts smoothly and evenly ; and, when tonus is poor, the muscle contracts sluggishly and spasmodically.

The stomach serves to illustrate this. It must be able to hold and to digest food without consciousness being disturbed, and for this purpose is divided into two parts—the fundus where food is contained, and the pylorus where it is digested. To allow of food being swallowed rapidly the fundus is able to distend without any rise of pressure being set up. In the pylorus regular co-ordinate movement takes place. When the stomach is at rest, X-rays suggest that the walls are not flaccid but are slightly tense. Whether the organ as a whole or the single movement is examined, three phases—contraction, relaxation, and rest—are obvious, in each of which tonus plays some part. X-rays enable us to note the difference between good tonus and hypotonia. With the latter movements are not so regular; and even when at rest the stomach has not the firm appearance that is seen in the healthy. In all phases of its activity sensations now come through to consciousness; and, though not amounting to pain, they are yet sufficient to disturb the sense of well-being.

The function of smooth muscle is perhaps better examined in the bladder. For being a hollow muscular tube that serves as a reservoir, its function is relatively simple. With the rise of intravesical pressure the desire to micturate is set up. Normally the bladder can hold 10 ounces before this rise occurs; this being possible from the power of its muscle to lengthen without being placed under tension. Should facilities exist, the sphincters relax, the muscle contracts in a steady manner, and the bladder is completely emptied. Though the muscle is now in a state of rest, recent work suggests that it does not lie flaccid, but is still slightly tense. In every act of micturition the three phases—contraction, relaxation, and rest—are evident. Now if it is not convenient to pass urine, further relaxation of muscle is possible and the rise of pressure passes off. On the other hand, even when the bladder holds only 5 ounces, urine can be passed. It is stated that the necessary rise of intravesical pressure is set up by contraction of the lower abdominal muscles.

This no doubt at times takes place. But each person can note for himself that often the abdominal muscles do not come into play. Rather does it seem that at the direction of the will the sphincter can be made to relax and the bladder muscle to contract. This power of the bladder to relax, to contract, and to be at rest is dependent on a supply of tonus ; it is no longer possible when the spinal cord is divided.

Relation of Tonus to Clinical States

Tonus bears a definite relation to the state of health and is affected by anything that impairs this. This is particularly noticeable with hæmorrhage and bacterial disease. The difficulty in estimating tonus clinically is considerable, as we have no instrument by which it can be recognised.

Relation to Nutrition.—When a voluntary fast is undertaken, there may be little wasting ; and little change in tonus occurs. But when malnutrition is prolonged, impairment of tonus is evident. This is particularly noticeable if there is a deficiency of vitamin A or B.

Relation to the Endocrine System.—With exophthalmic goitre there is hypertonia. With myxœdema and Addison's disease there is hypotonia.

Relation to the Special Senses.—In the blind the state is one of hypotonia and the face has a placid look ; at times it is expressionless. With the deaf there is often a worried look, particularly if deafness is due to some nerve lesion. This look is due partly to the effort they make to hear what others say. But some other factor comes in ; for even with deaf people who shut themselves off from the world, this worried look is still to be seen. It seems that a state of slight hypertonia prevails.

Relation to Mental States.—With mental activity leading to concentration, there is an increase in tonus which is visible to the eye. An increase of tonus is also present during emotion and after the loss of a single night's sleep. But when emotion is prolonged, when there is mental strain

or anxiety, or when there is prolonged loss of sleep, hypotonia is very evident.

Relation to the Skin.—As the external temperature falls and the skin is chilled, tonus of the muscles increases and may pass on into shivering. When an ice-bag is applied to the skin, spasm of the underlying muscle, due to hypertonia, arises. In hot weather tonus decreases. The application of heat to the skin relieves spasm by diminishing tonus. This is the one reason why the hot fomentation and the poultice give relief in pain. For, whatever the cause of this, it is certainly aggravated by spasm of the muscle. The relief in the pain that follows the application of a seton or blistering the skin is no doubt due to some reflex action upon tonus.

Relation to Diseases of the Central Nervous System

With a lesion of the spinal cord or of a peripheral nerve, there is atonia in the skeletal muscles supplied; in the smooth muscular organs tonus is markedly impaired but is rarely completely lost. In tabes dorsalis, hypotonia is very evident. This is responsible for the absent knee jerk, the inco-ordinated movement, and the overflow incontinence. In lesions of the cerebellum, atonia exists, and is associated with marked muscular inco-ordination; now when the limb is held horizontally, instead of the wrist being semiflexed it is now completely flexed owing to the absence of tonus in the anti-gravity muscles. With a lesion of the Rolandic area there is first atonia, for the limb lies flaccid. But in a short time spasticity develops in the limb which is due to hypertonia. When recovery follows a lesion of the corpus striatum, hypertonia arises in the parts affected.

Relation to Anæsthesia

General Anæsthesia.—When ether is given, there is first a stage of excitement, when voluntary movement is possible. This is followed by a stage of hypertonus, when the muscles become rigid. As anæsthesia is deepened, the muscles relax

and tonus becomes less. I am doubtful if it is ever completely abolished with ether. For, when a limb is amputated, slight retraction of the muscles still takes place, even when anæsthesia is deep and relaxation seems perfect. With chloroform the stage of excitation is less evident and the stage of hypertonia does not arise. When relaxation is perfect, it is possible that tonus is almost abolished; for when the muscles are cut across at times they no longer retract.

Spinal Anæsthesia.—Tonus is abolished in the skeletal muscles and in most of the smooth muscles. But in the abdomen a curious state is at times found; for, even when the abdominal muscles are completely relaxed, the small intestine may be in a state of spasm.

Local Anæsthesia.—The injection of 1 per cent. novocain into a motor nerve leads to paralysis of the muscle, which becomes relaxed. When the skin alone is anæsthetised, it is my impression that the underlying muscles relax. But for relaxation to be perfect, it is essential that the whole of the area of skin corresponding to the nerve supply to the muscles should be infiltrated. Though tonus is abolished, voluntary contraction is still possible.

This bearing of anæsthesia upon tonus is of great importance. It is possible that careful work along these lines may lead to important findings. It was my great wish to undertake this; but the setting up of team work, which now that knowledge has become so vast is essential to bring anything to completion, was not possible. Hence the paucity of my findings.

The Cause of Tonus

Though tonus is in some way related to the state of health, the blood-pressure, and the endocrine system, none of these is its cause. Each is, however, essential for its maintenance; and, when one is impaired, tonus is imperfect.

Tonus disappears from skeletal muscle when the peripheral nerve is divided, but does not seem to be affected after lumbar or cervical sympathectomy. Therefore tonus comes

from the central and not from the autonomic nervous system. When the spinal cord is divided, whether high up in the cervical region or low down in the lumbar, tonus disappears from the muscles drawing their nerve supply from below the lesion. When the crura cerebri are divided, a state of hypertonia prevails and reflex postural contraction is still possible. Therefore the centre for tonus lies between the upper part of the spinal cord and the crura cerebri. It is probably represented by the red nucleus in the mid brain. Once this is destroyed tonus disappears and with it reflex postural contraction. The limbs now assume the position in which they are placed. Tonus is also definitely related to the skin; for when there are extensive sensory changes as in tabes and in local anæsthesia, tonus is impaired.

The bearing of tonus on smooth muscle is a big subject and is best considered in relation to the bladder. After division of the spinal cord, the muscle is at first completely paralysed and retention with overflow follows. If the bladder is massaged through the abdomen, the power to contract may return and urine may be expelled, particularly if the muscle is excited reflexly by stimulating the perineum. This contraction may be inherent in the muscle itself, but more probably is dependent upon the local autonomic system. This passage of urine is, however, not the same as normal micturition, which is so purposeful, and in which the muscle contracts, the sphincters relax, and the bladder is completely emptied. The contractile power of the muscle after division of the cord is quite different from that which is possible when tonus is normal; the purposive rôle is gone. For the movement is jerky and spasmodic, lacks co-ordination, and complete emptying does not take place. True adaptability is therefore lost. As tonus disappears when the cord is divided, the centre must lie in the brain. The function of the bladder does not appear to be modified by division of the crura cerebri. Therefore the centre must lie below this. Barrington¹ has shown experimentally that it is situated in

¹ F. J. F. Barrington, *Brain*, 1921, xliv, pp. 23-53.

the pons. When this centre is destroyed, tonus disappears and complete contraction and relaxation are no longer possible. Tonus disappears from the bladder when the pelvic nerves or the posterior sacral nerve roots are divided. It is not affected by division of the hypogastric nerves or by presacral neurectomy.

The word tonus implies a state of persistent excitation of the muscles due to the passage into them of impulses, from centres in the central nervous system. In all probability these impulses are not the same as an ordinary nerve impulse; this accounts for the failure to produce tonus by electrical excitation or by any drug. These impulses are believed to result from the cells of these centres being in a state of constant rhythmic activity, such as is demonstrable in the vasomotor and respiratory centres. Stimuli from the posterior nerve roots seem to be essential for the maintenance of tonus. When these roots are divided tonus disappears from the muscles drawing their nerve supply from the corresponding segment of the cord. Physiologists say that this is due to the absence of stimuli from the joints, muscles, and ligaments, and claim that those from the skin normally play little part. This is, however, totally opposed to clinical findings. Pain is generally due to spasm of the muscle, which is merely an increase of tonus. The relief that follows the application of heat is due to this spasm being lessened. As we know that heat applied externally does not penetrate into the tissues to an appreciable extent, the diminution of tonus must be due to changes set up reflexly from the skin. A surgeon who had gall stones with pain referred to the right subcostal region and the tip of the shoulder tells me that the injection of 1 per cent. novocain into the skin where pain was experienced invariably led to relief. The only way that this can act is by relieving the spasm. When operating under local anæsthesia the injection of 1 per cent. novocain into the skin does lead to relaxation of the underlying muscle.

The relation of tonus to the special senses has already been

referred to. When the semicircular canals are destroyed there is hypotonia of the skeletal muscles. When running water is heard or a urinal is seen the desire to micturate often arises. This is frequently attributed to reflex action. As no paths have been demonstrated between the eye and ear and the bladder, such a view is possible only by giving an extremely broad interpretation to the word reflex. Desire to micturate we know is due to a rise of intravesical pressure. At such a time relaxation is replaced by contraction, and all that is known is that some change has occurred in tonus. This seems to be affected by the special senses in the same way as by stimuli from the posterior roots.

It is a general property of smooth muscle to maintain itself in a certain degree of shortening apart from impulses from the nerve centres. When smooth muscle is removed from the body and placed under tension, rhythmic activity is set up in which the three phases of contraction, relaxation, and rest form the basis. Since the tension that exists in muscle is regarded as equivalent to tonus, it might be said that tonus is inherent in smooth muscle, for this was the definition given on page 103. When the excised stomach is kept in situ in a suitable medium and slightly distended, rhythmic movement amounting to definite peristalsis is set up. But this lacks the co-ordination and purposiveness of that seen when the normal stomach is rendered opaque by the barium meal. Now in the clinical sense tonus controls if it is not akin to adaptability, being regarded as that property that allows a muscular organ to contract, relax or rest according to its own need or that of the body as a whole. Certainly in the case of the bladder tonus used in this sense is dependent upon contact being retained with the centre in the pons. It can, however, be modified by impulses from the special senses or the posterior nerve roots. As normal micturition is possible when the crura cerebri are divided, the tonus of smooth muscle seems to be completed in the mid-brain.

There seems to be no tonus inherent in skeletal muscle.

For though when the cord is divided the muscles drawing their nerve supply from below the lesion go on living, they show no sign of activity. The centre for tonus lies in the mid-brain in the region of the red nucleus, and once the crura cerebri are divided a state of hypertonia prevails. Yet purposive contraction and rest are no longer possible. So that though the stimuli giving rise to tonic contraction arise in the mid-brain, tonus of skeletal muscles, as used in its clinical sense of the power given to an organ to carry out purposeful activity, is not completed there. It is evident that centres in the basal ganglia or in the cortex exercise a controlling influence over the tonus of skeletal muscle.

The Purpose of Tonus

This is shown so well in the bivalve mollusc *pecten*, where the large striated adductor muscle giving rise to active contraction and the smaller smooth muscle giving rise to tonic contraction are separate structures. The former closes the shell rapidly and then relaxes, the valves being now held together by the contraction of the latter. The weight required to separate the valves when the latter muscle is contracted is many times that which is needed to prevent the closure of the shell when open. This observation is of much importance, as it demonstrates the great power inherent in tonic contraction. For, though this cannot initiate powerful movement, it seems able to maintain very effectively what active contraction can accomplish. As this tonic contraction can be carried on for twenty to thirty days without fatigue and without loss of weight, even if the mollusc is fasting, it is evident that tonic contraction leads to little expenditure of energy. The saving is therefore very great.

In man it is believed that active contraction and tonic contraction are quite separate functions of muscle. For clinically it is found that though at times muscular development is good and the power of contraction is forcible, the muscles are

not able to maintain this power for any length of time. If, as seems likely, that tonic contraction in man is associated with little expenditure of energy, the saving is extremely great if tonic can be substituted for active contraction. For the mere rousing of consciousness, and certainly if concentration is needed, leads to the expenditure of much energy and is fatiguing. As each is necessary for active contraction, the tendency in man is to replace as far as possible voluntary by reflex contraction, which is mainly tonic contraction. The saving of energy that results is very great. It is an advantage to the individual to have his organs brought into the position of rest and maintained there once the need for activity is over ; for in this position all structures are relaxed and from it movement can be most easily started. As the resumption of this position and its maintenance is due to tonus, very little strain is thrown upon the body and little energy is needed. It is believed that tonic contraction takes place whenever active contraction is set up and is closely associated with the latter, for which it can be substituted at any time. It is owing to this feature that the power of active contraction can be sustained, and the sudden sharp jerky movement seen when a nerve is simulated is replaced by movement that is smooth and co-ordinated. But there is no sharp line of division between active contraction, reflex contraction, and rest ; for one passes imperceptibly into the other. Tonus functions in each ; as we have no method of identifying it, it is not possible to be certain of the part it plays. For the time being I am assuming that with skeletal muscle there are three kinds, tonus of contraction, postural or reflex tonus, and the tonus of rest.

In the case of smooth muscle tonus supports active contraction. It also permits of relaxation. It also plays some part in maintaining rest. Tonus is essential if the contraction is to be smooth and not spasmodic or jerky and if relaxation is to be steady without any increase in tension and not a sudden rebound. When tonus is good, movement is co-ordinated and adaptability is possible.

Until we have some instrument by which tonus can be measured there is bound to be much doubt as to whether tonus is an entity in itself or whether it is composed of three factors, contractile tonus, relaxile tonus, and the tonus of rest. The position at present is extremely complex. I am inclined to the latter view.

Can Tonus be Modified by the Will?

In the case of the bladder, should the desire to pass urine arise and should no facilities be available, the act can be deferred for a time ; desire now passes off. The fall of intravesical pressure can be due only to the fact that further relaxation of the muscle is possible. It is said that as a result of the influence of the will, inhibitory impulses are sent from the cortex. But this is, after all, just a figure of speech, for no one has demonstrated these impulses. What has taken place is that the contraction that leads to the rise of pressure has passed off and is replaced by a greater degree of relaxation.

Those who believe in reflex action regard relaxation as due to the passage of inhibitory impulses to a muscle, relaxation being merely the cessation of contraction. According to the view expressed here, relaxation is a positive state due to a further supply of relaxile tonus. As a result greater lengthening of the muscle fibre is possible before tension arises. If this is the case, tonus can be to some extent controlled and modified by the will.

CHAPTER VII

THE BEARING OF THE CENTRAL NERVOUS SYSTEM UPON BACTERIAL DISEASE

THE relation of bacterial disease to malnutrition and to impaired states of the health in general is established. When, however, it occurs in those previously healthy, so often there is a history of undue fatigue, or some mental catastrophe, strain, or worry; all these lead to mental exhaustion. Such a history is more frequent than is to be expected from mere coincidence. At such a time, when a man looks ill and some disease seems imminent, removal of the strain may be followed by immediate restoration of health. Sir James Paget says : ¹

“ I mention these things that I may illustrate, as I have often before done, the influence of fatigue in developing disease or in at least making one susceptible of it. I can be as sure of anything which has now occurred that, if I could have rested for two or three days after the insertion of the virus, it would have done me little or no harm. I cannot tell you whether it is mere diminution of a normal power of resisting changes, or, as Dr. Carpenter has shown to be more probable, by the production in the fatigued organs of some material on which morbid poisons may multiply or flourish ; but you will find in every day's practice that fatigue has a large share in the promotion or permission of disease than any other single casual condition you may name.”

The value of a good night's sleep in combating bacterial disease has always been appreciated ; and, when influenza or the common cold seems imminent, either may be aborted if rest in bed is possible straightaway. With bacterial disease the prognosis is invariably good once natural sleep is forthcoming.

¹ *Clinical Lectures and Essays*, p. 328.

Though there is little doubt of the important bearing of fatigue upon bacterial disease, at times a feeling of well-being precedes the onset. Some catastrophe, such as pneumonia or tuberculosis, may arise at a time when a man feels ever so fit. This feeling of well-being is sometimes due to the stimulation from the mild toxæmia that takes place during the incubation period. For instance, a friend tells me that one night in India he sang and played to perfection. He felt almost like one possessed and was the star turn of the evening. The following morning he was down with his first attack of malaria. I am under the impression that there is a feeling of well-being which is independent of any toxæmia and which in some way predisposes to the onset of bacterial disease. For instance, some years ago a friend told me that he was certain to have an attack of pneumonia within a few days. He knew this because he felt so fit. He had had five previous attacks, and a similar feeling had preceded each. He had tried to work this feeling off by taking plenty of exercise and had merely been blamed for his foolhardiness. On this occasion he stayed indoors, but this did not prevent pneumonia from developing. At times it is noticeable how those who work in hospitals or the post-mortem room come back from a holiday feeling and looking fit and yet in a few days may be down with a sore throat that may lead to a fatal result. Some think that immunity has disappeared. But from what is known of immunity, this is unlikely in so short a time. Rather does it seem as if a certain state of increased vitality in some way predisposes to the onset of bacterial disease. This relation of bacterial disease to fatigue and increased vitality is possibly due to the power of resistance being in some way linked up with the central nervous system.

Clinical Findings

A. Diseases of the Nervous System

(i) Bacterial disease runs a less severe course when any nervous disease is present. Pneumonia, for instance, is

particularly benign in such diseases as tabes or general paralysis of the insane. Though the temperature is high and the respiration rapid, pain is usually slight and the patient looks and feels well. Empyema is relatively rare. It is surprising with what ease one who is mentally afflicted gets over an attack that would lay a normal person low. This absence of any marked reaction with bacterial disease is seen in nervous diseases in general. The perforating ulcer of tabes is a case in point. For, though it may extend deeply, it is rare for it to be the seat of acute inflammation.

(ii) In gunshot wounds of the spine where the cord is damaged, massive sloughing of the tissues and bed-sores are common. Though healing is extremely slow, it is rare for acute spreading inflammation to arise. The absence of a severe reaction is a conspicuous feature. Little can be done in the way of treatment. Remedies that ordinarily are so effective are now of little value, as the process they ordinarily set up can no longer be brought into action, the tissues being unable to respond.

(iii) When a nerve is completely divided, tropic changes in the skin are common and a superficial ulceration is by no means rare. These show little tendency to heal ; for it does not seem possible for the tissues to set up sufficient reaction. On the other hand, acute inflammation is rare. Some hundreds of lesions of the peripheral nerves passed through my hands during the War ; and, as the majority were treated in the same wards as septic compound fractures, opportunities for infection were only too common. But I cannot recall one in which acute inflammation arose in the area supplied by the damaged nerve, though injuries to the part were not uncommon.

(iv) With acutely inflamed boils or carbuncles the injection of $\frac{1}{2}$ per cent. novocain or 1 in 1,000 percaine into the surrounding tissues twice a day causes the pain to become less. At the same time the inflammation subsides. Spiess¹ has shown that, when the pain of an inflammation is removed

¹ Spiess, G., *Munch med. Wochenschr.*, 1906, vol. liii, pp. 345-351.

by orthoform or novocain, all sorts of wounds heal quickly. He says :

“ Inflammation does not occur if it is possible by means of anæsthesia to suppress the reflexes in the centripetal nerves coming from the inflammatory focus. Inflammation which already exists heals rapidly when the inflammatory focus is anæsthetised. The anæsthesia must affect only the sensory nerves and must not affect the normal behaviour of the sympathetic nerves.”

(v) In lesions of the Rolandic area giving rise to spastic hemi- or monoplegia, the limb eventually wastes from disuse and circulatory changes appear ; only rarely does ulceration or bacterial disease arise.

(vi) After division of the cervical and lumbar sympathetic nerves there is no tendency for bacterial disease to arise in the limbs.

B. The Urinary Tract

This relation of bacterial disease to lesions of the nervous system is seen in the case of the bladder, which has normally great resistance. In a healthy person and in animals it is almost impossible to set up bacterial disease. Should this take place, it quickly disappears unless some local lesion is present. One surgeon to whom I acted as house-surgeon had a large out-patient clinic. He had little belief in asepsis, and, when starting work, would put on a very old morning coat. Boric lotion (5 per cent.) was the only anti-septic employed for both gum elastic and steel instruments. Olive oil was the lubricant. He would pass from one patient to another without washing his hands and never cleansed the meatus. An instrument after being used was just replaced in the lotion and was never boiled. Yet none of the cases went septic. For it is established that when bacteria pass into an otherwise healthy bladder they do no damage. Yet when there is any disease of the central nervous system, it is extraordinary how easily bacterial disease arises and how persistent it becomes.

(i) After operation for cancer of the rectum damage to

the pelvic nerve may lead to paresis of the bladder muscle. If catheterisation is necessary, bacterial disease is likely to arise. The reaction is usually slight, and the disease persists until the muscle regains its power.

(ii) After injuries to the spine when the cord is divided, retention of urine follows. If a catheter is passed, bacterial disease of the urinary tract invariably follows, and, if cystostomy is not performed, spreads to the kidneys and leads to death. Cystoscopy shows that, whilst the bladder wall tends to slough and is covered with phosphates, there is little congestion and reaction in the surrounding parts. When the kidneys are involved, there is little pain or tenderness over the renal area.

(iii) In an asthenic nervous disease such as tabes, atony of the bladder is the rule. If catheterisation is necessary, bacterial disease follows and goes on for the remainder of life. But it is rarely virulent and by itself does not lead to death. Rarely is there any severe reaction ; and even when the disease has persisted for years, ulceration in the bladder is not marked.

(iv) Though disorders of micturition are not common with lesions of the cerebral cortex, yet sometimes in the early stages retention of urine supervenes and catheterisation is necessary. There is now not nearly the same risk of bacterial disease as after a lesion of the spinal cord ; in fact, it is quite exceptional for it to arise.

(v) After division of the presacral nerve the resistance of the bladder to bacteria does not seem to be impaired.

The Bearing of the Nervous System

Bowlby and Andrewes¹ say :

“ The nervous system plays in inflammation a less striking share than might have been anticipated. The influences which govern the behaviour of the leucocytes seem purely of a chemical nature. All phenomena of acute inflammation can go on quite well in regions bereft of their nerve supply ; for instance, in a rabbit's ear, all the nerves to which have

¹ *Surgical Pathology*, 6th edition, p. 33 (J. & A. Churchill).

been divided. The only part which the nervous system seems to play in inflammation is to be found in the vasomotor mechanism. Anything that impairs vasodilatation hinders the promptness and efficacy of the inflammatory reaction."

This applies to the physiological aspect of inflammation, for there is no question that the processes giving rise to this can occur in a part deprived of its nerve supply, for ulceration which is so common is just a variety of inflammation. There is, however, a big difference between the way in which wounds heal in normal tissues and in those deprived of their nerve supply, and healing of a wound is really aseptic inflammation. This difference is more marked should bacterial disease arise.

From the clinical findings there is no question that the power to prevent the inroad of bacteria and to set up those reactions that are essential for the overcoming of bacterial disease are in some way bound up with the nervous system. This was much stressed during last century. Hutchinson wrote :¹

"Catarrhal inflammations, in the sense in which I have used the word, are always peculiar. Their fundamental peculiarity is that they take their origin in connection with the nervous system, and are but little in dependence on the state of the blood, or what is known as the state of the general health."

· Paget wrote :²

"It is probable that among the conditions most often determining, after this manner, the local appearance of a constitutional disease is some disturbance of the nervous influence in a part ; a disturbance affecting not only the size of the blood-vessel and the quantity of blood, but, much more importantly, the relations between the tissues and the blood, which are organic or of the most refined chemistry. Crowds of facts make it certain that such disturbances may excite or may permit disease in a part. We are obliged, indeed, to speak vaguely of such cases ; we do not know the nature of the disturbance : we have to call it nervous irritation, and its results appear inconstant. . . . I wish it were

¹ *The Clinical Journal*, vol. ii, p. 307.

² *Clinical Lectures and Essays*, p. 429.

not necessary to add that in thus referring to nervous irritation for the explanation of many instances of the localisation of constitutional disease, we do not escape from the difficulty, but only push it a step further off. For the question remains, what determines that one portion rather than another of a nervous centre should be irritated? I have not read and cannot guess the answer."

It is my impression that the power to prevent and to overcome bacterial disease resides in a centre situated in the mid-brain. The following points lend some support to this.

1. Except in the case of the pelvic nerves, division of the autonomic nervous system does not affect resistance in the part supplied.

2. When a peripheral nerve is divided, resistance is lowered in the part it supplies.

3. When the spinal cord is divided, resistance is lowered in the parts that draw their nerve supply from below the lesion. This is the case whether the cord is divided high up or low down. The centre therefore must lie above the cord.

4. When the cerebral cortex is damaged and paralysis follows, resistance is not affected.

As the centre must lie between the cortex and the spinal cord, it is assumed to be in the mid-brain.

As the impulses from the central nervous system have so important a bearing in the maintenance of resistance and in limiting and overcoming disease,¹ a résumé of bacterial dis-

¹ Abernethy wrote (*Remarks on Scepticism*, by Thomas Rennell, 1819, p. 116): "Disorder, which is the effect of faulty actions of nerves, induces disease, which is the consequence of faulty actions of vessels. There are some who find it difficult to understand how similar swellings or ulcers may form in various parts of the body, in consequence of general nervous disorder, and are all curable by appeasing and removing such general disorder. The fact is indisputable. Such persons are not so much surprised that general nervous disorder should produce local effects in the nervous and muscular systems; yet they cannot so well understand how it should locally affect the vascular system. To me there appears nothing wonderful in such events, for the local affection is primarily nervous, and the vascular actions are consequent. Yet it must indeed be granted that there may be other circumstances leading to the peculiarities of local diseases, with which, at present, we are acquainted. Disorder excites to disease. . . ."

ease is given here. Lister demonstrated that putrefaction did not arise if bacteria were prevented from gaining entrance to the tissue or were destroyed soon after doing so. Antiseptics were first used for this purpose. Later, when it was found that bacteria could be destroyed by heat or be removed by soap and water, the idea of aseptic surgery arose. This was so successful that, when a wound that was made in healthy tissue went septic, this was attributed to a want of care in the preparation of the skin of the patients, of the hands of the surgeon or his assistants, or of some material used in the operation. Those who dressed before the War will recall some bacteriologist suddenly descending upon the dressers who were washed up in the theatre and taking specimens from the nails. Heaven help the dresser from whom a culture was grown! Most rigid precautions were undertaken, as it was assumed that a single bacterium gaining entrance into a wound would set up inflammation. It was also believed that a few bacteria in the blood created a state dangerous to the host. For they would multiply and lead to septicæmia or they might be deposited in an organ and give rise to inflammation. But as knowledge increased certain facts came to light that upset the theory. It has been demonstrated experimentally that large quantities of bacteria can be injected into animals without leading to disease and without affecting the health, the outstanding feature being the rapidity with which they disappear. In pneumonia and typhoid, bacteria are present in the blood in the earliest stages and disappear as the local disease becomes evident. They persist, and septicæmia develops, only if the patient is going to die. The presence of bacteria in the blood in disease is commoner and of less importance than was thought. With improvement of technique they can be detected when the patient is only slightly ill and no serious state of disease need ever arise. Barrington and Wright¹ examined a series of urinary cases and found that,

¹ F. J. F. Barrington and H. D. Wright, *Journal of Pathology and Bacteriology*, 1930, vol. xxxiii.

where the urine in the bladder was previously infected, bacteria could often be detected in the blood within a few minutes after the operation upon the urethra. They disappeared quickly from the circulation. Invasion of the blood was likely to occur again when urine was first passed. In most cases there was no rise of temperature. In only one was there a rigor. Now not one of the patients was ever seriously ill nor did signs of inflammation arise in a single organ.

Man has a great natural resistance to disease and it is rare for this to arise the first time he is exposed to the harmful influence. Provided he is in a state of health and his organs are undamaged, he is able to overcome bacteria with remarkable ease. Were bacteria to be injected into one hundred fit men in a fair state of health the chances are that disease would arise in very few.

During the War practically all the wounds must have been infected. Yet only a proportion went septic. This was more likely if there was extensive destruction of tissue. It was also dependent upon the state of the general health. For, when this was impaired and particularly if there had been mental strain or fatigue, the bacteria were likely to become active. But notwithstanding the large amount of material that came our way little advance took place in our knowledge of the factors by which disease is limited and eventually overcome. There is no test by which the natural resistance to disease can be estimated. And though the powers of resistance become obvious as the case progresses, in the absence of any standard, the discussion on the subject tends to become abstract.

The Resistance Factor

For bacterial disease to arise bacteria are essential. But when they enter the tissues they are destroyed if present in moderate numbers and if the host is in good health. The anti-bacterial bodies that are produced in the reticulo-endothelial system being sufficient, no local reaction is set up. We therefore speak of the resistance factor, by which is

meant that power inherent in the tissues and body fluids to destroy bacteria that enter. Unfortunately, this is just a phrase, as we have no method for estimating it. Now resistance is dependent upon the vitamins, for when these are withheld in animals, bacterial disease is likely to arise. Resistance is dependent upon the endocrines, for when some disorder of these is present, as in exophthalmic goitre or myxœdema, there is a greater liability to bacterial disease. Resistance is also related to sunlight, exercise, and fresh air ; for if these are withheld the liability to bacterial disease is increased. Resistance is particularly related to both the quality and quantity of the blood. For after a severe hæmorrhage, bacterial disease is liable to arise and in anæmia some form of septicæmia is likely to occur. But though these are essential for resistance to be good, they do not constitute the resistance factor. For any of them can nowadays be given in the desired amount when bacterial disease is present. And yet too often this persists. Therefore, essential as the former are, they act only if some reaction is forthcoming on the part of the patient.

Resistance is in some way linked up with the central nervous system. When trying to reason out this question, I keep before my mind certain clinical observations. Many might be put forward, but two will suffice.

1. After an injury to the spinal cord there is a greater liability to bacterial disease of the parts deprived of their normal nerve supply. Now the blood is the same throughout the body ; so is the endocrine content ; and the reticulo-endothelial system is undamaged. In one part resistance is good and in another it is poor. Sunlight, fresh air, and good food can improve the general health and raise resistance, but only in the tissues whose nerve supply is intact. They have little action upon those into which energy does not go from the central nervous system.

2. When a man returns from holidays feeling perfectly fit and in good health, he may be laid up with some virulent bacterial disease soon after starting work. At other times

a man who seems healthy and strong is afflicted with some bacterial disease and puts up no resistance and dies. Yet in this very type of man resistance is expected to be good. Now health and strength are just evidences of vitalism, by which is meant the energy that comes from a centre in the mid-brain.

It therefore seems that removal of the energy from the brain lowers the resistance of a part, so does excess of that energy lower the resistance of the body. This is borne out by the two examples just quoted. They act, however, in a different way. For if there is insufficient energy in the tissues, they are unable to resist the inroad of bacteria though they can limit its spread. And when the energy is excessive the tissues are able to resist the inroad of bacteria, but once this takes place the tissues have difficulty in limiting their spread. It is obvious that important as are blood and its constituents in maintaining the resistance factor, equally important is the energy coming down from the central nervous system.

On what does the Reaction to Disease depend ?

The reaction to disease is just a further stage of that healing power that is inherent in all life and which disappears only when life has come to an end. It is essentially basal, for it goes on in a tissue deprived of its nerve supply. Now though life itself is sufficient to limit the activity of bacteria, to overcome them vitality is essential. For this reason wounds infected in areas deprived of their nerve supply heal not at all or only very slowly. The reaction is not sufficient. There is just a low type of ulceration that keeps on discharging, for the congestion, the granulation tissue, and the fibrous tissue that are so essential to overcome disease cannot be adequately formed. Though it is obvious that the reaction is related to the nervous system, it is difficult to decide whether it is dependent upon a special centre or is just a manifestation of tonus ? I keep in mind two clinical findings.

1. In tabes bacterial disease becomes chronic. This is seen in the perforating ulcer of the foot. It is also seen in the urinary tract when catheterisation is necessary. Though this goes on for years and the urine becomes heavily infected, as a rule little pus forms, and there is not much fibrosis.

2. In a case of multiple sclerosis under my care, infection of the urinary tract followed repeated catheterisation and a permanent suprapubic cystostomy was necessary. The bladder has contracted down and the urine is like thick pus. What astounds me is that a man can go on living in this state.

In tabes there is hypotonia and there is little reaction. In this case of multiple sclerosis there is hypertonia and an excessive reaction shown by the thick pus and the amount of fibrous tissue that are formed. This suggests that the reaction bears some relation to tonus.

From what has been said it seems that resistance and reaction to disease are intimately related to the nervous system. They are also related to tonus and vitality, for they vary with the state of these. It might be that tonus, vitality, resistance, and reaction are the same thing. It is not possible to prove or disprove this, for there is no test by which one can be differentiated from another. My clinical experience suggests that though intimately related they are separate entities. For the time being I am assuming that resistance and reaction are controlled from a centre in the mid-brain. From this come two sets of impulses, the eusthenic and dysthenic. When these are well blended, resistance is good. When the eusthenic are in excess, as appears to be the case when vitality and tonus are increased, resistance to staphylococci and streptococci is lowered. When the dysthenic are in excess, as appears to be the case when vitality and tonus are diminished, resistance to bacillus coli is lowered. For years we have been aware of the bearing of anxiety, worry, and mental strain on the onset of bacterial disease. Now that the relation of this to the nervous system is being revealed, we can understand how they come into play.

CHAPTER VIII

PHYSIQUE AND STAMINA

A FINE appearance is stated to be a man's best letter of introduction. This undoubtedly applies to the platform and to the drawing-room, where a good impression counts. For a well-built, handsome man who carries himself well is given credit for much before he opens his mouth. In sporting circles, however, other views are generally held. For here it is frequently held that a good little 'un is better than a good big 'un. And such circles deal largely with the two things that count in stamina, namely, strength and speed. Where men try to come to grips with those problems of life in which far more than strength and speed count, little importance is attached to size, appearance, and bearing ; more is given to that elusive factor, charm ; and most to stamina, by which is meant the strength lying inherent in man that gives him the power to endure and overcome not only in matters pertaining to the physical, but also in the mental sphere as well. It would, however, only lead to confusion to use stamina in this latter sense ; and in the circumstances it is advisable to retain the meaning as denoting strength and staying power in their physical conception. As the question of physique is bound up with height and weight, the bearing of these upon stamina are reviewed.

Height and Stamina

The view that tall men are stronger than short receives support from military circles ; for in the early days of the War when recruits were pouring in in large numbers, recruiting was limited to men above 5 feet 6 inches. But in military life there must be strength to carry equipment, and things other than stamina, such as the length of step, count.

Later on great prowess in endurance and in fighting was given to the Guards, who were stated to be the best of troops ; this was attributed to their fine physique. But soldiers from other divisions maintained that the Guards were sprightlier only because they were favoured troops and were given greater spells of rest. In addition, so rigid was recruiting for them that even in the last few months of the War only perfectly fit men were selected. And after enlistment recruits were put through most strenuous training at home and any who seemed likely to crack were immediately transferred to the B.1 or C.1 class ; whereas other divisions were crying out for men and any who could march and handle a rifle were sent to the front. Such action in the long run was bound to lower the standard and morale of good troops ; this resulted, however, not from the size of the recruits, but from their inferior quality as men. When the Bantams' Division went to France they undertook full military duties and acquitted themselves in a most creditable manner, notwithstanding that they landed when fighting was intense and desperate and they themselves were untried troops. The 13th Division, to which I was attached, was drawn from the Western Command ; many of the troops came from counties along the Welsh Marches, and those of Celtic and Anglo-Saxon descent were evenly mixed. In Gallipoli an opportunity was given to observe the bearing of the men under conditions that were a severe test of stamina ; for, in addition to the strain of fighting, climatic conditions, disease, and ennui came into play. Only those who have gone through such an experience can realise how devastating is their rôle in the undermining of morale ; and, once this takes place, it is strange how quickly stamina gives way. I formed by no means too favourable an impression of the tall bulky man. They were very fine when all was quiet or the task little more than a route march. Yet many cracked in a surprising manner when fighting was intense and the strain severe. Somewhere in the region of 5 feet 8 inches seemed the best height ; and, were I to have to choose a body of

men haphazardly, I think I should pick those from 5 feet 5 inches to 5 feet 9 inches, with a preference for those with a clear eye, a glow in the skin, and the muscles firm and full of tone rather than those whose strength seemed to lie in the size of their muscles or the thickness of their bones. Undoubtedly some of these would fail because stamina is not the same as physique. In addition, by choosing only men of this height the exuberant vitality of those who are small and the quiet steadiness of those who are tall would be missed.

Weight and Stamina

The relation of weight to stamina is best exemplified by reference to boxing, where a few extra pounds often play a vital part. Though smaller men are speedier, generally speaking the heavier the weight the greater the strength, punch, and reach ; and these all count in the ring. Before the War the fame of the boxers of South Wales was world wide. For if Pontypridd, a small mining town, were taken as the centre and if a circle with a radius of seven miles were drawn round it, this contained in one year a world champion in every class except the heavy-weight. And were these not forthcoming, there were hundreds of others to take their place. Many still think that so far as boxing is concerned that was the age of the giants. In the circumstances competition was extremely keen ; and the question would often arise as to why some men just missed being champions and some just failed to stay the course. Numerous theories were forthcoming. Our chief guide in those days was Jim Driscoll, the greatest craftsman the ring has ever known. Though he had little knowledge or learning, he had an extraordinary grasp of the principles of his art. Arguments ceased when he spoke, his reasoning was so sound. He told us that we always forgot that a champion must be a champion's weight. In boxing the recognised classes are as follows :¹

¹ The weigh-in may be at two o'clock in the afternoon as in England or ringside as in America. The latter method means that a man boxes according to his weight, while the former may mean that he is a few

The fly-weight is up to 8 stone.
The bantam-weight is up to 8 stone 6 pounds.
The feather-weight is up to 9 stone.
The light-weight is up to 9 stone 9 pounds.
The welter-weight is up to 10 stone 7 pounds.
The middle-weight is up to 11 stone 7 pounds.

Just as a few pounds can make a big difference to a race-horse over a course of a few furlongs, so can they decide against success in the ring. Take the feather-weight class ; it is rare to see a man champion who weighs only 8 stone 10 pounds. If he can reduce his weight sufficiently to get into the bantam class without weakening himself, he stands an excellent chance of becoming bantam-weight champion, otherwise he fails to make good. A perusal of the respective weights will reveal the importance that is attached to a few pounds. It will be noted that the difference between any two classes gradually increases until the heavy-weights are reached, so that it seems that the heavier the man the less difference a few pounds make. For with the lighter men a difference of 6 pounds is sufficient to justify the creation of a new class. Whereas with the heavier men one stone is needed.

Some boxers give weight away without feeling the effect Carpentier frequently boxed men 1 to 2 stone heavier than himself ; so did Bob Fitzsimmons. The greatest marvel of all was Jimmy Wilde, who entered the ring at 6 stone 10 pounds and yet was at one time feather-weight champion of Britain. Such men are, however, exceptional. Whilst on the whole strength is proportional to weight, this does not apply to stamina, by which is meant the power to endure and to overcome. Generally speaking, the stamina of the average weight is a little greater than at either end of the scale. For with the lighter men there is exuberance of

pounds over. For, if he takes no fluid the previous evening and no breakfast or lunch and empties the bowels and bladder before going on the scale, he may take off as much as 4 pounds. This is put on immediately he starts to eat and the procedure does not weaken him in any way.

vitality, but not the same steadiness ; with the heavier, steadiness, but not the same vitality.

Physique and Stamina

When the term "normal physique" crops up in clinical medicine it seems to be assumed that there is a standard to which the average man conforms. But were anyone to try to put his ideas into words, he would realise how vague are his conceptions. And were he to be pressed to give a general definition, he would have great difficulty in formulating one that would not exclude the majority of fit men. He would speak of the curves of the spine, the slope of the ribs, the size of the epigastric angle, and the shape of the limbs ; yet when everything is said these really amount to so little ; and from them it would not be possible to construct the configuration of a man to distinguish him from another. Really, of course, the configuration, like the facial appearance, is peculiar to each man, no two being exactly alike ; and were a standard to be taken as that to which man conforms, it will be found that out of one hundred fit men, the exceptions would outnumber the others. It is even probable that no organs of any two men are really alike ; but our method of comparing an organ with a supposedly normal standard precludes us from giving to each organ its own individuality. On medical boards during the War men were examined completely stripped. A distinguished surgeon drew our attention to the fact that the peculiarity of each man was revealed not only in his face, but also in the shape of the penis and scrotum, for none were alike. Though this remark caused much amusement, it was nevertheless true.¹

If some general standard of physique is taken as normal, men deviate towards what might be described as the hypersthenic type of physique at one end and the hyposthenic type at the other.

¹ Man is individualistic in all his organs. This applies even to the papillæ of the skin.

(a) *The Hypersthenic Type of Physique*

The build is massive and powerful and the framework heavy and bony (Fig. 6). The muscles are of large size, very firm, and full of tonus. The thorax is wide and deep from before backwards and short from above downwards, and the ribs tend to be horizontal. The diaphragm lies at a high level. The subcostal angle is very wide. The abdomen is very capacious, particularly in its upper part. The limbs are thick and well formed. When the viscera can be outlined by the X-ray, they are found to have a firm appearance and to lie at a high level. This was first noted with the stomach and intestine, but is also the case with the gall-bladder and kidney. Hypertonus and rapid emptying are characteristic of all.

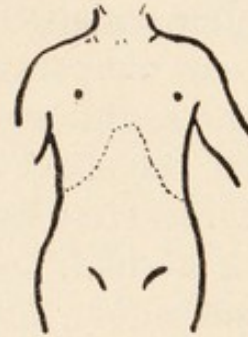


FIG. 6.—The hypersthenic type of physique. Here the muscles are powerful and the viscera lie high. Tonus, vitality, and energy tend to be in excess.

(b) *The Hyposthenic Type of Physique*

The build is slender and frail (see Fig. 7). The bony framework is light. The muscles are fine and soft. Tonus is not conspicuous. The thorax is long and narrow. The dorsal curve is pronounced and the shoulders are round and sloping. The subcostal angle is very narrow. The abdomen is narrow above and wide below. The limbs are long and thin. The abdominal viscera, including the kidney and gall-bladder, lie at a low level. Those that can be outlined are wide and capacious. A want of visceral tone and sluggish activity are characteristic and this is particularly noticeable with the stomach and intestine.

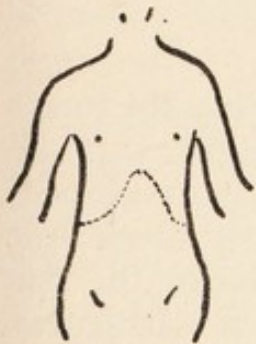


FIG. 7.—The hyposthenic type of physique. Here the muscles tend to be flabby and the viscera lie low. Tonus, vitality, and energy are wanting.

Now from a simple inspection it is possible to tell something of the physique of man. Though this gives a fairly accurate

index as to the position of the viscera, it gives only a slight clue to stamina ; for, though this bears some relation to physique, it is far more dependent on the state of the health for the time being and upon the state of the nervous system. Mere malaise falling short of ill-health and disease can interfere, temporarily it is true, with the power of adaptability and endurance. In all investigations it is impossible to allow for the effect of this state of malaise ; for there is no real clinical test for health. The pulse and blood-pressure should be normal, but then normalcy is something peculiar to the individual, and the health may be poor without any change in pulse or blood-pressure being detectable. When health is present, the tone of the muscles should be good, the skin should have a glow, and the eye should be clear. As unfortunately there is no instrument by which the state of health can be estimated, the practitioner has to depend upon the sense of well-being of the patient and on his own observations, and the difficulties that face him are immense. He is at an advantage if he has known the patient over a number of years and if he has trained himself in the detection of those minor changes in appearance that vary with the state of health. Generally speaking, when the physique conforms to the hypersthenic, strength is to be expected ; and, when to the hyposthenic, staying power.

The nearest approach to Adonis it has been my lot to see was Driscoll. Standing 5 feet 5 inches in height, with all parts of the body in proportion and each muscle developed, his figure was perfect. In addition he had curly black hair and beautiful features ; and, as he entered the ring, he was the picture of that manhood the cultivation of which was so diligently pursued by the Greeks. But it by no means follows from this that stamina is perfect only when physique is perfect. For Freddie Welsh was just as strong and yet on first appearance he seemed rather frail. But Jimmy Wilde was the most extraordinary man I ever came across. He had no physique according to our standard for estimating this. Yet in the boxing-ring he was strength personified. He was never known to be tired and never was he seen to

have lost his wind. He could stand tremendous punishment and his blows had the force of a sledge-hammer. His co-ordination of movement and his timing were perfect and no doubt this was the case with his tonus and vitality. Possibly these are the basis of stamina, and height and weight play only a minor rôle.

As no instrument is available for estimating tonus and vitality at present we are all at sea when we speak of stamina. When tonus and vitality are good the individual can overcome deformities that with others cause much distress. And when the tonus and vitality are wanting, there may be much want of power even though the physique and health seem perfect. When ptosis of the viscera was first detected it was regarded as the cause of numerous states of ill-health ; and as time went on attempts were made to link these up with what might be called habits of the body, for so often ptosis was associated with the hyposthenic type of physique. But it was soon found that ptosis of the viscera occurred in many who had good health and who seemed indifferent to the strain that living imposed. Similar symptoms appeared in those whose physique seemed perfect. It now seems established, that whereas those of the hyposthenic type of physique have the viscera lying low and are liable to certain states of ill-health, there is no other relation between the position of the viscera and the state of health. Rather does it seem that the want of power is due to something inherent in the constitution. This is no doubt responsible for the configuration of the body, the position of the viscera, and the failure of stamina.

The little disablement to which marked displacement of the viscera gives rise becomes very evident to anyone who takes the trouble to observe those who, notwithstanding some deformity, do the day's work well. A short time back a lady aged 44 consulted me for urinary symptoms due to coli infection. She had separation of both recti with a large hernia into which almost all the contents of the abdomen passed ; this dated from the birth of the last child, ten years

before. She did not wear a belt. Yet she was able to do quite heavy housework and up to the time of the onset of the coli infection a few months before had enjoyed good health. Women with large umbilical hernias are not infrequently seen who are able to do housework and who suffer no malaise except when the hernia becomes obstructed or strangulated. One of the boys in the mining village where I lived had a deformity of the dorsal region due to Pott's disease. Yet his strength was very great and he never seemed to tire. In the ring he was a terrific hitter and a contest with him was dreaded by the rest, for he was so quick on his feet and had such a reach that it was not possible to get near. In some way he got into the Army. Even there his strength was a matter for comment ; and it was stated that he could move a gun-carriage on his own. In the first case there was much displacement of the abdominal viscera and in the latter of the thoracic. Yet neither had any effect on vitality or stamina.

CHAPTER IX

THE BASIS AND NATURE OF THE CONSTITUTION

EVER since man could reason he has been interested in the question of health. For in days when little sympathy was given to the sick, it was essential for him to have power to adapt himself to conditions that he was called upon to face. Through the ages physicians noted that the breakdown in health coincided with certain types of physique ; and some with clinical acumen were able to foretell in what type of person this breakdown was likely to occur. But unfortunately few were able to put their thoughts into words that could convey to some future generation the impressions they had formed. Largely owing to the difficulty in formulating satisfactory definitions, life, the constitution, the temperament, health, ill-health, and disease are regarded in a different light by each generation. Though this difference in outlook is usually very slight and impossible to define, it is sufficient to lead to much confusion. In addition, recent experience has shown that certain standards, such as physique and the prevailing type of disease, that all along were regarded as fixed, can vary in one generation. As this variation no doubt takes place in both the constitution and temperament, the problem is likely to remain extremely complex.

Past generations paid much attention to the bearing of the constitution upon predisposition to disease, to the progress of this, and to any modification in the reaction that was set up. But the bearing upon disease is, after all, only a small aspect of the constitution. When this is sound a man can adapt himself to conditions that are regarded as reasonable for the members of his race. He should be able to do the day's work well, to pass through periods of strain in his own life and in that of the nation with calmness and fortitude,

and to face adversity with equanimity. Even when things go wrong, he should feel little or no ill-effect ; and, should disease or ill-health arise, this is overcome.

It may be said that this applies to few. But this is not true if allowance is made for those silent folk who form the majority of mankind. After all, good health is the prerogative of man ; and most men are able to enjoy life because they are healthy. Life is not year in year out easy for any. Yet many pass through enjoying the good things and meeting adversity with their courage unsubdued, thus proving that the constitution is sound. But because men of this type rarely seek medical advice, their presence is not a matter for comment. Though the recent advances of science have revealed to us much about the nature of disease, they have added little to our knowledge of the constitution. No satisfactory definition is yet forthcoming and any discussion of the subject is likely to be rather vague.

The Basis of the Constitution

When the function of some essential organ is impaired, first the health becomes affected, and later the constitution becomes changed. But however important this function is in the maintenance of health and life, the organ must not be confused with the constitution. Paget stressed the importance of differentiating between an organ whose function had an important bearing upon the constitution and the constitution itself. He wrote as follows :

“ When some disturbance to the action of the liver or the kidney gives a distinctive character to every process in the economy, either of these organs might be thought to determine the whole constitution. But though the influence of the blood or of the liver may be everywhere, yet neither blood, nor liver, nor anything else is everything ; a constituent is not a constitution. A constitution should not be thought of as less than the sum of all those intrinsic things, from which a whole health-character is derived.”

In recent years we have acquired much knowledge about the functions of the various organs ; and the approach to

the basis of the constitution is perhaps best made by eliminating those factors which, though of importance, have only an indirect bearing.

A. Relation to Nutrition.—Though the War was a severe test of temperament and stamina, it was found that the ration of troops could be reduced to a half or even a quarter without affecting their courage or staying power. When this level was maintained for long periods, there was no question that harm did follow ; this was particularly noticeable if men were inclined to worry. If a voluntary fast is undertaken, there is a little preliminary exhaustion for twelve to twenty-four hours, after which there is often a feeling of well-being that lasts some days ; during this time there is no impairment in the power to do mental or physical work. In childhood, however, food is essential for growth and daily wear and tear. If malnutrition is prolonged at this age, the constitution is soon undermined ; and, as the bones have not hardened, changes appear in the physique. If extensive, these persist throughout life. Otherwise any undermining of the health and of the constitution that has taken place is overcome once sufficient food is taken. Malnutrition must be differentiated from that state in which essential foodstuffs such as vitamins are wanting. For, however nourishing food may be, if there is deficiency in vitamins, the child is restless and irritable, the muscles are flabby, and rickety changes appear in the skeleton. A similar state was seen when scurvy developed in adults. It is also seen in animals if vitamin A or B is withheld ; their vitality returns, once vitamins are given. Now, though an adequate diet is essential if health is to be maintained, it would be wrong to regard food as the basis of the constitution. For no matter what care a man takes in dieting himself, it is not possible to convert a hyposthenic into a hypersthenic constitution. At the most health is improved, and the original constitution is restored.

B. Relation to the Endocrine System.—The endocrine glands are linked up with the personality, for disorders of the

pituitary, the suprarenal, and the thyroid lead to marked changes in the temperament and the constitution. As yet we are by no means certain as to how the secretions of the endocrine glands act. Some have an action upon the central nervous and vasomotor systems ; one function is to keep the tissues and organs of the body in the state in which the temperament and the constitution can be best maintained. The thyroid alone will be dealt with here. A state of hypertonia is found when the secretion is excessive as in exophthalmic goitre ; but if a part of the gland is removed, the normal state returns. When the thyroid secretion is deficient, there is listlessness and weakness, and mucoid changes appear in the tissues. The change in temperament and in the constitution is obvious ; but the original are restored once thyroid extract is given. One of the greatest miracles I ever saw was in a woman aged 20 who attended the out-patient department at St. Bartholomew's Hospital. She had little vitality, the muscles were flabby, and the features were thick and solid. Yet when thyroid extract was given, she became beautiful and vivacious. As thyroid restored the constitution, it might be regarded as the basis. But we must remember that as the extract is obtained from animals, were such a view right, something of the constitution of these should be transmitted. Nothing of the sort happens.

C. Relation to the Cardio-Vascular System.—Anything that impairs the quality or the quantity of the blood will ultimately affect the health ; and as a result changes in the temperament and in the constitution will appear. It is dramatic to watch the restoration of vitality after a blood transfusion in a person almost moribund from hæmorrhage. For at one moment he is lying listless and at death's door ; and at another he is sitting up and chatting pleasantly to those around. It might be reasoned from this that the blood is the basis of the constitution. But all that has happened from a transfusion is that the vital organs are provided with sufficient oxygen and nutriment and that the products of metabolism are removed. Were the blood the basis, we

would expect certain qualities of the donor to be transmitted. Yet there is no suggestion of this taking place. The original temperament and constitution are not in any way affected.

D. Relation to the Central Nervous System.—On p. 80 it was suggested that in the hypersthenic there was too much tonus, vitality, and energy, and in the hyposthenic too little. In all probability these represent the basis of the constitution. Vitality was discussed in Chapter V. This, when sufficient, gives rise to adaptability. For this to be maintained not only is sufficient blood essential, but in the case of the bladder the connection with a centre in the base of the brain must be preserved. In Chapter VI it was pointed out that in muscular organs adaptability is linked up with tonus. Again, for the maintenance of this, not only is sufficient blood essential, but the connection with a centre in the base of the brain must be preserved. In Chapter VII it was suggested that resistance to bacteria depended upon a centre in the base of the brain. As vitality, tonus, and good resistance are inherent in a sound constitution, and as they are dependent upon centres in the mid-brain, the basis of the constitution is believed to be situated here. As this aspect is of considerable importance, it will be further illustrated. When a nerve is divided there is not only paralysis but a loss of tone in the muscles, trophic changes appear in the skin, and the resistance to bacteria is lowered. In addition, the power of adaptability is completely lost. These are restored only if the nerve regenerates. Again, take an injury to the spinal cord. In tissues that draw their nerve supply from above the lesion, vitality, tonus, a good resistance to infection, and the power of adaptability to carry out some purposeful action are present. In those that draw their nerve supply from below the lesion, vitality, tonus, resistance, and the power to overcome bacterial disease, are absent or impaired. The tissues, however, do not die, they go on living in an imperfect form. There is, however, only life without any real purpose, and the constitution of the part is lost. With a lesion of the

Rolandic area, the state is just the opposite to that seen when a nerve or the spinal cord is divided. Spasticity due to hypertonia soon appears. There is no wasting of the muscles. If an attempt is made to straighten out the spastic fingers, it is extraordinary what force has to be employed to overcome the contraction of the muscles. Here vitality and tonus are running riot, but the power to adapt these to some purposeful end is lost. Though after some years there may be atrophy of the limb from disuse and the circulation may become impaired, resistance to bacteria is not affected. As when the nerve is divided or the spinal cord is damaged, the constitution of the part affected disappears ; and, as when the Rolandic area is damaged, the constitution of the part affected runs riot, the basis of the constitution must be in the part of the brain that intervenes between the cortex and the spinal cord.

The regeneration of a nerve is always interesting. In addition it serves to bring out this aspect of the basis of the constitution. The position of the neuroma is indicated by a thickening which causes a tingling on pressure. This thickening passes further and further into the distal part as regeneration goes on. Then comes the filling up of the muscle, the change in the appearance of the skin, and finally the return of voluntary power. We say that recovery has taken place, for vitality is restored to the tissue. Now when the endocrines or blood are wanting, the deficiency can be made good by supplying the product from an animal or from a donor, and the original constitution is at once restored. But with a nerve, grafting from an animal or man is valueless ; regeneration does not necessarily follow even if the ends are sutured together. Whether regeneration occurs depends entirely on whether the patient can react. And by this is meant that the proximal end grows down into the distal right into its terminal filaments. If this reaction is not forthcoming, the finest surgery fails. This shows the significance of the nervous system and is in favour of the basis of the constitution being here. It is only as the nerve regenerates by the

action of the individual himself that restoration of the constitution of the part occurs.

It is not essential that tracks should be established passing from these centres in the base of the brain to the various organs. For though a nerve impulse has to be conducted along a special nerve fibre to its destination, there is nothing to suggest that the energy essential for the maintenance of vitality, tonus, and resistance is the same as a nerve impulse and has to be conducted in the same way. Thirty years ago the only means of communication with places at a distance was by telephone wires. But the discovery of wireless waves changed this and all that is now required is a suitable medium. There is no reason why this vital energy which forms the basis of the constitution, and which is needed if vitality and tonus are to be maintained, should not pass down the central nervous system to the various organs, this acting as a medium for its transmission just as the ether does for wireless waves.

The Nature of the Constitution

When tonus and vitality are adequate, sufficient vital energy is forthcoming to permit the individual to do and to endure. But it does not necessarily follow that the constitution is sound. It is true that there is plenty of stamina. But so often when stamina is excellent and physique perfect, there may be a failure to stay the course in life. The stamina of a man who is able to go twenty rounds in the boxing-ring is perfect. Yet amongst the boxers I knew in my youth were six champions of the world, and of these Tom Thomas, Freddy Welsh, Jim Driscoll, and Percy Jones died in the prime of life. At one time they were so fit that no one ever thought of them as dead. All that can be said is that there was some flaw in their constitution.

The constitution must not be confused with health. It is at times surprising to note how those who seem healthy crack up suddenly and go to pieces when called upon to face any strain ; and, when some illness arises, they put up no resistance and die in an unexpected way. Whereas those

whose health is poor may show an unexpected reserve of strength that enables them to overcome insuperable difficulties and to remain active in middle and old age. In many a family it is noticeable how the healthy and active fail to stay the course, whilst the invalid gets stronger as the years go by and dies in old age without a single faculty impaired. Where the constitution is sound, fair if not good health is expected ; and certainly the state of health must not prevent a man from doing ordinary work. Paget wrote :

“ And there are constitutions even less defined and less signalised than these which yet should be observed. Thus we speak of the weak and the strong in constitution, and the terms are not unmeaning. Generally men are called strong or weak according to their capacities for work or pleasure, for mental or muscular efforts : but these capacities have no constant or necessary relation to strength or weakness of health, though they are often found together. The highest strength of constitutional health is shown in that very rare state in which a man passes through a long life without disease, and dies of old age, all his functions becoming less active and all ceasing at the same time. This state may be where there may be few, if any, of the popular evidence of health. A man of 96 told me that he had never deemed himself a healthy man ; and another nearly as old, who had never suffered anything worse than slight indigestion, said that he never enjoyed health. Neither of these had been vigorous in mind or body, but in both there had been the main characteristics of ‘strong’ health, namely, such tenacity of composition in every part, and such balance of them all, as cannot be disturbed by the ordinary forces of disease, or, being disturbed, can be quickly and perfectly recovered.”

Even nowadays the relation of the constitution to disease is extremely difficult to define, and whatever is written requires much qualification. One of the strongest and healthiest men I ever came across had Pott’s disease that had healed with much deformity. And in the 13th Division in Gallipoli there was an officer with a well-marked mitral systolic lesion that had followed an attack of rheumatic fever at the age of 10. He had been an explorer. Though 50

years of age he could hold his own with many a younger man and never suffered from shortness of breath. In both these men there was predisposition to disease that had developed in a severe form. Each had been able not only to localise, but also to overcome the disease and the predisposition. Though the deformities persisted, the function of no vital organ was affected : and as tonus and vitality were perfect, they could do anything they wished. Generally speaking, when the constitution is sound there should be no predisposition to disease ; should this arise it is quickly overcome.

A sound constitution does not necessarily imply that the owner will live to a good age, though he should carry his age well. At times men go through life without any mishap, enjoy good health, and do all they wish ; and yet round about fifty some illness or what might be described as a tendency to decay lays them low. This early decline may be found in many members of a family. Often no adequate cause is found and heredity is blamed. All that can be said is that some are predestined not to know what age is. It must have been these of whom Paget wrote :

“ There are notable differences of constitution in respect of the times in which the course of life is run from birth to death in senile degeneration. Living to ‘ old age goes in families,’ and so does dying before old age. The time in which the changes ending in the senile degeneration are achieved is in one group of persons much longer than in the other. Often, indeed, the earlier or later dying is because of inherited disease, of which some are earlier, some later, developed. But sometimes it is plainly because the degeneracies of old age are quickly reached ; not, only, it may be in the hair or teeth, but in much more important structures or in all parts. It is probably due to this that in some families many members die at or near the same age, soon after middle life, and these do not die of the same disease, but it may be of various casual diseases or injuries, or as if they all had lost before the usual time the power of repair.”

Where the constitution is sound, an equable temperament is to be expected. It is quite exceptional for an emotional

person to have a sound constitution ; almost invariably there is a want of staying power. Now the doctrine of the temperament arose in an age when, owing to a want of self-discipline, neuroses were common. At such a time the bearing of emotion on health and stamina becomes obvious. Temperament then referred to the state of the temper and was estimated by the control of the emotions, instincts, and impulses that had been acquired. But temperament nowadays refers rather to the direction in which a man allows his mental faculties to play than to his self-control. At times a man in whom the constitution is sound and temperament seems equable dies from angina pectoris or develops some spastic disease such as colitis that generally occur in the sensitive and highly strung. When going into the history, it is found that the control which made him appear so well-contained and phlegmatic was never absolute ; so often he worried over the small things of life. It is our inability to estimate this that makes it so difficult for us to make proper allowance for temperament. As such worries are regarded as weaknesses of which patients are ashamed, they rarely refer to them. Though a highly sensitive nervous system is a disadvantage and particularly so if an illness is unduly long, much depends on the discipline that has been acquired. It is my belief that in the long run the highly strung temperament that has been disciplined is as big an asset as the temperament that has been equable throughout life : and when some flaw in the temperament is revealed, prominence should be given to the control that has been acquired rather than to the flaw itself. But though an equable temperament is probably the most valuable single asset a man can have, temperament is not the same as constitution. For at times the former may be admirable and yet stamina may be lacking and the health poor.

There is little difficulty in reasoning as to what the constitution is not. But the problem is quite different when an attempt is made to say what the constitution is, particularly if philosophical terms are avoided. Perhaps the best

method is to work upwards from our knowledge of life and of living processes in general. Activity in its simplest form is seen in the amoeba ; there is a phase of contraction when the pseudopodia are put out and foreign bodies are engulfed, a phase of relaxation when they are withdrawn and digestion goes on, and a phase of rest. Similar phases are also seen with the leucocyte in man. When smooth muscle is placed under tension, rhythmic activity is set up in which the three phases of contraction, relaxation, and rest are observed. These are demonstrable in all muscular organs, whether it is the single movement or the function of the organ as a whole that is examined. In past years contraction alone was regarded as active ; relaxation and rest were regarded as passive states, the former being the rebound from contraction and the latter a mere nothingness. Nowadays each phase is regarded as purposive and requiring energy. Whenever activity can be demonstrated in the cell or in an organ or in the body as a whole, the phases of contraction, relaxation, and rest are found. The question that presents itself to us is whether life as a whole and activity which is the manifestation of it is dependent on the interplay of its organs, or whether eventually centres will not be found controlling these phases for the body as a whole ; since activity is really the result of the interplay of contraction, relaxation, and rest, which seem to be dependent on three centres in the base of the brain.

In the case of the bladder the three phases are linked up with the centre of tonus in the pons. Its function is not modified if the crura cerebri are divided. This is not the case with skeletal muscles. For though when the crura cerebri are divided reflex postural contraction is still possible, it is no longer possible to adapt this to a purposive end. Tonus is running riot and the power to relax and to rest is gone. The view I now hold is that somewhere among the basal nuclei are to be found three centres subserving contraction, relaxation, and rest, these have a controlling influence upon the centre of tonus. I am aware that with a lesion of

the Rolandic area in man, this condition of hypertonia develops in the affected limb and it can be said that what I now attribute to basal centres is really a part of the activity of the cortex. Still, for the present I am assuming that three such centres exist somewhere in the brain above the mesencephalon and that the nature of the constitution is dependent upon the degree to which each is developed. Such a view, of course, is just supposition.

Throughout the ages, however, the tendency has been to regard activity as composed of three phases: work, relaxation or leisure, and rest or sleep. The Victorians, it is true, believed in work and sleep and did not consider that man was in need of relaxation. At the end of last century workmen went from bed to work and from work to bed, and the opportunities for relaxation came only when no work was available. But long before the War the error of such a view had become obvious. The plan evolved at public schools of eight hours work, eight hours leisure, and eight hours rest was gradually being taken up by all classes. Here are exemplified the three phases of contraction, relaxation, and rest.

For too long relaxation has been confused with passivity, or the doing of nothing, and this attitude has been increased by a wrong interpretation of Buddhism. It is true that Buddha taught the destruction of desire, or Nirvana, but only in later years was this regarded as suppression of the mind, or passivity. The yoga, however, states that the power of repose and the power to suspend certain mental activities are positive actions that are only to be acquired by careful training. It is in the latter sense that relaxation is employed here. By it is not meant the doing of nothing, but rather the directing of the mind to dwell upon the quiet things of life that bring contentment and peace. The cultivation of this requires thought and practice and becomes easy only as habit is acquired.

The difficulty of trying to work out the constitutional factor in health and disease is still extremely great. Hutchinson pointed out that the signs supposed to denote the

temperament (and he used the word where we use constitution) might disappear from trivial causes. He wrote :

“ I have said so much in disparagement as well of the general as of the special signs which have been held to indicate temperament, that I fear it may be suspected that I almost doubt the reality of temperament. If I have given that impression let me hasten at once to remove it. There can be no question whatever as to the reality of the difference between individuals, nor any doubt as to the importance of the recognition of these differences by the medical practitioner. By far the commonest error of the prescriber, and one which must interfere with his success, is the easy-going habit of regarding all persons alike, and recognising differences only in their disease ; or, to put it in another language, ignoring the predisposing causes and taking account only of immediate cure. The farmer who would succeed in his pursuit must not content himself with making sure that he has sown good seed, and according to the most approved methods. He must go further back to take knowledge of the nature of the soil with which he has to deal ; of the crops which it has previously borne ; and of the manures which have been used. It is much the same with us in the diagnosis and treatment of disease. In addition to the primary or exciting cause, which is of paramount importance, we have various others which may perhaps be conveniently classed together under the term contributory, since they contribute to control and modify final results. Among these temperament—the original vital endowment of the individual—is unquestionably a real force and one which we would most gladly recognise and estimate if we could. The scepticism which I have been expressing applies not to the reality of the thing, but to our ability to discriminate it.”

He then went on to point out the important bearing of race upon disease and the necessity for taking it into consideration in clinical work. But he regarded the difficulties that confronted the clinician as too great to be overcome. Though in those days the drift from the country to the industrial areas had begun, men still remained rooted to the soil ; and the majority preferred to work and die in the homes of their fathers. As there had been no great war since

the beginning of the century, a state of stability prevailed at home and abroad. In the circumstances many feel that, as Hutchinson failed, success is not likely to come our way to-day. Were ability alone to count, this would no doubt be the case ; but we should bear in mind that nowadays facilities exist for research and for acquiring knowledge that were not dreamt of when he lived. In some respects our generation is much favoured. On the other hand, nowadays, it is more difficult to have a working knowledge of mankind.

A consultant works along a small arc of a large circle and, however big his practice, acquires only a glimpse of life. This was brought home to me a few years back. One hot summer's afternoon so many patients attended my outpatient department at the Cardiff Royal Infirmary that I came to the conclusion that the majority of the people in South Wales were seeking medical advice. Wandering that evening to Roath Park, I did not follow the usual route, but went diagonally across the city and passed through streets the names of which I had never heard. The vastness of the city became obvious, and I could not help wondering what all the people did for a living. I would see some of them at football matches or in the streets, but there they were just a crowd. The great majority would be unknown to me. Now at the Infirmary I see on an average twenty-five new patients a week and the same number in private. As many of these, however, are drawn from Glamorgan, which has a population of one million, in thirty years 7 per cent. will pass through my hands if the population remains stationary. As this is now so mobile, I am doubtful if in my lifetime 1 per cent. of the people will come my way ; and the majority will be just birds of passage. The following day I went for a consultation to a small town in West Wales. As I wandered down the streets with the practitioner, he nodded to all who passed. He could tell me something of each ; it did not seem to matter whether they were patients or not. What a store of knowledge he had of his fellow-men ! What a wonderful contribution such a one could make to our know-

ledge of the constitution ! His outlook recalled my life in the mining valley where my parents knew all the people who lived around. Not only did they know much of each, but they would often speak of the relations, of the children, and of episodes in which the man had taken part. A man was not so much an individual as a part of the district with the life of which he was intimately linked. The personality was the aspect that seemed to count. Knowledge such as this with the large outlook on life that it gives comes only to a few in these days of change, and it is becoming increasingly difficult for those who live in cities to write upon the subject of life. I am doubtful if in Cardiff a couple of hundred people are known to me ; and the majority of these are just nodding acquaintances. Months often pass without my seeing neighbours who live close by ; and at times I first become aware that they have been ill by seeing the death announcement in the press. So often when a friend comes to consult me I am surprised to find how much of a stranger he is ; for his history brings to light much that was never suspected. After all, in these days of rapid change does a man really know himself ? When it is necessary to do a little self-examination he begins to realise how much of a stranger he is. The difficulty of making contact with humanity makes work upon the constitution and life of such doubtful value nowadays.

When a student enters upon his hospital duties, he is obsessed with the idea of getting through his examination ; consequently he becomes interested in disease and the detection of physical signs. Should the patient die, he is concerned as to whether or not some clinical sign has been missed that might have enabled a diagnosis to be made and life to go on. Few are interested in the larger problems of life. In my days at Bart.'s the dangers of paying too great attention to books was stressed and importance was attached to ward work. By attending there a student not only obtained a working knowledge of disease, but was enabled to make contact with mankind. It was realised that a house-

surgeon represented his chief in the hospital. The ways and mannerisms of members of the staff were noted. Their understanding of human nature was very fine, and we noted the joy that would come to a patient from the apt remark or the quiet chat of home. I am, however, doubtful if a hospital was ever a suitable place for work of this kind, even in days when patients remained there for months. It is true that a careful observer could acquire knowledge of the ways of the people, but this is not quite the same as a knowledge of his fellow-men.

When a medical student it was my good fortune to be associated with some of the settlements in the East End, where I went to box with the boys and where I came in contact with many aspects of life. The great charm was that the boys were so honest and sincere. Some had mental ability which was encouraged in every way. These were interesting in that they had a possible future and there was a chance that they would rise above their fellow-men; though their very cleverness at times made one just a little suspicious of their sincerity. Others had stamina which made them rather dangerous in the ring; and when they were likely to be opponents some thought was given to the type of men they were. But there were some who laid claims neither to stamina nor to great mental ability, yet who were most likeable. They were men of character. Though it is not possible to define this, it seemed to me then, as it does now, that its essential is that the man does not use his stamina and ability for his own ends but to be of service to his fellow-men. The friendships that were so valuable in giving an insight that could never come from work in hospital were unfortunately cut short by the War. What, however, was taken away was given back in another form. For there came an opportunity to make contact with men that could come in no other way.

In France in 1914 death was viewed with indifference and the courage of the men was admirable. When they got back from the trenches for a rest, women and wealth played their

part ; and men who had behaved so splendidly a few days before would at times be disloyal to their best friends. I had not the good fortune to be a battalion medical officer there, but the impression formed from my short stay was, that so many factors were coming into play, that it was not possible to see human nature at its best.

In Gallipoli totally different conditions prevailed. Troops remained in the line for months on end and little temptation crossed their path. At Anzac the mountains came close to the sea ; and though the firing-line and the trenches were perfect death traps, many of the valleys were absolutely safe. Though the firing-line was scarcely three-quarters of a mile inland, thousands and thousands of troops were concentrated there who came from many countries. At the time I was attached to a field ambulance. Once fighting ceased there was nothing to do but to lounge and to chat ; and, consequently, there was plenty of time for observing the behaviour of men. No such opportunity of observing men in the mass is likely to occur again. Their reaction to changing circumstances could be observed. For after the 13th Division had landed at Helles in June, dysentery broke out and the course could be noted when the men were in the best spirits and health was good and when hope ran high. But after the repulse at Anzac in August, all hope of success disappeared. To add to this, the mountains that at first added to the beauty of the scenery, now looked grim and unconquerable ; and at times it appeared as if they were helping to push us into the sea. Everything combined to lower the spirits of the men. There was a difference in the way they now reacted to dysentery. Race also played some part, for the Anglo-Saxons and Celtic races reacted differently. But there was no question that amongst the best disciplined battalions there was less tendency not only for disease to arise, but for it to make inroads. Obviously discipline rose above temperament and race. At a time when even in the best battalions the morale was low and malingering was on the increase, there was an appreciable improve-

ment. This coincided with the arrival of General Maude. I believed then, as I do now, that his quiet influence came into play. Though a stern disciplinarian, the welfare of his men was part of his religion. We soon became aware that not only had we in command of our division one who was a great gentleman and a Christian, but also a man of character whose mere presence inspired us to do all that lay in our power. Confidence was soon restored.

After the transfer of the division to Suvla Bay, I was attached as medical officer to the 4th South Wales Borderers, probably the greatest battalion the New Armies were to produce. They took over the firing-line in front of the west hills. These were mere pimples compared with the hills at Anzac, and on the three miles that separated the firing-line from the sea, composed of the flat Salt Lake, there were no trenches or men. Everything was different from the conditions at Anzac. The opportunity was now given me to know intimately a few hundred men. There was again plenty of time for observation and thought ; and my want of experience could now be supplemented by chats with the officers. The epidemic of amœbic dysentery was on the wane, but there followed bacillary dysentery and colitis. At the end of November we had the storm when men froze to death. In December came the epidemic of jaundice. As from then on preparations were being made for the evacuation, circumstances were most favourable for watching the reaction of men. The difference between the men who came in the drafts and those who originally comprised the battalion was noticeable, and was at first attributed to the former not being acclimatised ; but at the time I took over, climatic conditions were not too severe and played just a minor rôle. For even when the men came from hospital, where they had spent some time recovering from wounds or illness, they stood the strain so much better when they belonged to the original crowd. The great discipline that had been instilled into them and the sense of duty that they had acquired somehow came into play. For this battalion had the good

fortune to be trained under Colonel Gillespie, who in the few weeks he was on the Peninsula had made so great a name as a soldier. A stern disciplinarian, he had the gift of instilling all that was fine in the traditions of the regular battalion into men worthy of such a leader. Long after he was dead his influence went on ; and I could not help noting how when his name was mentioned a feeling of reverence arose. As the time for the evacuation drew near, the C.O. and adjutant would have chats in the dug-out about the men to be chosen for those duties where great courage was needed. Men were chosen because they were reliable. How correct they were in their judgment was revealed by our subsequent experience. Now those upon whom they placed reliance did not often appear on a sick parade ; and if some disease gripped them they seemed to overcome it in an extraordinary way. The improvement that had taken place in my own health during the few months I was with the battalion was obvious. On my return to England, I discussed the whole question with my father, who always sought for first principles. He was convinced that there was something in the views to which I had come, for the men he had found reason to trust were not often ill. He pointed out, however, that this applied only to ill-health that incapacitated and not to disease ; for this was no respecter of persons and made inroads on the finest natures. For man was not immortal and often he preferred that death should come quickly rather than that his powers should gradually fail. Consequently, there came a time when the onset of disease was preferred to lingering through the stages of decay. But he thought that much of what I was regarding as a sense of duty and discipline would in civil life come under character. Though he felt that this could not be defined, he considered that the outstanding features of character were that a thing was done because it was the right thing to do and power was used not so much for a man's own ends as for the good of his fellow-men. Considerations for and courtesy to others were essentials of the creed.

In surgical work an opportunity arises to study the temperament and constitution and their bearing upon the reaction to operation. Prostatectomy is most suitable for this ; for the risk is always great. When the patient returns to bed, the surgeon and nurse are on the alert. For the operation is done at an age when degenerative changes begin to appear and every factor counts. Once the patient starts to go downhill he dies ; he has so little in reserve. When done in two stages, the reaction to the first often gives a good clue as to whether the patient will survive the second. Shock, hæmorrhage, and a flare-up of sepsis play a fundamental rôle and are particularly harmful if some myocardial or renal lesion is present. An equable temperment is a great blessing, and so is the disciplined mind. Practising in an area where some of my patients have been known to me since I was a boy, whose children are my long acquaintances, and whose grandchildren are about, something of the temperament and the constitution is likely to be grasped. As the surgeon sees one patient survive and another die in some inexplicable way he sometimes wonders whether such a thing as character does not here also count.

How elusive this subject can be was brought home to me recently. Two farmers, sent to me in Cardiff for acute retention of urine secondary to an enlarged prostate, had died after preliminary cystostomy. Now farmers are usually good risks, and this operation, after all, amounts to little more than a cut in the skin and can hardly by itself be the cause of death. Both men just faded away, no adequate cause for death being detected. A month later a third patient, a farmer aged 72, was admitted to the same nursing-home from the same district and cystostomy performed. No cardiac disease was detectable and he was not uræmic. Ordinarily he should have been a good risk, but something about him made me guarded in the prognosis. After the operation the sister told me that, like the two others, he had no desire to live. He could not understand why he had been sent. For he was perfectly content to die, and rather longed for death.

Though he recovered from the operation, progress was not satisfactory ; he was so restless. No cause could be found and sedatives brought little relief. Thinking that his condition might be due to the relaxing air of Cardiff, he was sent back to his home in the mountains of mid-Wales ; but there he faded away. There was a gradual failing of many organs though no disease was evident in any. All that could be said was that he had gone into the decline. Many nurses are convinced that, once a patient gives up hope and does not wish to live, nothing that medicine can do is of the slightest avail. So that whatever the temperament, whatever the constitution, and no matter how great the character, once hope goes all is changed. Who can say whether want of faith or want of hope exerts the bigger influence once health breaks down ?¹

¹ This reference should not lead to a feeling of despair. As a man is watched going through life, a good estimate is formed of the constitution by the careful practitioner. In my consultations I am often astonished at the wisdom he there reveals. A short while ago I had a consultation with such a one over a man, aged 75, who had an enlarged prostate. There was a certain amount of muscular atony and we were naturally concerned about the kidneys and the myocardium. The renal function tests were satisfactory ; the absence of shortness of breath and of præcordial pain, a blood-pressure proportionate to the age, the good heart sounds, and the absence of clinical signs suggested there was sufficient cardiac reserve. But there was something about him of which we were uncertain, a something that neither of us could put into words. He was obviously highly strung. But was this the case of a man who had disciplined himself in life and who had thus acquired an equable temperament, or was it the case of a man who was indifferent to life and was content to pass on ? The former would be an asset after an operation ; the latter implied the end whatever was done. Whether prostatectomy was performed depended upon the view reached. We decided in favour of the former, and this was confirmed by the result. Though at other times I am wrong, this forms no excuse for not reasoning along these lines, difficult as it sometimes is.

The constitution and temperament are just aspects of life. A practitioner is helped in his work if he has knowledge of the family history, the constitution being handed on from parent to child. According to the Mendelian theory, two-thirds of inheritance comes from the grandparents. But the temperament is best revealed by watching the children. These are naïve and reveal their feelings, which are so often concealed in those who are grown up and in the aged. Up to the age of twelve heredity counts ; then the strain of living comes into play. And anyone who realises what life means must wonder that anything of heredity does survive.

CHAPTER X

SOME ASPECTS OF THE CONSTITUTION

WITH the rise of anatomy and physiology it was advisable for the purpose of assimilating and of conveying knowledge to study the body as if it were a series of compartments. Possibly on account of this man has come to be looked upon as if he were a complicated mechanism composed of a large number of organs, any energy he possesses being regarded as the result of their efficient working. Even the modern tendency to regard the constitution and temperament as being something to the maintenance of which the various systems work takes our conception of man only a stage farther. For it leaves him much as if he were a mixture of several components and when these are well blended he has health. A view to which many are coming round is that man is a microcosm in the macrocosm of the world. The energy that controls this microcosm is known as vitalism, and comes from a centre to the maintenance of which the vital functions are devoted. This centre gives to the body its configuration, its power of adaptability, and its reserve of energy. This view differs from the preceding in that vitalism is regarded, not as the result of life, but as the inherent force that not only gives life, but keeps the body going. It is true that no reliable evidence is forthcoming to support the presence of this centre. But, after all, this is hardly to be expected until we know something more as to what life is and as to what is the nature of vitality. Certain evidence was put forward in Chapter II. The following can be added :

1. The shape of the bladder and its power of adaptability undoubtedly depends upon its connection with a centre of tonus in the pons ; and, when this is destroyed, the bladder

becomes flabby and toneless and its power of adaptability is lost. If this applies to the bladder, may it not apply to other organs? May it not apply to the body as a whole? Why should there not be a centre controlling the energy that is man?

2. In Gallipoli I noticed that bearers would at times put the stretchers down because they knew the man had died. At first I attributed this to their realising that he had stopped breathing or had ceased to make a noise. But now and again a bearer was heard to say that he knew a man had died because the stretcher seemed heavier. It has always been felt that the weight of a dead man is heavier than when he was alive; and the expression "dead weight" is as old as the hills. Though probably there is no difference to be recorded on the weighing machine, there is little doubt that when a man dies something that gives his body buoyancy disappears. Experience convinces me that there is some difference noticeable when lifting a man who is alive and one who is dead. And, when an anæsthetic is given, the weight of the patient seems to increase as the anæsthesia deepens. There is a difference noticeable when the arm is raised and allowed to drop in one who is merely sleeping and in one who is comatose. But the contrast is more marked when the arm is paralysed; for now it drops like a log. It seems that something gives buoyancy to the body during life, gradually lessens during anæsthesia, and disappears entirely with death. For the time being I regard the buoyancy as due to something the body obtains from the centre of energy. Though possibly what is now called energy is really tonus.

A. The Theory of Vitalism

In earlier chapters a distinction was drawn between life and vitality, and the difference between these was made evident by a reference to structures with and without their nerve supply. Vitalism goes a stage farther and suggests that there is in man some power that shapes his ends and gives him vital energy throughout life. But the difference

between life, vitality, and vitalism is probably just one of degree.¹ Vitalism is best exemplified by a résumé of activity as described in previous chapters. When smooth muscle is placed under tension, contraction, relaxation, and rest occur. Such rhythmic activity is seen wherever there is life. For this activity to be devoted to a purposive end, the connection with the centre of tonus must be preserved. When this is possible, adaptability is said to be present. The power to maintain adaptability for a period is an indication of vitality. The bearing of this has already been stressed with the bladder. Adaptability is seen in its being able to retain and to expel urine, and its vitality is indicated by its power to carry out micturition over a period of time. Were it possible to speak of the vitalism of an organ, this would refer to its power to carry out micturition throughout life.

Now rhythmic activity is just a manifestation of life, and depends upon the muscle cell receiving adequate nourishment. Tonus is essential for adaptability and for vitality. Is vitalism dependent on a continuous supply of tonus, or is it something different? Tonus for an organ is probably limited to it; by which is meant that the tonus of the bladder could not be distributed to the stomach. The energy that represents vitalism is capable of wider distribution. Though closely associated with tonus, I regard it as

¹ *Vital force, vitality, and vital energy* are manifestations of life. Until we are more definite as to what this is, such expressions cannot be used with any exact meaning. The vital power of a tissue is revealed by the way a wound therein heals or by the way that tissue reacts to and overcomes some harmful influence. The vital power of an organ is revealed in its power of adaptability as a result of which some purposive act can be performed. This vital power is primarily dependent upon that *vital force* inherent in life. *Vitality* is that force obtained from the central nervous system that gives to an organ or to man sufficient power to adapt itself or himself to varying conditions over a period of life. *Vital energy* is the force obtained from the centre of energy that has given shape to the body. This forms the great reserve during life. It is not possible to say where vital force, vitality, and vital energy begin and end. My clinical experience suggests that they are separate entities that in states of ill-health can be picked out individually.

something independent that is produced in a special centre. My views on life for the time being are as follows :

1. Rhythmic activity, leading to contraction, relaxation, and rest, is inherent in all life and is just a manifestation of vital power.

2. When a muscular organ is connected with the local autonomic nervous system a certain amount of peristalsis is possible. But for purposive movement such as adaptability the connection with the centre of tonus in the mid-brain must be maintained.

3. Adaptability refers to the single act ; vitality to the power to maintain adaptability over a period. In muscular organs this is dependent upon contact being maintained with the centre of tonus in the brain. The vitality of organs with smooth muscle is thought to be completed in the mid-brain and not to be dependent upon the higher cerebral centres.

The centre for the tonus of skeletal muscle is also in the mid-brain. But for this tonus to be directed the connection with the base of the brain, and in man with the cerebral cortex, must be preserved. If this connection is severed, tonus runs riot. It can no longer be directed to a purposive end, and relaxation and rest are not possible.

4. When the activity of the body is viewed as a whole, the phases of contraction, relaxation, and rest are obvious. These are regarded as being dependent upon three centres, situated somewhere in the base of the brain, subserving contraction, relaxation, and rest, which have a determining influence upon tonus.

5. On a different and probably a higher plane is the centre of energy. This is not developed as the result of living, but is formed at the time the ovum and spermatozoa unite. It gives to the foetus its shape. It gives to man that vital energy that is called vitalism. Through this comes his reserve of power. All cells that live have rhythmic activity. When the cells are grouped in a centre this is autonomous. This has been demonstrated with the

vasomotor and respiratory centres, and no doubt applies to the centres of tonus. These are self-supporting. Should the necessity arise, they can call upon this centre of energy for a further supply. This acts as a depot for these centres. The reserve that accumulates is also to some extent under the control of the will. The direction in which this reserve is expended gives man his character.

This reserve of energy has three main outlets :

(a) It may be used largely to promote rest. In this way arises the lazy man or the idler in life.

(b) It may be directed inwards, in which case a man becomes introspective. If his thoughts are concerned with his organs or with his state of health, he may become neurotic. On the other hand, he may dream some great dream.

(c) It may be directed outwards into some form of activity. If a man uses this only for his own advancement, he tends to become selfish. If he uses it only for some great cause, he tends to become a bigot. If he uses it in service to others, he develops character.

The happy man is he who is content that sufficient of the energy is devoted towards the maintenance of the vitality of his organs and his body, and thinks in terms of the three phases of activity—work, relaxation, and rest. For bountiful as Nature is, a man becomes all the more endowed with the good things of life in so far as he becomes qualified by giving consideration and thought. The reserve of energy such a one utilises for the furtherance of some great cause or in service to his fellow men.¹

¹ After the manuscript of this book was completed, my attention was drawn to the writings of Abernethy. It is there evident that John Hunter's work was based upon the theory of vitalism, and it is to this that those who are interested should go. The reader should keep in mind the words of Abernethy : " May I, however, venture to suggest another reason why some do not understand Mr. Hunter. If we wish to learn what another thinks, we must dispose our minds to receive instruction in the very manner it may be conveyed to us. We must relinquish, for a time, all attention to our own opinions, in order to learn those which are to be communicated. The same processes of mind must be gone through, or the same results cannot be obtained. We must follow in exactly the same steps, or we

B. Relation to the Configuration of the Body

The curves of the spine and the shape of the bones are attributed to the influence of gravity. But all are present at birth, though of course not so marked as later in life. During the last few months of pregnancy the foetus lies inverted, and gravity is acting in a direction opposite to what it does after birth. And, as the spine and the bones have the same shape, whether the presentation is a breech or transverse, gravity obviously plays little part in determining the shape of a bone. When the relation of the chest and abdomen to the underlying viscera is being considered, at one time importance is attributed to the bones and at another to the viscera. But too often the discussion leaves some uncertainty as to which counts most. Is it not the old question of which came first, the egg or the chick? Now the growth of a bone is due to the activity of centres of ossification in the epiphyses, and the shape is present at birth, shall never arrive precisely at the same point. It is a very ancient observation, that self-conceit imposes a constant and sometimes an insurmountable barrier to instruction. 'Seest thou a man wise in his own conceit? there is more hope of a fool than of him.' Under the influence of these considerations, I do not wonder that young men, who will not take the pains necessary even to learn what Mr. Hunter thought respecting life, should be unable to understand his general writings, and suppose others to be as incapable as themselves."

A few years back I began to doubt the claims put forward by certain surgeons. To satisfy myself on this point, I visited most of the clinics of Europe. It was quite obvious that however able the surgeon he still had to contend with local difficulties. If these were anatomical they could be overcome by some change in the technique. If they were pathological this was not always possible. But what was strange was that few surgeons were taking the constitution and temperament into consideration. Some seemed to think that in their hands surgery was so safe that even the general condition of the patient no longer counted. It was obvious that insincerity was rampant. So I decided, so far as the general principles were concerned, to follow no school, but to think out the problem on my own. I discussed the position with Dr. Martin Jones. He suggested my giving some attention to the Bart.'s surgeons of the middle of last century. For not only had they a good practical knowledge of disease, but they were so sincere in their outlook. As a result Paget's lectures were read through each year. Each time this was done something new was revealed. At first I was inclined to pay attention only to what seemed of value to me. It was only as I realised that he had received little help from laboratory

when the bone is soft cartilage and malleable. Were the external pressure to be the factor that counts, obviously the skeleton would conform to the shape of the uterus ; whereas we know that the uterus has to adapt itself to the foetus within. Just a little thought makes it very evident that the shape of a bone or of an organ cannot be due to any external pressure, and must be due to some vital force acting from within. This is now demonstrable experimentally. For it is possible to watch the growth of a bone or an organ outside the body and the original shape is maintained. Obviously this is not due to external causes, and can result only from the action of some force within. It is true that, if an external pressure or force is maintained sufficiently long, the shape of an organ is altered. But the alteration should be regarded as a deformity. If this external pressure is removed before the parts have become fixed by growth, there is a chance that the normal shape may yet be restored. As life goes on, certain lines of stress appear in bones or organs as a result of the action of muscles or of gravity. But these normally have less influence on the shape than is realised.

tests, and that he had to rely almost entirely on his experience and powers of observation, that the greatness of his work dawned on me. But I still felt that I was not appreciating to the full his line of thought, for it was so difficult for me to visualise him as the great man he was considered by his generation. One evening, however, it dawned on me that he was bringing to the bedside not only a great knowledge of disease but a tremendous knowledge of life. Obviously he looked at the whole man in whose life the constitution, temperament, and disease were side issues. His line of thought viewed in this light has much bearing on our work to-day, for life does not change from one generation to another. In addition, it is the same in a country village or a mining valley.

How Hunter is to be approached I do not know. I am not sufficiently well read in his writings to give quotations. As his style is not clear I have much difficulty in understanding his meaning. Whilst it is essential to first find out what he thought, it is equally important to view his work in the light of the thought of his generation.

Many of us have great difficulty in putting ourselves in the position of the surgeon of his day. Great help might come from an historical film of surgery. For there was no great revolution in thought or in the way surgery was performed from the day of Hunter to the day of Paget. Many are still able to recall in detail what then took place.

Though the theory that the shape and size are due to a vital force acting within offers a satisfactory explanation for the shape of the organs, it leaves them as independent structures floating about in the body. Yet we know that each is anchored to a certain part of the body in a very effective manner. This is easily demonstrated when internal organs are rendered opaque to X-rays. For no matter what posture is taken up by the body, and no matter how mobile is an organ, it comes to rest in a position constant for the individual and fairly constant for the race. There must be some force at work to keep the organ attached. Importance is attributed at one time to the bones and at another to the ligaments or muscles. The bearing of each of these is best examined by noting their function in a limb. It is then found that it is upon the nerve energy going into the muscles that so much depends. This has been illustrated in the case of the limb (see page 101).

With the abdomen, important as are the bones and fascia, muscles are more so. This is demonstrable with a hernia. For, though a fascial graft is of value, this stretches if muscle is not available to take hold and to give adaptability. When the viscera are examined under the X-ray, it is found that their mobility is to some extent governed by the state of the abdominal muscles, being greater when these are relaxed than when they are contracted. But the position taken up when rest is resumed is much the same. This must be due to something in the pedicle. For once this is cut across, the organ can be placed in any position, and even be detached from the body. Now in the pedicle are muscle, fascial and ligamentous bands, and at times pathological changes, to each of which much importance has been attributed. During an operation it may not be possible to displace the viscera until the patient is properly relaxed, when displacement is easy. Now though deep anæsthesia helps surgical approach by causing the surface muscles to be relaxed, the only effect it has upon internal organs is by abolishing tonus. Anæsthesia in itself does not modify pathological changes ;

and even when relaxation is complete, it has little effect upon ligamentous and fascial structures. Anæsthesia does, however, diminish tonus ; for when the patient is properly relaxed this is abolished throughout the body. If organs can be displaced more easily under deep anæsthesia, this can be due only to the fact that the normal fixity is due to the tonus of the muscle. Treits and Lockwood demonstrated bundles of muscle in many peritoneal folds and in most pedicles. As they were so small it was felt that little importance was to be attached to them. But we know from the mollusc pecten that the power exerted by the tonic contraction of a muscle is quite out of proportion to its size. There is no reason why the muscles in each pedicle should not act in a similar way. The attachment of an organ should therefore be regarded as due to tonus.

When the body is at rest the joints take up a position that is fairly constant for the individual and the race. In this position of rest the natural curves of the body are present (see Fig. 1). This is the position to which the embryo conforms during development. It is the one taken up by the child immediately after birth. It is the one assumed by man throughout life when he is at ease or asleep. Any other position can be taken up only from active muscular contraction or from passive force. And when these disappear, the position of rest is resumed owing to the action of tonus. Though the position of rest is to some extent dependent upon the bones and ligaments, it is far more so upon the tonus of the muscles. As the position of rest is dependent upon tonus, and as it is the position to which the body tends during the greater part of life, it seems likely that tonus plays an important part, not only in the maintenance, but also in the development of the configuration. The shape of the bones and of the organs is due to some vital force acting from within. The attachment of organs is due largely to the tonus in their pedicles. Whilst the configuration of the body is dependent upon the shape of the bones and the size of the organs, it is maintained by tonus. As tonus is dependent

upon a centre in the brain, the vital force that gives attachment to an organ and that maintains the configuration must come from the central nervous system. This is the force that gives to man his power of adaptability, and allows the taking up of any position without any strain being placed upon any structure.

When tonus is excessive, the development of the muscles is greater than normal ; and there is an undue tendency to approximate the insertion of a muscle to its origin. As a result the curves that are outlined in the position of rest and which are dependent upon tonus are increased. The thorax becomes wide and deep from before backwards with the ribs more horizontal than normally. The subcostal angle is very wide and the physique is of the type shown in Fig. 6, which is associated with the hypersthenic constitution. Now, tonus is a general and not a local state, and what applies to surface structures applies to the internal organs. The pedicle therefore tends to be shortened and consequently the organ lies at a higher level. In addition, as the tonus of the muscle of the organ is also increased, this has a firm appearance when visualised by the X-rays. The excess of tonus is also responsible for the rapid emptying.

When tonus is deficient, the muscles tend to be long and fine and to be soft in consistency. The features dependent upon tonus are not so marked. The thorax is long and narrow, the dorsal curve is pronounced, and the subcostal angle is narrow. The physique is of the type shown in Fig. 7. This is that associated with the hyposthenic constitution.¹ The pedicles are also lengthened, and consequently the organs lie at a low level. As the consistency of the surface muscles is somewhat soft, these organs are palpable if solid. As the tonus of the muscle of the organs is also deficient, they are wide and capacious and emptying is slow.

¹ It may be that in the hypersthenic contractile tonus is in excess and in the hyposthenic relaxile tonus.

C. Is it Possible by taking Thought to change the Constitution ?

(a) At certain periods of the year man feels seedy. He looks wan, the face appears strained, and the muscles become flabby. If he now pays attention to the health, takes more exercise, and spends time in the fresh air, his skin glows, and he is a pleasanter person to live with. It is said his health has improved. On the other hand, tonus has also changed, for the muscles feel firmer.

There was a remarkable difference in the appearance of the recruits who joined up in 1914 compared with the men who left for the Front the following year. On enlisting many were pale and wan and the muscles were flabby. The want of stamina, even when they looked fit, became evident when they were called upon to undertake a long route march or to carry a heavy load. There was so little in reserve. Yet as training went on stamina developed, and was associated with a healthy appearance and an improvement in the musculature and in their bearing.

Something similar is also seen with the athlete. When he first goes into training, his muscles are flabby, and the pulse rises rapidly after slight exertion. Yet after a little time the muscles become firm, and the rise in the pulse is less marked. Tonus has undoubtedly improved.

There is, however, a limit to what can be accomplished. For once a certain stage is reached further improvement does not take place, no matter how thorough or for how long is the training. In fact, if persisted in, deterioration sooner or later follows. This is well shown with the rowing man. For once his condition becomes perfect, no further improvement is to be anticipated. Even the maintenance of this for any length of time is difficult ; and, if carried out for too long, the health breaks down.

(b) When going into the country, the mind is expectant, and all the senses are alert so that nothing can be missed ; and the singing of the birds at such a time can be a perfect joy. When relaxing and taking rest after lunch, songs

come through that were not heard before, and the singing is in a different strain. As Nature is much the same, some change has taken place in oneself.

(c) When going up to Anzac for the attack in August 1915, the ship I was on was rammed. The men, awakened from sleep, fell in on deck. All thought she was going down. A feeling of tension was obvious, and the strained look on the faces could be observed in the full moonlight. Then one of the men said in an audible whisper, "I wonder which is the worse; to have a life-saving belt and not to know the drill, or to know the drill and not to have a belt?" Everyone laughed, and a quiet smile came over the face. Though it was still thought the ship was sinking, the tension had gone and the atmosphere had changed.

(d) When the turns are poor in a music-hall, men are bored and the faces have a strained look. When the turn comes that makes men laugh, everyone livens up, and quite a different atmosphere prevails.

Changes such as those described in these episodes occur not infrequently in the lives of all. We attribute this change to mood. But what do we mean by mood? Surely not something that is abstract and a negative term. Something very definite has happened so far as the individual is concerned; for he passes from a stage of slight tension to one of relaxation and ease. If the face is watched, the changed expression is obvious. Now, the expression is dependent upon the tension in the muscles; and when an expression suddenly changes, some change in the muscles has taken place. This can only be because the tone of the muscles is not the same. Are mood and tonus the same? Is it not that in the first stage the muscles are slightly contracted and contractile tonus is acting; in the second, the muscles are at rest and relaxile tonus is acting? It may be said that mood is dependent upon the state of the internal secretions. But the change occurs so suddenly that it is difficult to believe it is due to this. In addition an internal secretion must act upon something. It does not merely

circulate in the blood. I prefer to regard mood as dependent upon tonus. This being the case, the instances just given indicate that tonus can be influenced by suggestion. It is known that one man by his presence does good and another does harm. Much is rightly attributed to the apt remark and the charming manner. But something more than this comes into play and personal magnetism has been spoken of. In past years the conveyance of vital spirits was referred to. But nowadays few believe in this. Rather does it seem that one person can alter the line of thought of another, and in this way modify tonus and so change the mood.

(e) At birth a child has only slight voluntary power in the limbs, and tonus is poor. As he grows older both increase. As he is taught to write, his power over the muscles of the hand increases. As control is gained over the muscles, they fill up and tonus is increased. Again, in a nerve lesion of the upper limb it is interesting to watch the stages of regeneration. First, there is a filling up of the muscles, then voluntary power is restored. Whilst the amount of power that eventually comes back is dependent upon the amount of tonus that develops, some effort on the part of the individual is essential. For everything fails if application is lacking. Nowadays we prefer to speak of the conditioned reflex ; but this, after all, leaves perfection and ease of procedure somewhere in the air. They are not abstract conceptions, and must depend on something. Now, so far as muscular activity is concerned, it is known that voluntary movement is initiated in the cortex and reflex movement in the spinal cord. What has been started as voluntary movement tends to become reflex with practice. As a result less attention has now to be given and activity is less of a strain. But neither can be carried out nor continued if tonus is not available. Whilst perfection and ease of procedure result from ability and practice, they are certainly dependent upon the tonus that is available. It does seem that by taking thought it is possible to direct this. The saying that practice makes perfect is as old as the hills. It is well

illustrated in the development of muscular power. The drill sergeant, when given a body of men, knows that he can improve their stamina and bearing. Though instruction and suggestion come into play, he is aware that ability also counts. For if men cannot learn, nothing can drive knowledge into them, and as a result their muscular power may be wasted. But equally important is their willingness to learn. He is certain that he will be successful in training the majority of recruits. For the power to adapt the muscles to a purposive end is possible if a man will but think. Is it that tonus can be increased by the will, or is it that training by directing the mind does transfer into certain channels energy that was held in reserve or that is being created?

From the preceding remarks it is obvious that a change in health, stamina, and muscular power is possible by attention to the rules of living, by suggestion, and by taking thought. But instead of regarding them as abstract conceptions they are now linked up with tonus, which is at each of these times increased. As tonus represents the basis of the constitution, it might at first be thought that it is possible to change this. And, when the wan recruit is contrasted with the muscular soldier, it seems at first that it is possible to convert the hyposthenic constitution into a hypersthenic. But from what we know of the constitution a complete change is unlikely, and I am doubtful if it does take place. For, when the original mode of living is resumed, the original constitution is restored. Rather does it seem that as health improves and thought is properly directed tonus increases; and as a result the constitution becomes modified. But modification is not the same as change. There is, however, a limit to which modification can go; and what is attained depends so much upon race, the type of individual and the state of health. Anyone who has studied training is aware of this.

D. Relation to the Time of Day, the Season, and the Weather

It is well known that energy varies during the day and night and is in some way linked up with the relation of the

earth to the sun. This is not a matter of suggestion, as some are inclined to think ; for it is seen in animals and plants. Other changes somewhat difficult to explain are noticeable. For instance, those who wander in the country are aware of the feeling of suspended activity over the whole countryside. Amidst this there is a feeling of watchfulness as if all things are waiting for the break of day. Then suddenly between three and four the dawn chorus of the birds breaks forth. It then dies down before morning breaks.

Robert Louis Stevenson writes as follows (*Travels with a Donkey in the Cevennes*) :

“ Night is a monotonous dead period under a roof ; but in the open it passes lightly, with its stars and dews and perfumes, and the hours are marked by changes in the face of Nature. What seems a kind of temporal death to people choked between walls and curtains is only a light and living slumber to the man who sleeps in a field. All night long he can hear Nature breathing deeply and freely : even as she takes her rest, she turns and smiles ; and there is one stirring hour unknown to those who dwell in houses, when a wakeful influence goes abroad over the sleeping hemisphere and all the outdoor worlds are on their feet. It is then the cock first crows, not this time to announce the dawn, but like a cheerful watchman speeding the course of night. Cattle awake in the meadows, sheep break their fast on dewy hillsides, and change to a new lair among the ferns, and horseless men, who have lain down with the fowls, open their dim eyes and behold the beauty of the night. At what inaudible summons, at what gentle touch of Nature, are all these sleepers thus recalled in the same hour to life ? Do the stars rain down an influence, or do we share some thrill of mother earth below our resting bodies ? Even the shepherds and old country folk who are deepest read in these arcana, have not a guess as to the means or purpose of this mighty resurrection. Towards two in the morning they declare that they take place, and neither know nor inquire further. We are disturbed in our slumber only, like the luxurious Montaigne, that we may the better and more sensibly relish it.”

Frequent references are to be found in the poets :

" I arise from dreams of thee
In the first sweet sleep of night."

Shortly after noon a quietness comes over the countryside and lasts for a couple of hours. Fewer birds are to be seen and there is little song. Animals now prefer to rest under the hedges. This quietness, present at all times, is more marked in hot and sultry weather.

There is little doubt that there is a change in the energy of man during the twenty-four hours. The temperature is at least half a degree higher in the evening than in the morning. And when the condition of a patient is serious, three to four in the morning is a critical hour. A good nurse, realising the need for employing all aids to maintain energy, now has the window shut and the room warm, and hot drinks ready in case the patient wakes. For it is the hour when depression is most marked. Battalions in the firing-line stood-to at dawn and dusk ; and when attached to the 4th South Wales Borderers I used to go up to chat with the men. At the stand-to at dawn there would be an air of expectancy that passed off immediately the morning broke, when those off duty would turn in to sleep. This expectancy was not due to any strain ; for these men were the coolest it has been my lot to know. Generally speaking, they were not very lively at this time. Yet at dusk they were cheerful and bright and full of fun. The difference was at first attributed to their having their tot of rum in the evening. But later it was realised that it was a question of inherent energy.

It is my impression that the centre of energy, like life in Nature, reacts to the relation of the earth to the sun. In consequence, energy varies during the twenty-four hours, being lowest in the morning and greatest in the evening. Certain influences also come into play ; and this is seen in men of a certain temperament who are affected by slight changes. A friend, whose sense of sleep is so refined that he is disturbed if he does not rest with his feet to the south,

tells me that up to 3 a.m. he prefers to lie on his right side and then turns on his left. He has always awakened at this hour ; but if he reads for half an hour he is able to fall asleep. In the early afternoon a feeling of tiredness comes over him which bears little relation to what is eaten. It disappears if he lies down and relaxes for half an hour. It is his impression that he is better if he does not fall asleep.

The bearing of the seasons upon life is obvious in Nature. Man is affected in the same way. For his energy is increased in the spring and early summer.¹ Then there comes a falling off and a holiday is needed about August to build him up. Energy is definitely diminished in late autumn and in winter. The view now held is that the centre of energy, like life in Nature, is affected by the relation of the earth to the sun and of the earth to the meridian. As a result, energy is increased or lowered according to the time of day and to the season. As to whether the sense of well-being is improved depends so much on the type of constitution. For the hypersthenic having already plenty of energy and the hyposthenic too little, one is improved by conditions that adversely affect the other. The hypersthenic has always sufficient energy, and, were he to rise at six in the morning, he would be able to do his work quite well. But, as the day goes on, the energy increases, and, his nervous system now becoming too active, the feeling of well-being disappears. For this reason, as the evening comes on he desires some sedative and is inclined to indulge in alcohol and hot baths. The hyposthenic is normally lacking in energy. He feels worse when rising, for it is now low. He is a little inclined to work at this time.

¹ My prostatectomy cases do better in the spring and summer and I will take a risk in these seasons that would mean certain death in the winter. At one time I attributed this to lung complications being less frequent. But some other factor comes into play, for shock is less evident and wounds heal more quickly. I recently saw for Dr. Martin Jones a patient on whom I had done a cystostomy last year. We both agreed that he was not yet fit for prostatectomy. On my suggesting that the final decision should be left until after May, Dr. Martin Jones told me that Sir Thomas Smith, to whom he had acted as house-surgeon, preferred to do his cleft palates after May.

He benefits as energy increases. For this reason he does his best work in the evening often when about to retire. He is a late riser, but, on the other hand, goes to bed late.

This view of the relation of energy to the time of day and to the season does help in guiding a patient through life. If he is inclined to wake about 3 a.m., it may be advisable for him to do some reading or writing at this hour ; if so, he should make it a habit to rest during the middle of the day. The hyposthenic often feels depressed about 11 a.m. This depression may be relieved by a cup of coffee. On the other hand, it can often be prevented by taking a little *nux vomica* after breakfast. The hypersthenic is benefited by taking a little opium in the afternoon or evening. Vital energy is something definite that the practitioner should endeavour to study, for at times it is possible for him to exercise some control. A form of therapy was much in vogue at the end of last century which aimed at giving some drug to increase or decrease energy, and the expression toning up or toning down the system was referred to. I cannot help feeling that its revival would lead to an improvement in the sense of well-being of many who now suffer from those minor ills of life—ennui, irritability, and depression.

The seasonal nature of bacterial disease is established. Seasonal changes have in addition considerable influence upon life in general, and should be taken into consideration when treating those who are not well. People have always realised the need for a break at Easter and a holiday about August. They would feel better and would no doubt be healthier if they broke up the year a little more and conformed to the ways of Nature. Such advice is necessary nowadays, when many try to live life in the same way all the year round. Animals hibernate in winter and many plants retire into the ground. But this should not be regarded as a form of paralysis. It is merely preparation for the months that lie ahead. Man would feel better were he to give up exercise in December and January, February and March

being employed in quiet preparation for the spring.¹ For if he wishes to enjoy this to the full, his general condition should be good and his senses alert. After the solstice in June life should be taken a little more quietly. This certainly applies to August, the month of quiet in the country. Now, as much time as possible should be spent in the open, but rest rather than exercise is indicated. In September and October there should be greater activity. Those of a religious turn of mind can use Advent for quiet contemplation and thought. The shortening days make it evident that the winter solstice is approaching. It is an appropriate time for a man to look back on his own life. In Lent some trouble should be taken to prepare the mind and body for the spring that lies ahead, in the same way as an athlete prepares for a contest. This does not imply that living in spring and summer is a contest. Rather is it a perfect joy. But to be appreciated to the full some preparation of mind and body is essential. Viscount Grey wrote :

“ One thing perhaps should be borne in mind to prevent disappointment, and that is not to ask too much of Nature

¹ Those who live in the temperate zone consider they suffer from the weather. On the other hand, the temperament and the constitution of the northern races are often the admiration of those who are brought up elsewhere. An outstanding feature is their adaptability. Whilst this is no doubt largely dependent upon race, may it not be partly dependent upon the variability in the weather? The uncertainty of this from day to day must in some way modify our outlook upon life.

Once the winter solstice passes, the lengthening evenings help us to anticipate the spring. However bad the weather, the mere thought of April and May brings peace and enjoyment to the mind. Though the spring lingers, we are certain it is only for a while. From June onwards the country in England is a perfect joy. When September comes the shortening days make us realise that the year is on the wane. Now the gardens and parks seem so beautiful in the light of the setting sun. No matter how bad the weather, there is always the chance of an Indian summer. Even if this is delayed, hope is never abandoned until St. Martin's or Armistice Day is past. Then, if the weather is bad, I just settle in for the year. After all, December 21st is not so far off.

Now much of the grumbling about our weather is really a good-natured grouse, and is done just to pass the time of day. When the weather is bad, remember that because of it we shall appreciate all the more the good weather when it comes.

suddenly, when we have been strained by overwork ; at such times we are out of tune, and more fit for rest than for enjoyment. If we are to enter into the moods of Nature, we must bring with us some vigour and elasticity of spirit. A feeble mind looking upon fair scenes with a languid eye will not feel the joy of them, and it is with Nature as with friendship—we cannot take all and bring nothing. On the other hand, work, if it be of an interesting sort and not crushing in amount, is a fine preparation for the country. Such work is stimulating, and when we make our escape we do it with faculties alert and active, with every sense alert and eager for sights and sounds and all joys, which are not to be met with in cities. Then we bring with us such an uprising of the spirit, that we seem to be fit companions for Nature even on the finest and best days in spring.”

And what applies to Nature applies to living. To the man who makes preparation health and enjoyment come more abundantly.

Weather has also some bearing. We know the feeling of well-being that comes with sunny weather. Yet, if this is long continued, the health may become impaired. On what the immediate change is dependent we do not know ; but whether sun in the long run does good depends on whether a reaction is possible, and whether it is advisable that this should take place. The north-easter tends to make men miserable. Even before getting out of bed many are aware of the direction of the wind by the dryness of the mouth and nose, the tingling of the skin, and the change in the temper. If the wind persists, the health soon becomes impaired. I suppose there are some who do appreciate Kingsley's poem :

“ Welcome, wild North-easter !
Shame it is to see
Odes to every zephyr ;
Ne'er a verse to thee.”

Precautions can be taken against the sun by remaining indoors and living life quietly. But even nowadays with central heating it is impossible to contend with the north-easter. For even if a man remains indoors the “ weak spot ”

is still picked out. Now that we are appreciating how the effects of season and weather arise, it should be possible to find drugs that act on the nervous system and so minimise if not overcome the harmful influence. What tribute would many a man not pay to Science were she but able to provide him with something that would make him indifferent to the east wind ?

E. Relation to the Reaction to Disease

The man with a sound constitution can adapt himself so easily to most things in life. This adaptability is dependent upon his vitality. Whether this can be maintained depends on the energy that he has in reserve or that he can create. Should such a one when he is well be presented with some harmful influence, he overcomes it with little ill-effect and without disease arising. This has been demonstrated experimentally. For, when pathogenic bacteria are injected in moderate amounts into healthy animals that are not unduly susceptible, bacterial disease rarely follows. This energy, however, can be influenced by many factors, such as the relation of the earth to the sun and to the meridian and by a change of weather. But the man with the sound constitution having so much in reserve is not affected by the time of day, the season, or the weather. Should, however, the energy be impaired, and should the impairment persist sufficiently long, vitality, and with it the power of adaptability, soon become affected. Now, bound up with vitality is resistance to disease. When this becomes impaired a predisposition is said to arise. In Chapter VII the bearing of the central nervous system in overcoming disease was pointed out; if sufficient vitality was not forthcoming, disease tended to persist. But to overcome a general bacterial disease, energy is also essential. If energy is normally low, as in the hyposthenic, disease tends to persist and to be associated with little reaction as in coli infection. If the energy is normally high, as in the hypersthenic, the tendency is for the reaction to be great as in staphylococcal

disease. The reaction to disease is related to vitality and energy. Both come from the central nervous system. As this is the basis of the constitution, the bearing of this upon disease now becomes obvious. Consequently, when the reaction is insufficient or is excessive, attention should be paid to the state of the central nervous system.

F. The Bearing on Therapy

The alchemists believed that the body was composed of three primary substances—sulphur, mercury, and salt. When they were in right proportion, there was health. When ill-health arose, all that was necessary was to replace the missing substance. There is little doubt that when there is a tendency to staphylococcal disease, sulphur does good; and when there is a tendency to coli infection, mercury does good; when there is a tendency to tuberculosis, diminution of chloride does good. The old practice of giving children sulphur in the spring and mercury in the autumn had much to be said in its favour. It fell into disrepute because all the children were treated alike. Now sulphur was supposed to tone down the system and mercury to build it up. I have noted that those who are hypersthenic speak well of brimstone and treacle when given in childhood, and those who are hyposthenic of grey powder. A little attention to the constitution early in childhood might prevent unnecessary suffering. In the treatment of syphilis before the War, mercury was the stand-by for primary and secondary lesions, and iodide for tertiary. The large, hard chancres, massive secondary lesions such as rupia, and tertiary lesions with marked fibrosis, were often very resistant. When salvarsan was introduced, they disappeared almost in a day. It was in lesions where fibrous tissue was in excess that its action was most marked. Salvarsan has some action in staphylococcal and tuberculous lesions when the reaction is excessive and much fibrous tissue tends to be formed; but unfortunately its action is not nearly so marked as in syphilis. In certain forms of bacterial disease, where

the reaction is not sufficient, the heavy metals do good. In certain sinuses that keep on discharging and yet refuse to heal, the injection of lipiodol may be followed by healing. And in certain types of bacterial disease of the urinary tract associated with pyuria the injection of uroselectan may lead to a cure. The result is most dramatic ; but, unfortunately, does not occur sufficiently often to justify its use in therapy. Working from this, I use the arsenical compounds when fibrosis tends to be excessive ; the heavy metals when ulceration is unduly persistent and the reaction not sufficiently great ; and iodine when suppuration goes on. It is quite erroneous to think that any of these drugs act directly or as germicides. Improvement follows only if some reaction is induced in the body. The practitioner is guided by the type of constitution, the temperament, and the state of health. Small rather than large doses are advisable ; and this certainly applies when health is not good.

In the treatment of nervous exhaustion in the past much attention was given to phosphorus and its compounds, as the nervous system contained so much. As inorganic phosphates had little action, organic phosphates were tried, and then vegetable phosphates. It was assumed that the more nearly the compound conformed to that contained in the nervous tissue the more likely was it to have effect. But therapy is not so simple as this, and few drugs act directly. In addition, any phosphate given is first broken down by the digestive fluids into constituents that can be absorbed by the cells. But even were the drug injected intravenously, it must first be able to pass through the barrier that exists between the circulation of the central nervous system and that of the cardio-vascular system. In addition, it must be soluble in the lipoid membrane of the nerve cells before it can enter. Overton has pointed out that ether and chloroform act because they are soluble in the lipoid membrane. This also applies to hypnotics in general. The first essential for a nerve tonic is that it should be soluble in the lipoid membrane. The overlooking of this is, no doubt, responsible for

our failure to make any advance in the treatment of nervous exhaustion.

When hexamine is given as a placebo before some urinary examination, the patient not infrequently experiences a feeling of well-being and increased vigour. It was difficult to account for this until Billard showed that hexamine acted directly upon the nervous system. In all probability it is the presence of the aldehyde group that enables the drug to be soluble in the lipoid membrane. A feeling of well-being may follow starvation, exercise, or the taking of fatty food. Research work has shown that ketones are formed at such times. The ketone body probably acts directly upon the nerve cell.

The beneficial effect of a mature wine or brandy is due to the action of its volatile ester. Red wines lead to quiet talk and to thought; port wine being the best. White wines increase vitality. At a dinner-party people are often quiet until the champagne is brought out. Then it is not long before they start to talk and to become hilarious. When the sick need to be stimulated, brandy and champagne are given. Rarely at such a time is port or a red wine prescribed. Now the ethyl alcohol in each is the same, and the action of this can be studied by drinking dilute spiritus vini rect. It leads to inebriation and forgetfulness, and in this way brings contentment to a mind that is worried. But a wine has some other action that is no doubt due to its volatile ester. Unfortunately, it is so difficult to dissociate the action of a volatile ester from such a powerful poison as ethyl alcohol, and it is difficult to obtain the ester in a pure state. But from its chemical composition it again is likely to be soluble in the lipoid membrane.

May it not be that we should look for nerve tonics to drugs containing the ketone or aldehyde groups, or to those resembling the volatile ester rather than to those containing phosphorus? This point is important now that it seems that the basis of the constitution is in the central nervous system. For the relation of nervous exhaustion as a pre-

disposing cause to the onset of disease is established. There is little doubt that some toxins act directly upon the nerve cells. And the exhaustion that persists after disease is overcome is due to the injury that these have suffered. Had we a form of therapy that really could build up the nervous system, much might be done to prevent disease arising. By taking measures to protect the cells from the action of the toxins whilst disease is active, much can be done to prevent the harm that ensues. Were scientists to provide us with some drug that could act upon the nervous system, great relief could be given to those who find convalescence so irksome and so long.

Whatever form of therapy is undertaken, faith and hope come into play. Not only must the patient have confidence in what is undertaken, but also in his own power to get well. Much now depends upon the practitioner he calls in. For at a certain stage of an illness, one indiscreet remark may undo all the good that has been created by nursing and careful therapy. A hopeful outlook is essential. Consequently, the best possible interpretation is put on all that happens. For, once hope is abandoned, therapy is not unlikely to fail. Faith and hope come into play in all forms of therapy. When deciding between faith, hope, and therapy, it is well not to attribute too much to the last. Should ill-health tend to become persistent, give a thought to the original, "Faith, Hope, and Charity, these three, and the greatest of these is Charity." Now, charity properly translated is love; but this word does not mean "fondness of," but "consideration for and courtesy to others." At times the continuance of ill-health is due to a man being too self-centred and not sufficiently interested in his work and in his duty to others. We are inclined to think that a changed outlook on life comes because a man gets well. But sometimes he gets well because his outlook on life becomes changed. For at times it is extraordinary how health returns once a man can be taught to think outside of himself and to adapt part of his energy to giving thought and attention to the welfare of others.

G. A Test for Energy

If a practitioner wishes to know if a man is alive or dead, he watches to see if he breathes. If this does not take place, he listens to the heart. If the sounds are not heard, he places his hand on the forehead to see if it is warm. If it is cold, he assumes the man is dead. In the twentieth century life is surely entitled to some finer test than this. As for vitality, we are dependent for its estimation upon watching some organ function. The practitioner observes the glow of the skin, the brightness of the eye, and the state of the pulse. The blood-pressure may be of help, but generally this is very slight. Otherwise he is dependent upon the sense of well-being of the patient and his power to react to any temporary strain. As for vitalism or energy, this can be estimated only as life goes on. To-day little notice is taken of this aspect of life, and so few give it thought. There is no instrument by which this energy can be roughly recorded. Nor is one likely until scientists think aright on this subject of life.

Each man can reason out this energy that is the basis of vitalism in the light of himself. He will realise how it varies during the twenty-four hours and the seasons of the year. Its expenditure surely is associated with some definite change that as yet cannot be recorded. We were unaware of wireless waves until Marconi revealed them to us. Since then what marvellous results have been achieved! In these days when scientists can measure the electron and the ray of light, measurement of this energy should not be beyond their conception, were they but to think aright. At a time when great advances are taking place, it is the hope of the clinician that some research worker will come along and tell us what this energy is and how it can be estimated. Then there will come the day when the practitioner will be able to measure the energy of man as easily as he now does the weight.

CHAPTER XI

THE NATURE OF BACTERIAL DISEASE

The Source of Bacteria

THOUGH a healthy mucous membrane is very resistant to the inroad of bacteria, work upon typhoid has shown that organisms of a certain type have no difficulty in passing through into the blood. Pneumonia was at one time attributed to a few pneumococci being inhaled into the lungs. But we now know that bacteraemia occurs in the earlier stages, and there is no history or evidence of any lesion in the throat. Barrington and Wright have shown how easy it is for bacteria to invade the blood-stream from the posterior urethra once the mucous membrane has been lacerated. We are by no means certain whether, with diseases such as pneumonia, coli infection, etc., the bacteria are those normally present in the body or whether they come from some outside source as in typhoid. It is, however, quite possible that the virulence of those normal to man changes from time to time. The energy of man, animals, and plants varies with the season and with the weather. This also applies to the smaller forms of life. As one sits on the bank of a river, one sees the Rough Olive, the March Brown, the Iron Blue, the Mayfly, the Red Palmer becoming active at certain hours of the day and in certain months, and those who have a great knowledge of Nature are able to tell to a day when they will appear. May not this variation in energy take place with bacteria? It is possible that, had we some means of recording it, the energy of these, like life in general, would be found to change with the season and with certain climatic conditions. And with bacteria change in energy means a change in virulence. Bacteria from some outside source are generally more virulent than those normally resident in man.

But contact with disease is not essential if this variability in the energy of bacteria is possible. Nor is a lesion of a mucous membrane necessary for bacteria to get into the blood. All that can be said is that, under certain circumstances that are not as yet understood, a mucous membrane that is apparently healthy lets through bacteria.

The Relation of the Reaction to the Type of Bacteria

Generally speaking, it can be said that the reaction bears a much more definite relation to the type of bacteria than to the constitution. From the nature of the reaction it is often possible without a microscopical examination to name the organism. But exceptions frequently occur. A urethritis leading to creamy pus is generally due to the gonococcus and one leading to sero-pus to the bacillus coli. Yet I have seen a urethritis due to the latter organism where the pus was thick and creamy. Again, the staphylococcus gives rise to a localised inflammation in the skin and the streptococcus to a diffuse cellulitis. But a diffuse cellulitis may be due to the staphylococcus. When an attempt is made to link up bacteria with the reaction to which they give rise, the following classification acts as a rough guide :

B. Anthracis	}	Sthenic state most likely gram-positive.
Streptococcus		
Pneumococcus		
Staphylococcus		
Gonococcus		
B. Coli	}	Asthenic state most likely gram-negative, except B. diphtheriæ and B. Welchii.
B. Diphtheria		
B. Typhosus		
B. Welchii		
B. of Influenza		

The gonococcus gives rise to a local reaction with the formation of pus. As a rule, there is no general reaction. As the table is ascended, the local reaction becomes more marked, the congestion more intense, and the tendency to

the deposit of fibrin greater and to the formation of pus less. The general reaction is now more marked, and the bacteria tend to invade the blood-stream and to give rise to the septicæmic state. The reaction also becomes more sthenic in its local and general aspect. As the scale is descended, the local reaction becomes less marked, there is less congestion and less tendency to the formation of pus or to the development of leucocytosis. On the other hand, the general reaction characterised by mental prostration and weakness is more marked. The reaction in its local and general aspect is definitely asthenic.

Generally speaking, the gram-positive organism gives rise to the sthenic and the gram-negative to asthenic inflammation. Is the nature of the reaction partly dependent upon some chemical produced by the bacteria that is in some way related to its staining power? For the difference in the reaction between the gram-positive and gram-negative organism is obvious. And in the lower half of the scale, though the general reaction from the *B. diptheriæ* and *B. Welchii* is asthenic, they do give rise to a marked local reaction. And both are gram-positive.

A Working Hypothesis

Normally there is no contest between man and his bacteria so long as the latter confine their activities to the usual channels. Because the virulence of the bacteria is increased, because there is a laceration of the mucous membrane, or because the resistance factor is lowered, a contest takes place. The bacteria have first to contend with the anti-bacterial properties of the body fluids. If they are successful in this, then bacterial disease arises. There are two main types :

1. Where the reaction at the start is purely local, as in gonorrhea and infected wounds. Here invasion of the blood, if it takes place, is a secondary event.
2. Where the bacteria pass into the blood at the start and multiply, giving rise to a bacteriæmia. This may be over-

come by a rise of temperature, a shiver, or a rigor, each being evidence of an attempt by the central nervous system to restore the resistance factor. If this takes place, the bacteria disappear. If not, septicæmia is imminent. To prevent this, inflammation arises in some organ. Why the lung should be picked out with the pneumococcus, the skin or the bones with the staphylococcus, the synovial membrane or the skin with the streptococcus, and the gall-bladder or pelvis of the kidney with the bacillus coli, we do not know, any more than why the bacillus typhosus picks out the intestine. It is assumed that as a result of the inflammation protein bodies are absorbed into the circulation that help to restore the resistance factor. Whilst the host is making every effort to do this, bacteria, by their toxins, are endeavouring to create a situation in which they can survive. Disease must always be looked at from two points of view :

1. The effort of the host to overcome some harmful influence.

2. The effort of this harmful influence to form a soil in which it can extend, or at any rate survive. We must not think that the aim of the bacteria is the death of the host. For when this takes place death of the bacteria follows if the host is cremated or is buried in the ground. The bacteria would surely prefer for the disease to become chronic ; for the chances of survival of the species is then much greater. For instance, where a person who has had typhoid becomes a carrier, so far as the continuation of the bacillus is concerned that person is more effective than 10,000 dead from the disease.

The natural course of bacterial disease is best considered, not by taking extreme cases or where the disease arises in those who are constantly ill or nearly dead, but rather where it arises in those who previously have carried on fairly well in life. Two main types of reaction occur, the sthenic and asthenic. This is shown in the general state and in the local reaction. With the asthenic, of which typhoid is an example, the nervous prostration is extreme and the patient

lies listless with a rapid soft pulse of low tension. The high temperature suggests that his nervous system is making every effort to produce a reaction, but this is not possible owing to the reactive powers being paralysed by the toxæmia.

As the disease progresses, the patient gradually becomes weaker. Then, just as the end seems near, the turn occurs ; and he begins to improve. With the sthenic, of which pneumonia is an example, the patient is restless with a tendency to delirium. There is a full bounding pulse with the tension tending to be raised. Watching him, one cannot help feeling that his best chance comes from lying listless. He is unable to do so because the toxin for the time being is stimulating the nervous system. As the disease progresses the reaction becomes more severe. Then suddenly the crisis occurs. In pneumonia it is the severity of the reaction that is doing the patient so much harm ; in typhoid it is the absence of a reaction that is so disconcerting. As the practitioner compares them, he must have felt that, if he could transfer to the other what is doing one so much harm, the aim of therapy would be attained. The temperature is an indication of the effort of the central nervous system to raise the resistance factor. The toxæmia is the effort of the bacteria to create a soil in which their survival is most easy.

Organisms such as the pneumococcus, staphylococcus, and streptococcus create a state where the energy is high and the tendency is to hypertonia ; organisms such as the bacillus typhosus and the bacillus coli create a state where the energy is low and the tendency is to hypotonia. Organisms no doubt exercise some choice in the host they attack. Those such as the pneumococcus prefer to work where the energy is high. For this reason the hypersthenic or one whose health is good is preferred. This state no doubt makes the survival of the bacteria easier. Those such as the bacillus typhosus and bacillus coli prefer to work where the energy is low. For this reason the hyposthenic or one whose health is not too good is preferred. Until recent years the hypersthenic constitution was that to which

men rather than women tended. Consequently pneumococcal, staphylococcal, and streptococcal diseases are found more commonly in men. This is certainly the case with boils and carbuncles; and, for every case of staphylococcal disease of the kidney I have come across in women, there are four in men. Coli infection and typhoid occur more commonly in the hyposthenic, where energy is wanting. As this is the constitution to which women tend, coli infection is more common in them. When strong, healthy people are affected, it will be found that previously the health was impaired by mental strain, or some disease such as influenza.

Certain bacterial diseases are more prevalent in certain seasons and in certain weather. The energy of man, like that of life in Nature, varies during the year, being greatest at the summer solstice in June and lowest at the winter solstice in December. Like disease in general, pneumococcal, staphylococcal, and streptococcal diseases are more common in winter, when impairment of health is likely. But when arising in those previously in good health, they are common in the early spring and at the close of summer, when energy is high. For this reason they may occur on the return from a holiday, when the health was "never better." Coli infection is more common in autumn and winter, when the energy is low. Typhoid is more prevalent in September, October, and November.

The Stages of Inflammation

In the treatment of inflammation in past years we have at times been too much influenced by the local reaction, rather than by the state of the patient. Even when excision was not possible, direct treatment was preferred to treatment of the general state. In pneumonia it is the latter that receives first consideration, and when the crisis has occurred the patient is not treated in the same way as when the disease is active. Yet the examination of the chest suggests that no evident change has taken place in the inflammation in the lung. This procedure should be followed with in-

flammation in general, and I now divide this into stages. The following scheme is of help in practice. It does not follow, however, that all have to be gone through or that the disease is not cut short in any one.

1. *A Stage of Progress*, when the contest between host and bacteria is going on. As this continues, infiltration of the tissues is added to the congestion. This is also a tendency for granulation and fibrous tissue to form around the infected area, the object being to limit its extent.

2. *A Stage of Ripening*.—Here the inflammation reaches its height and the resistance factor is restored. Products that were before needed can now be discharged ; the crisis occurs, as in pneumonia, or the disease comes to a head, as with carbuncles and boils. This is the optimum time for incision, if one is needed.

3. *A Stage of Decline*.—The active congestion now disappears, and, if destruction of tissue has taken place, it is necessary for granulation tissue, and, later, for fibrous tissue to form.

4. *A Stage of Convalescence*.—Once the resistance factor is restored and the inflammation subsides, health is not immediately regained. There was some impairment before the disease arose, and some is certain to follow the toxæmia. For some reason we do not yet understand, the healing of disease is exhausting, and, so to speak, " takes it out " of a patient. Consequently, after it is over mental and physical fatigue easily arise ; it is now necessary to build up the constitution.

5. *A Stage of Relapse*.—Even though inflammation comes to an end, it does not necessarily follow that the organ is straightaway restored to the normal. Time is necessary for this to take place. Once inflammation has occurred, the mucous membrane remains unduly sensitive and fibrosis does not clear up straightaway. With impairment of health, or with a change of weather, some congestion is not unlikely at the weak spot. At such times symptoms may recur and pus may form in which bacteria may be found. Whether

these come from the original source or whether they have been lying dormant in the tissues is not known. The chances are that, even when inflammation clears up, the bacteria do not entirely disappear. For in syphilis and tuberculosis it is established that, though the disease becomes quiescent, and the patient apparently cured, destruction of all the bacteria rarely takes place. This no doubt applies to bacterial disease in general.

6. *The Stage of Chronicity*.—Once the resistance factor is restored, the tissues can deal with bacteria and the disease quietens down. If there has been a pre-existing pathological lesion at the site of inflammation, such as a hydronephrosis or a calculus, the disease does not clear up until this is treated. Or the pathological lesion may result from healing. In such a structure as the skin, excess of fibrous tissue does little harm. But with an internal organ the fibrous tissue may cause adhesions to surrounding structures and so prevent a cavity from collapsing; and as healing cannot now take place, the disease becomes chronic. This also occurs if the fibrous tissue constricts a duct, and so prevents the discharge from escaping. At other times the resistance factor is not restored, the fibrosis is insufficient, and ulceration continues.

The Bearing of the Diathesis

At the end of last century physicians spoke of the gouty, the bilious, the scrofulous, and the nervous diatheses. By diathesis was meant that a man had in his constitution something that predisposed him to disease. But when the bacterial conception of disease arose and technique improved, bacteria were found in many places where previously it was thought the affection was due to a diathesis. Ill-health was now attributed to the activity of these, and the aim was to destroy them or to remove the diseased organ. As operative surgery was becoming safe, the latter was frequently attempted. The error of this was evident in tuberculosis. Many disorders previously regarded as due

to the scrofulous diathesis and treated on general lines were found to be due to the tubercle bacilli. As these were foreign to the body, it was naturally assumed that if disease could be removed, the patient would be cured. Whenever possible this was done, but the disease only broke out elsewhere and often the last condition of the patient was worse than the first. It was then realised that the tubercle bacillus was only one factor, and that before it led to disease a predisposition existed. Unless this was overcome at the same time as the disease was removed, the tubercle bacilli became active elsewhere.

Consequently, it was considered essential to overcome the predisposition before an operation was carried out. For this purpose treatment by fresh air, sunlight, etc., was undertaken in a sanatorium. It was found that, as the general health improved, the disease became quiescent; as a result operation was avoided. The end-result was better than that which followed operative treatment. The bearing of the diathesis was so obvious here that many wondered it did not count in other bacterial diseases and whether treatment should not be directed to overcome it. Might not the failure to pay sufficient attention to the predisposing cause be the reason for the ill-health that so often followed the operative treatment of chronic bacterial disease? Consequently, medical men once again turned their attention to the study of the diathesis. And before the War the relation between the bilious diathesis and coli infection was noted; so was that between the gouty diathesis and staphylococcal disease.

A. The Bilious Diathesis

There is a type of individual, more common in Celtic and Latin than in Nordic races, who, following some period of strain, suffers from indifferent health and malaise associated with disordered function in one or more organs. A characteristic feature is the mildness of the local symptoms compared with the degree of malaise. For though the pain is often de-

scribed as "hardly bearable," this is due rather to its nature than to its intensity. Generally, it amounts to discomfort or a feeling of rawness. In those picked out the energy is naturally low; the build is frail; tonus is often poor; and the constitution is hyposthenic. The malaise is more evident in winter and autumn and in cold weather. In persons of this type the resistance factor is affected by causes to which a person with ordinary health is indifferent. At such a time inflammation is set up in an organ, the object of the inflammation being here, as elsewhere, to restore the resistance factor. Rarely is much pus formed, and there is little tendency to fibrosis. As the energy is naturally low, the bacillus coli is likely to become active, and for some reason we do not yet understand it prefers a mucous membrane. At the start many mucous membranes may be involved; but after a time the inflammation tends to become localised in one, the so-called weak spot for this patient. This may be the nose, the gall-bladder, the appendix, the uterus, or the urinary tract. Why a particular one is picked out we do not know, but it is possible that in the individual all the organs have not the same powers of resistance and there is likely to be some flaw in one, the so-called weak spot for the patient. As gastro-intestinal symptoms are apt to be present, and as these are associated with discomfort in the upper abdomen and a certain heaviness of the mind, it was formerly thought that the chief trouble lay in some disorder of the bile, and the term bilious diathesis was applied. It is important to realise that with a diathesis the ill-health comes first and the inflammation is secondary. Remove the affected organ and the inflammation breaks out elsewhere unless the strain in living that reveals the diathesis is at the same time overcome. As there is a definite relation of bacterial disease to the central nervous system it is possibly to this that attention should be directed, for symptoms of nervous instability are usual and many of the patients are inclined to be emotional.

The diathesis is not commonly revealed in childhood.

More often it becomes evident at puberty. Often the onset is related to some period of strain, such as working for an examination, marriage, or some illness. Whilst the diathesis may become evident in the forties, when the change in life is taking place, it is my impression that, when it has existed earlier on, there is a likelihood of it disappearing at this time. From then on in life the passage is smooth and cancer is unusual except as a terminal event.

B. The Gouty Diathesis

There is a type of boy to whom puberty seems no strain, other than that his excess of energy gets him into trouble. Generally good at games, his failure in these is due either to laziness or to an absence of a desire to excel. He always has sufficient energy, and as his temperament is sanguine he is the life and soul of the party. There is a tendency to muscularity, tonus is good, and the constitution is hypersthenic. His state is often worse in the spring or autumn, when the health tends to be good. Such a one is predisposed to staphylococcal and streptococcal disease. When they arise they are quickly overcome and do not give rise to much subsequent disablement. But at times they may go rapidly ahead and cause death in an unexpected way. Now, bacterial disease is an effort to restore the resistance factor and has certain advantages. For those who have recurrent attacks of boils do not suffer much in later life. If predisposition does not work itself out in this way and if no attention is paid to the mode of living, hyperthyroidism, duodenal ulcer, and gastric ulcer of the perforating type may arise in the thirties. In the forties such a one is predisposed to gall stones or to uric acid calculi in the urinary tract. Even if these are avoided, he often has a stormy passage as the change of life comes on, as if to compensate him for his smooth passage through puberty. So often it is at this time that his troubles begin. Hyperpiesia is now common. Later still he seems more liable to cancer than the average person, and this is often of a rapidly growing and painful type.

Gout is a disappearing disease in regard to its articular manifestations. But physicians at one time spoke of the irregular type of gout. It is my impression that the diseases to which reference has just been made conform to this.

In preceding chapters references have frequently been made to resistance. When this is impaired the person is then predisposed to disease. But the term predisposition is in medicine used rather to denote some state that can be detected clinically or the onset of disease itself. The difference between predisposition and diathesis is really one of degree, a diathesis being applied to a predisposition that is persistent or that becomes revealed through slight causes. The question arises whether the term diathesis should not now be discarded. Instead of bilious, diathesis we could speak of one of the hyposthenic constitution who is predisposed to coli infection and asthenic states. Instead of gouty diathesis, we could speak of one of the hypersthenic constitution who is predisposed to staphylococcal and streptococcal disease and sthenic states. But the old terms have a general meaning and give a conception of a clinical state that is not conveyed in modern terminology. We should remember that in days gone by physicians viewed the whole patient. And as their time was not taken up by much that now confuses the mind, their conception was likely to be more accurate than our own.

“In our own country not only is gout in its most marked and typical manifestations exceedingly prevalent, but in its lurking and undeveloped forms it is probably still more so, and exercises a considerable influence over the character and progress of other disorders. . . . We are better prepared to direct our attention to the investigation of irregular forms of gout, remembering that it is of the highest importance to the advancement of medical science that we should not use the latitude which the term affords us as a cloak for our ignorance of the nature of any disease, but be careful to apply the name only to such instances as we can clearly demonstrate to depend on a gouty state of the system.”¹

¹ Sir Alfred Garrod, *Gout and Rheumatic Gout*, 3rd edition.

CHAPTER XII

THE TREATMENT OF BACTERIAL DISEASE

“ THE medical man trains himself, or has been trained by the example of those who taught him, to recognise the qualities and individual needs of his patients. He realises that each is an individual, and not merely a member of the human race. The task of the practitioner is far more than to apply the knowledge supplied to him from the laboratories ; he does not merely ask himself or look to his textbook to tell him what is good for pneumonia, but calls upon his experience to guide him as to how he may best help the particular patient to come through his attack of pneumonia with the least possible damage.” ¹

The great improvement in the healing of wounds that followed first antiseptic and then aseptic surgery made evident the power of antiseptics. Consequently, once bacterial disease had arisen, the aim was to destroy the bacteria either by the local application of an antiseptic or by the administration of drugs which were supposed to have some germicidal power when circulating in the blood or when deposited in the tissues. This line of thought led to the production of salvarsan. The wonderful results that followed made us feel that *therapia sterilisans magna* of Ehrlich was within reach. The efficacy of iodine in sterilising the skin has shown us that a powerful antiseptic need be in contact with the bacteria for only a short time. But as in the syphilitic lesion there is so much endarteritis and fibrosis, it is difficult for the drug to get into contact with the spirochæte ; and as 80 per cent. is excreted within half an hour, it cannot remain in contact with them for a long time. In the circumstances it is difficult to believe that the action of

¹ Sir Archibald Garrod, *The Inborn Factors in Disease*, p. 23.

salvarsan is entirely, or even largely, that of a germicide. Besides, bismuth has a definite action upon syphilitic lesions and yet has no germicidal action upon the spirochæte when placed in contact with it outside the body. Though mercury has little if any action in the tertiary stages of syphilis when fibrosis is rather great, it has a definite action in the primary and secondary stages. But the amount circulating in the blood at any one time is too small for it to have much antiseptic power. Though the iodides are not antiseptics, they are very efficacious in tertiary syphilis. No one disputes the efficacy of these drugs in syphilis. To appreciate them one has only to watch the rapid disappearance of the massive syphilitic lesions when salvarsan is given. It may be that they are adsorbed by the spirochæte which is as a result destroyed. But there is no proof of this, and such an action seems unlikely. If they do not act upon the spirochæte, how do they lead to cure? For there is no question that this takes place when they are given.

Now the body has a natural resistance to the spirochæte. Were this not the case, septicæmia would arise soon after the spirochæte enters the tissue. The chancre is evidence that resistance is being established. For too long the lesion has been regarded as the evidence of the activity of the spirochæte. Syphilitic lesions are equally as much the effort of the host to limit and to overcome this activity. Is it not possible that drugs help to complete this action of the host and in this way promote a cure?

One of the most remarkable instances I have come across of the action of a drug upon bacterial disease followed the application of iodoform to a foul-smelling appendix abscess. The odour completely disappeared after two applications. As iodoform has little antiseptic action when placed in contact with bacteria, some consider its action is due to the liberation of nascent iodine when brought into contact with a discharging wound. But iodine can be liberated in this way by other methods, and its action is then slight. All that can be said is that iodoform sets up certain reactions in the

tissues, as a result of which certain processes that are hanging fire are stimulated and the inflammation is overcome. Though the action is still upon the local inflammation, the power to respond will depend upon the constitution, the state of health, and the state of the tissues. Iodoform seems to act best in the hypersthenic, and particularly if there is some tendency to plethora or to muscularity.

During the War we had great experience of infected wounds. We found that antiseptics were of great value in the destruction of bacteria; and if they were applied early enough inflammation need not arise. But the action of antiseptics was very slight upon inflammation itself. It is unlikely that they can have much action upon the bacteria at this time. For it is not those upon the surface that are causing the trouble, but those in the tissues; and even if an antiseptic is able to penetrate it would be immediately carried off by the lymph current and would not remain in contact with the bacteria for any length of time. Towards the end of the War many had little faith in the action of drugs once inflammation had started. But if the reaction was excessive, the continued application of weak flavine diminished this. If the reaction was insufficient, weak eusol stimulated this. We did not know how or why this change took place. But in the guillotine amputations that were sent over from France during the War, the wound would be covered with a thin greyish pellicle if a flavine dressing had been applied. There would be no congestive reaction and no tendency to the formation of granulation tissue. It seems that flavine depresses the vital response. When eusol is applied to a wound, not only does it lead to the absorption of sloughs and blood clot, but at the same time it stimulates the formation of granulation tissue. In some way it increases the vital response.

Is it that in bacterial disease drugs given internally act by increasing or decreasing the vital response that is being set up to limit the activity of bacteria? Is it not possible that

drugs act this way in syphilis ? ¹ Granulation and fibrous tissue form the basis of the reaction that leads to the production of the lesion. Mercury acts best in the primary and secondary stages when granulation tissue predominates and salvarsan and the iodides when fibrous tissue predominates. It seems that arsenic, the iodides, and the aniline dyes do good when the reaction is excessive ; mercury, the heavy metals, and eusol when it is not sufficient.

As there is always a reluctance to break with past teaching, particularly when it is easy to grasp, I will stress again that our present knowledge suggests that it is extremely unlikely that drugs have an antiseptic action in bacterial disease. Therapy that is based upon a supposed direct antiseptic attack upon bacteria, is not difficult to grasp. All that has to be done is to get the drug excreted in the vicinity of the bacteria in the greatest concentration possible and to maintain this until the patient recovers. If drugs act by increasing or decreasing the vital response, therapy will need much thought, and to-day men dislike having to think as much as ever. For the mere sitting down to think can be exhausting. Were an antiseptic present in sufficient con-

¹ The relation of the resistance factor to the central nervous system has been stressed in preceding chapters. The gram-negative organisms prefer to act in a body where the vital energy is low, and their toxins tend to aggravate this state ; the gram-positive organisms in a body where the vital energy is high, and their toxins tend to aggravate this state.

The reaction to bacterial disease goes on so long as there is life. But for it to be adequate vitality is essential, and vital energy in the case of general bacterial disease. The reaction is related to the staining power of the bacteria as well as to the supply of energy from the nervous system. He who can tell us what the basis of this is is laying the foundation-stone of scientific chemotherapy.

Salvarsan was scientifically conceived. Ehrlich based his work on the supposition that if a dye is capable of staining protoplasm, it could penetrate the bacterial envelope. By attaching to the molecule of the dye various substances he produced salvarsan, which was toxic to the spirochæte, but not to the cells of the body. But few nowadays believe that salvarsan acts entirely as a germicide. Is it that Ehrlich did light upon the basis of the reaction in disease and then unwittingly misled us by assuming that the action of a drug depended upon its power as an antiseptic ?

centration to harm bacteria, it would be equally likely to harm the cells of the body which are far more delicate. If these are damaged, the restoration of the resistance factor is likely to be delayed. Two medical men, who suffer periodically from carbuncles and boils, tell me that they have tried all new methods ; but, apart from applying magnesium paste to relieve pain, they now do nothing until "ripening" takes place, when a small incision is made. In erysipelas many practitioners have abandoned specific measures and now carry out expectant treatment and apply ichthyol. How little we can do by direct therapy is illustrated by the following case :

"A baby, aged 8 months, was admitted to the Isolation Ward at the Cardiff Royal Infirmary with erysipelas of the left ankle. Anti-streptococcal serum was given at the onset, but did no good. The inflammation slowly spread up the leg, and was not in any way influenced by substances applied over it or over the healthy skin above. The lower part of the abdomen became involved ; as the umbilicus was approached, the inflammation turned of its own account and went down the right leg where it worked itself out. The baby did quite well. Apart from giving glucose and alkalis, no treatment was attempted in the later stages. The sister felt that keeping the parts dry with powder did as well as anything."

Though in the case of erysipelas and boils the practitioner is favourably placed, since he is dealing with a surface inflammation which he can see and to which he can apply any substance in any strength for any length of time, is it not strange that many are falling back upon the procedure that was recommended fifty years ago ? If antiseptics have so little action upon bacterial disease when applied directly, how are they going to have an action when given internally ?

If an organ, the seat of bacterial disease, can be removed, a direct attack is possible, otherwise bacterial disease has to be viewed as a contest between patient and bacteria. The practitioner finds himself in the position of an active second

in the boxing-ring, who is definitely in favour of the patient. He knows what he wants accomplished. He may be able to give the most perfect advice. The difficulty is that the patient may not be able to respond because his tissues cannot react. This difficulty may be only temporary, and with a little coaxing the power may return. It is true that the patient does all the fighting, but the advice of the practitioner plays a vital part. If all is going well, he prefers to do nothing. If the reaction is excessive, he will take means to diminish this ; if it is deficient, to increase it. For each case he should have a definite plan. The principles underlying this have already been dealt with in my books on Inflammation and Infections of the Urinary Tract, and only certain aspects concerned largely with nursing are referred to here.

Is it possible to Abort Inflammation ?

In acute gonorrhea where the reaction is excessive, the injection of salvarsan intravenously lessens this. The injection of sterilised milk or the production of protein shock has a similar action, and may even cut short the attack. But cutting short the acute stage and cutting short the course are not always the same ; and in my practice some of the cases where the disease has become chronic and has been most difficult to cure have been those where abortive treatment was attempted. If inflammation really helps to restore the resistance factor as is now thought, it might be advisable, in the interest of the general health, to allow the disease to run its course and not to attempt to shorten it. For years it was held that health was subsequently better and recurrence less likely if disease ran its normal course. Paget had several attacks of pneumonia. In a letter to Sir George Paget, he says, "Remember what the old doctor said when he heard that I had a kind of gouty pneumonia, a sort of 'incomplete gout.' He had better have got it *in toto*." Two practitioners who suffer periodically from carbuncles and boils tell me that, if

they allow these to run their course, not only is progress more rapid, but after the attack they feel fitter and recurrence is less likely. Formerly practitioners talked about a disease working itself out. Nowadays we speak of the restoration of the resistance factor, which after all is only a change of words.

If bacterial disease is going on satisfactorily, I am reluctant to adopt extreme measures, particularly as it is not always possible to foretell what may follow, for such therapy at times aggravates the disease. On the other hand, from the earliest stage it is advisable to do everything to restore the resistance factor. For this purpose I inject 2 c.c. of omnadin daily for four days in the hypersthenic and $\frac{1}{2}$ c.c. on two occasions in the hyposthenic. As the stage of progress is coming to an end, myosalvarsan may be given if the reaction is sthenic and mercurochrome if it is asthenic. They have of course no germicidal power, but they do seem to promote that reaction which is bringing the disease to a close.

The Stage of Progress

The patient should lie still and make no effort. Good nursing is now invaluable. Morphia is given when the reaction is sthenic and opium when it is asthenic. Not only do these lead to peace of mind, but they protect the cells of the nervous system from the action of the toxin. It is possible that these drugs tend to diminish the reactive powers of the patient. My experience does not bear this out, and I use these drugs freely at this stage. If plenty of fluid combined with glucose and alkalis is taken, the cells of the heart, liver, and kidney are also protected. The prevalent practice of forcing food to maintain strength and of giving aperients to make certain that the bowels act, has little to be said in its favour. It is true that, when a patient takes his food well and when the bowels are acting regularly, the outlook is good. But this is not quite the same thing as saying that the improvement is due to these. For, when the appetite

is good and the bowels are open regularly, it means that the toxæmia is not sufficient to upset the function of the stomach and intestine. The expectant treatment of the acute abdomen, where every effort is made to keep not only the patient, but all the organs at rest until the stage of decline sets in, has convinced me that a patient is better off, in the stage of progress, if he is disturbed as little as possible and is given no food or only that which he desires.

The Height of the Inflammation

The nurse must maintain an air of confidence and of optimism, and must lead the patient to believe that all is going well and that the turning-point is being reached. She will warn the patient that he must not be alarmed if he should feel worse. This is expected, and is just a part of the natural course of the disease. For the patient may feel his weakness somewhat acutely ; and, if he has not been warned, may think that his end is drawing near. Beyond giving morphia or opium and glucose now combined with insulin little can be done to counteract the great strain that is being thrown upon the nervous system. If any weakness of the cardio-vascular system is feared, my preference is for cardiazol and coramine : adrenalin also does good. A well-matured brandy by the mouth and paraldehyde per rectum are at times invaluable.

The Stage of Decline

During the stage of progress in the sthenic type of disease much complaint may be made of pain and discomfort ; but, if neither is present, the patient does not stress unduly that he feels ill. Probably this is due to the toxins stimulating the brain. For though the patient may appear perfectly rational, once the crisis is over he can recall little of what has taken place. Once the stage of decline sets in, the patient's contest with the disease is over. From now on he has to recuperate. Though it is obvious to the trained eye that an improvement has taken place, for some days he feels worse.

His condition is essentially asthenic, and for the first time the feeling of weakness is coming through to consciousness. Previously the stimulation from the toxæmia prevented this. This should be explained to him. Should he be inclined to dwell on the illness he has passed through, advise him to regard this as a thing of the past, and that he will be far better if he will forget the illness altogether and dwell on the improvement that is anticipated and the good health that is in store. The nurse must do all she can to cultivate this attitude of mind. She should, however, be careful not to tell him of the rapid cures that have come her way. Far better is it to point out to him that, though complete recovery is eventually certain, some time is bound to elapse before he regains his strength. He will then be less worried if relapses occur or weakness persists. During the first few days of this stage the patient should be left alone. It is still unwise to force food upon him. But any inclination for food on his part should receive every encouragement. The building up of the system is now the aim. Much may be done to stimulate the appetite by putting tasty dishes before him. There is no longer any necessity for keeping him at rest. He should be encouraged to move his arms and legs and also to raise himself in bed if there is no myocardial lesion. After the first few days it is as well to get him to take an interest in things around. Visiting in moderation may be allowed. But visits must be of short duration, for the patient is easily tired. Point out to visitors that it is unwise to dwell upon the illness or any prevailing symptom; for this creates a form of self-pity that is most harmful. They should be hopeful, and should be content to leave the medical part to those in attendance. The impression seems to have got about that a sick man needs sympathy and not cheer. Nothing is more fallacious: the latter, however, should be moderate both in its tone and amount. The tactless remarks of visitors becomes obvious after visiting days in hospitals, where the strained looks and red eyes tell their tale. At this stage the temperamental patient is likely to cause trouble

and needs to be watched. When ill, he was sufficiently subdued. But the moment he feels power returning, he wants to be up and about. Any restraint or discipline is now irksome. If he is hypersthenic, he is proud of his prowess and is inclined to be boastful of his rapid progress. He wants to be up and about long before this is advisable, and if given the slightest opportunity, he is apt to cut out convalescence altogether. This is the type of patient who makes good progress earlier on and then suddenly goes to pieces. With such a one the practitioner must be wary of what he says, for the patient tries to do better. Tell him repeatedly that the man who in the long run does best after an illness is he in whom progress is slow. For this means that rest is sufficient and that all the organs are given a chance to recover. Point out that an illness is always a big strain to the nervous system. Whilst rapid recovery denotes a good constitution and his having this is to be admired, it takes time for the nervous system to recover completely ; if sufficient care is not taken at this stage, there is a chance of his becoming a chronic invalid. Even if such advice lowers his spirits, this is only temporary and does no harm. It may be necessary to go farther and to warn him that taking unnecessary risks has led to a patient having to be carried out feet first. Sometimes it is in the interest of a patient that he should be frightened. The hyposthenic makes an effort and fails. He is depressed because he does not get on so quickly as others he knows. Tell him it is not always the man who goes along most quickly who eventually does best. Do not tell him that slow progress for him is essential, since his constitution cannot respond quickly. For often he is inordinately proud of his physical powers. So tell him that for some reason we do not yet understand, disease does not run the same course in two men ; and he who has the more refined nervous system and the finer nature invariably suffers most. Though he has to go along slowly at the start, if he is content to do this his is the type of case that eventually does best.

The Stage of Convalescence

A healthy man has good adaptability. As a result he is unaware of his organs, and is able to exert himself without feeling any ill-effect. In the weakness that follows a severe illness stimuli from the organs come through to consciousness even when they are at rest, and certainly as soon as any strain is placed upon them. Such symptoms do not mean that the organ is diseased, but that its function is affected. This usually clears up as health improves. The discomfort tends to disappear if the patient relaxes or if he directs his mind to something of interest. The development of the power to relax, the directing of the mind to something of interest, and the resumption of mental activity are the key to successful convalescence. They will need to be stressed with the temperamental patient if ill-health is to be avoided. Bacterial disease is a bigger strain upon the nervous system than is sometimes thought. We are too inclined to give much attention to the body and little or none to the mind. Some guidance upon the rules of living does not come amiss to many. If a man is hyposthenic he should take life quietly, live in warm rooms, sleep in beds with flannelette sheets, take a diet that has great ketogenic powers, and be given small doses of mercury, magnesium, and the heavy metals. If he is hypersthenic he should take more exercise and live as much as possible in the open air. The rooms should be well aired and the bed-clothing very light. He should not take large amounts of meat or fat and he should be given arsenic and sulphur.

The Stage of Relapse

It is essential to warn the patient early on that a return of symptoms is not unusual before cure is complete ; but that this is not the same as the return of the disease. A rest in bed for a day or two often gives much relief. Even when the patient has received this advice, he becomes despondent if the symptoms persist. He looks round to see if some reason cannot be found, or if something cannot be done to

bring him ease. At such a time friends can be a curse. They will tell him of the wonderful cures of which they have heard, and he will wonder why such treatment is not being applied to him. Recall to him the tale related of Sir Henry Thompson, who removed a stone from the bladder of a wealthy commoner. His progress was not too satisfactory. Hearing that Lord X, who had undergone a similar operation, was doing well with boric acid irrigations, he wrote to Sir Henry asking him why similar treatment was not being given to him. The answer was, "Because you are not Lord X." Point out that the constitution and idiosyncrasy have to be considered for each case; and that therapy that does one patient good may have little influence upon another and may even do him harm.

The Stage of Chronicity

As many lay people confuse the word chronic with incurable, explain at the start that chronic is merely used in opposition to acute. It does not signify persistent or permanent, but just refers to a stage of inflammation. Therapy may still be effective in allowing Nature to assert herself. But in comparison with acute inflammation, the course is likely to take longer. It is unwise to pretend that it is going to be short. The practitioner may be tempted to do so just to comfort patient and relatives. But the peace of mind is just temporary. In the long run this practice is harmful, for the patient loses confidence as the disease goes on. It is now that temperament has an important bearing. A patient with the sanguine temperament makes up his mind that when an acute illness has been overcome some symptoms are likely to persist for some months which he is going to regard as a nuisance that must be tolerated. He realises his energy is not likely to be as great as before the illness. But so long as he has sufficient energy, he prefers to do his work, and is prepared to put up with discomfort should it arise. Periods of malaise he faces with equanimity; for he realises that these will become less severe and less frequent as the health im-

proves. Another patient of the despondent temperament thinks that once he has got over the illness he should feel perfectly well. If symptoms persist, he is apt to worry, and, what is worse, indulges in self-pity under the impression that he is being unfairly treated by the gods. He is for ever dwelling on what he has suffered, and anticipates a return of symptoms and has a plan for their treatment. He will not realise that if he will but visualise health he is more likely to attain it. If malaise is present, he refuses to regard this as just part of the constitutional upset ; and prefers to search round for disordered function or some focus of infection. And when this is found, he demands its immediate removal by operation, feeling that once this is done he will get well. Any form of treatment demanding self-discipline is for him extremely irksome and is scarcely tolerated. The former, who is generally hypersthenic, is likely to get well in a short time. The latter, who is generally hyposthenic, becomes introspective, sooner or later develops neurasthenia, and is not unlikely to become a chronic invalid.

At this stage the practitioner has to bring into play his clinical acumen, for so much can be done to bring relief to the sufferer from chronic bacterial disease. He must use every diagnostic care. At this stage it is essential that a thorough examination should be carried out, for only in this way can pathological lesions be spotted that are not amenable to expectant treatment. Each year I see cases where a patient with a pyonephrosis or a calculus has been treated for years with urinary antiseptics in whom no cystoscopy was performed. It is sad at times to see the suffering and expense to which a want of care leads.

When bacterial disease becomes chronic, the practitioner must be on his guard. He should put to himself the following questions :

1. Is persistence of the disease due to failure to restore the resistance factor ? Often some tonic mixture, a change of air, or adequate rest works wonders. The following demonstrates this:

“ Practically all the men of the 4th South Wales Borderers suffered from dysentery and jaundice which disappeared with the onset of the cold weather. At the time of the evacuation of Suvla Bay most had colitis and gingivitis and some a chronic ulceration of the skin which would not heal. The tone of the muscles was poor. After a week's rest at Lemnos, the general health improved, the muscles became firmer and of better tone, and the eye became clearer. The colitis and gingivitis were disappearing and the ulcers of the skin had already healed.

Relief in the local symptoms can come from a counter-irritant. X, who had cholecystitis for years, tells me that the application of a blister to the right side of the epigastrium or to the tip of the right shoulder gave much relief when pain was present. This he at first attributed to the production of a surface pain, for when two pains are present only the more intense is felt ; and a surface pain is more tolerable than one from some viscus. But later he realised that the relief was greater than could be explained in this way, and was due to some reflex changes set up in the gall-bladder. The relief of pain is due to some change in tonus. Now that we realise the bearing of the nervous system upon bacterial disease, there is no reason why this cannot be influenced reflexly.

2. Is persistence due to the element that leads to fibrosis ? If this is the case, arsenic or small doses of iodides should be given.

3. Is persistence due to the element that leads to ulceration ? Small doses of the heavy metals, such drugs as hexamine, acid hydrochlor dil., boric acid, acid sod. phos. might be tried. The ketogenic diet now does good, even if the disease is not in the urinary tract.

4. Is persistence due to some pathological lesion that existed before the onset of bacterial disease ? If a hydronephrosis or calculus in the urinary tract preceded the bacteriæmia, the bacteria are liable to become localised here. The disease persists until the preceding lesion is overcome.

5. Is it due to something that has developed as a result of

the disease? For instance, fibrous tissue that constricts a duct or that prevents a cavity from contracting may be troublesome. This may be overcome by minor surgical procedures such as the passage of a ureteral catheter. Sometimes an operation is necessary.

The Place of Operative Surgery in Chronic Bacterial Disease

Before the War surgery was associated in the lay mind with great risk and pain, and many felt that it should be carried out only as an alternative to death or severe suffering. For some could recall the days when an operation was done without anæsthesia and when most wounds went septic. Consequently, a patient would hesitate before agreeing to an operation which would often have to be urged by the surgeon. The chances were that no great abuse of surgery was likely to take place, particularly as surgeons then had great knowledge of the natural course of disease. But a certain amount did occur. This was particularly noticeable in chronic bacterial disease. Surgeons were beginning to call a halt, for the practice was doing surgery harm. Nowadays the outlook has changed. The public have been told that operations can be done without pain, without risk, and without loss of blood; and they believe that surgery can achieve wonders. As a result, they are now asking that an operation should be done merely to relieve discomfort. When an operation fails it is not uncommon to hear the patient ask if one upon some other organ could not be done. This happened in the isolated case before the War. It is now becoming much commoner, particularly in chronic bacterial disease. This abuse of the practice of surgery will sooner or later lead to a reaction. And as a result an operation may not be done when it is indicated.

As there is some risk of this happening, the indications for operating in chronic bacterial disease will now be given. They are illustrated by three types of cases:

1. Once an appendix has been inflamed it is liable to become a seat of bacterial disease at some later date. Its

removal is advised, even though the inflammation subsides. This is done, not to improve health, but to avoid a risk. Sometimes, however, a stricture follows the acute attack. This may give rise to disordered function or to recurring bacterial disease, each of which may impair the health. Improvement now follows removal of the appendix. Here the impairment of health is secondary to the local disease, and is not that which was associated with the lowering of the resistance factor that led to the acute attack. As this ran its course the resistance factor was restored. In this type of case the disordered function and the ill-health followed the acute attack, and generally it is possible to fix the date of their onset. Were it not for the local lesion, the health of the patient would be perfectly fit.

2. When bacteraemia arises in a person who has some pathological lesion, such as a hydronephrosis or a calculus, the inflammation is very likely to be localised here. Once this occurs, complete recovery is not likely until the pre-existing lesion is treated. But whether health is regained depends upon the time at which the operation is undertaken and on the type of patient in whom it is carried out. Now when bacterial disease persists and a complete clinical examination is made, the local lesion is detected. If the health is not good, it is very tempting to assume that this lesion is the cause. But impairment of health led to a lowering of the resistance factor; and though the pathological condition has existed for some time, the bacterial disease is of recent onset. Though on a priori grounds it is right to say that the less disease and the less discomfort a patient has, the fitter he will be, it should be borne in mind that the local inflammation is helping to restore the resistance factor. And if the operation is done before this is accomplished it is likely that the bacterial disease will break out elsewhere. There is no test by which the resistance factor can be estimated and none by which the ill-health that is responsible for a bacteraemia can be differentiated from ill-health that is secondary to bacterial disease. If at the operation I find

frank pus or marked fibrosis, and if the disease can be completely removed, such a patient should do well. For frank pus and fibrous tissue mean that resistance has been restored and the power to react is present. In these cases where there is a pre-existing pathological lesion it is important to investigate carefully the life the patient lives before the operation is performed. For it may be necessary to warn him that, unless he alters his mode of living, he will not derive the maximum benefit from the operation.

3. The health of a man becomes impaired, and at such a time disorder arises in some organ that may become the seat of bacterial disease. He naturally puts his illness down to this. On going into his history so often it is found that the ill-health dates back to puberty or followed mental anxiety or strain or an attack of influenza. It is important to bear in mind that, as the local disease followed the ill-health, it cannot be its cause. This is something in the constitution that is linked up with the central nervous system; it is what is described as a diathesis. Operative treatment here just removes the local disorder, and is purely symptomatic. It does not improve the general health for any length of time, and bacterial disease recurs elsewhere. The following cases illustrate this point:

(a) In 1911 there was demonstrated, at the out-patient department of the National Hospital for Nervous Diseases, a woman aged 32, complaining of a want of energy. Her health had never been good since her marriage at 23. It had become worse after the birth of a child at 26. To overcome the malaise curettage had been done. The appendix, gall-bladder, and tonsils had been removed for some infection, and a movable kidney had been sewn up. The physician did not hesitate to make an attack upon surgery. He could have desired no better case. He then demonstrated how the impairment of health was due to wrong living. In his opinion the disorders of the various organs were largely functional and imaginary.

I think, however, he was wrong in the conclusion he reached. This patient was ill because her nervous system

was particularly vulnerable. This could have been overcome by small doses of mercury and opium. She was in need of these.

(b) J. J. had had symptoms of cholecystitis that dated back to the age of 40. No operation was undertaken, as she had marked arterio-sclerosis and the risk was not justifiable. At the age of 75 acute cholecystitis arose which was treated expectantly, and an abscess developed. Cholecystostomy was indicated. Cholecystectomy was, however, performed, apparently on the supposition that her best chance of recovery depended on the whole of the inflamed tissue being removed. She recovered from the operation, but one infection just followed another, such as neuritis, rheumatoid arthritis, bronchitis, colitis, from which she had never before suffered. They eventually took her away.

As her energy was never the same after the operation, the recurring infections might be attributed to this. But I am inclined to think that hers was a case of the bilious diathesis that became evident in the forties. Whenever her health broke down, the disease in the gall-bladder flared up. When this was removed disease broke out elsewhere. This case demonstrates the sequelæ to the extensive operation for bacterial disease that are not usually recognised.

When these types of cases are reviewed it is seen that in the first, operative treatment brings relief and restores health. Here, however, health was good before the disease arose. In the second, removal of the organ relieves the local symptoms and may be beneficial if done at the right time on the right type of patient. In the third, operative surgery is just an abuse of therapy, and is likely to do harm.

It is essential for the practitioner to be extremely guarded in the views he reaches upon the bearing of operative surgery in chronic bacterial disease. For though we speak of the resistance factor, there is no test by which it can be estimated. The position is becoming confused by the entrance of a new type of patient. Some think that it is advisable to educate the public upon medical matters by

talks on the wireless or articles in the press. The dangers of certain disease are stressed. For instance, the danger of not having an immediate operation for acute appendicitis is often referred to. When accounts appear in the newspapers of the death of prominent people from this disease, people become frightened about the state of their own appendix. Should they have a little intestinal colic, they are apt to convince themselves that they have appendicitis. It is not long before they induce some surgeon to operate. Afterwards they have the perfect health they had before. They feel better merely because they are relieved of something that gave them a little anxiety. These are the very people who talk so volubly in hotels and on golf courses about the great benefit derived from operation. If attention is paid to them, a false impression may be gained of the relief to be expected from operating for chronic bacterial disease.

CHAPTER XIII

THE CAUSE OF ILL-HEALTH OR ASTHENIA

THE medical profession is at times accused of indifference to ill-health. No unfairer charge can be made, for when two or three medical men are gathered together this subject crops up. It is true that medical literature in recent years does not abound with writings thereon. But this is largely because of the difficulty in conveying in words exactly what is meant. There is no exact standard for health. And by ill-health is meant, not necessarily the presence of disease, but just that want of energy that gives to man a joy in living and the power to do and to endure in life. Though when we speak of ill-health we refer to something that is very real to the patient and very obvious to the practitioner, yet the moment an attempt is made to write upon the subject it seems to be too abstract to be grasped. But this is due to its vastness. At the bedside ill-health is only too concrete.

When ill-health is being investigated the practitioner keeps in mind all aspects of disease, and all features of living. The routine clinical examination that is made and the history that is taken, have these in view. At such a time it is essential to have a working plan. The following must be excluded :

1. Local disease, as a result of which the function of some vital organ, such as the heart, is sufficiently impaired to lead to disorder.
2. Set diseases, such as cancer, tuberculosis, gastric ulcer, etc., that can themselves cause ill-health or may be secondary to it.
3. Diseased states, such as Bright's disease, diabetes, etc., due to disordered function in an organ.
4. General disease, such as arterio-sclerosis.

5. Deficiency disease due to : (a) some internal factor—(i) the endocrine, (ii) the blood in quality and quantity ; (b) some external factor, such as the vitamins.

Though each of these can lead to ill-health as soon as they arise, each may be present in an advanced degree without ill-health arising, and the practitioner is again and again surprised to find the advanced state of disease that can exist without health being affected. For instance, a man may have severe aortic regurgitation from which he has never had one symptom until he drops dead. At other times ill-health is persistent, and the patient eventually dies ; yet no definite disease is ever to be detected. It is, however, unwise to assume that ill-health is inexplicable. Rather should we realise that it does not fit in with any theory we now hold. Now, the taking of a complete history with a thorough clinical examination whatever the complaint is the hall-mark of a good practitioner. Yet the procedure is responsible for much loose thinking in medicine ; and this becomes evident in the case of ill-health. For when this is present so often no adequate cause is to be found ; and ill-health is then apt to be attributed to any disordered function or any abnormality that the examination reveals. Many volumes could be written on the theories that have at one time or another been put forward : only six of these are referred to here.

A. Disorder of the Alimentary System

The view is held that, owing to the adoption of the upright position, the stomach and intestines in man work at considerable disadvantage, and much strain is thrown upon the flexures which become kinked ; and, as man is not able to have the bowels open immediately the desire to defæcate arises, conditioned reflexes are set up. Stasis follows that leads to the absorption of toxins and bacteria, and as a result the health becomes impaired. Consequently, it is our practice to ask a patient how often the bowels are open. If this does not take place each day, remedial measures are adopted. On the other hand, if the bowels are open too

frequently, ill-health is attributed to this. But man took up the upright position half a million years ago ; and, if he is unable to adapt himself to this, we should wonder whether such a thing as evolution occurs. In addition, modern lavatories are extremely convenient compared with the old out-house ; and man to-day is favourably placed the moment there is a desire to defæcate.

Normality is a standard fixed we know not how ; and often views that are handed down from one generation to another are accepted too easily. It is true that most healthy people feel better for having the bowels open once a day. But the question arises—are the bowels open because a man is well, or does he feel well because the bowels are open ? In their room at a County Court solicitors were discussing this point one morning. Some in the rush to get there had not been able to go to the lavatory. All were convinced that when the bowels were not open, they suffered discomfort and did not feel so fit. These men were healthy and well, and the discomfort could hardly be due to toxæmia. It must have been reflex, and due to over-distension of the intestine. This affects some and not others. For there are quite healthy men who have the bowels open every few days, especially as they get on in years, and yet experience not the slightest discomfort. A short while back I saw a man with prostatic trouble, aged 92, whose bowels were open only when he took a pill, which was about every two weeks. This had gone on since he could remember. Yet he was hale and hearty, and for his years was mentally alert. It would be absurd to suggest that he would have been fitter or would have lived longer if his bowels had been open each day. If a few hundred fit men were questioned, it would be surprising to note the number in whom constipation occurred, but who never gave it a thought simply because their health was good. Were medical men to take their standards from healthy folk, they would have many a surprise. When the normal routine of the bowels changes with the onset of ill-health, it is well to ponder as to whether it is not a question

of *post hoc* rather than *propter hoc*. For with ill-health secondary to some definite lesion in the heart or lungs, some disorder of the gastro-intestinal tract not infrequently appears at an early stage. But this is the result and not the cause of the ill-health. There is in addition a definite relation between the function of the gastro-intestinal tract and that of the central nervous system, and loss of appetite and constipation occur early on if there is any anxiety or mental strain.

B. Disorders of Sex

At puberty the secondary sexual organs begin to function. The seminal vesicles become distended, and as a result the urge of sex arises. Fortunately for the boy, this is relieved by the nocturnal emissions that take place during sleep. Whether consciousness is aroused depends on the depth of sleep and on the force with which the genital muscles contract. How frequently the emission occurs depends on the rapidity with which semen accumulates and on the degree of tonus of the muscle. Frequency therefore bears some relation to constitution and temperament. As this urge of sex is physiological, an emission is not weakening, and does little more harm than emptying the bladder or rectum. But the whole procedure is unpleasant and somewhat disgusting to one who is refined. Now, this adjective can also be applied to kissing and eating if they are reasoned out too finely. For a time a boy is going to be upset by the emissions and his thought will be disturbed. Owing to this the health no doubt becomes impaired. It is essential to differentiate between the harm resulting from an emission and the harm resulting from that anxiety and worry to which the emission may lead.

The urge of sex leads to a certain amount of desire. But the urge and desire, though closely associated, are not the same. The urge is physiological, and occurs to all men ; and though unpleasant, it cannot be prevented or controlled. Though desire first arises from the urge, it soon becomes an

image in the mind. Since such an image can be recalled at will, a line of thought may be created. Much now depends upon the temperament with which a man is endowed, the direction in which he allows his imagination to play, and the self-control and discipline he acquires in his passage through life. Though when a man is asleep and the will is dormant thoughts come to the front that he would prefer to be without, during the day the line of thought can be controlled. But, if a man toys with sexual thoughts in his idle moments, he is creating a habit ; and from now on he can make certain that desire will play some part in his life. For whatever image he creates in the mind returns again and again. But he should blame his line of thought and not sex. It is difficult if not impossible to differentiate between desire that comes from the urge and desire that comes from thought. But we should be a little fairer to Nature and to our instincts than we sometimes are. My impression is that desire does not play the fundamental rôle in life that is sometimes thought. This impression is based on the rarity of references to sex in the conversations of men. There are four main outlets for desire :

1. Through thought that dwells on intercourse, though no attempt is made to accomplish this. This constitutes psychical masturbating, and in itself can be exhausting. For thought uses up energy, particularly when combined with emotion. This procedure is dangerous, for images tend to recur. If persisted in it is weakening.

2. Manual masturbation. Certain writers state that all men have masturbated, but on what authority such statements are made I do not know. My experience does not permit me to give an opinion. Occasionally it is necessary for me to ask a patient something of his sexual life. But this is only because there is some indication. I am doubtful if the question is put to one in ten patients, and even then the chances are that truth is only partly revealed. Of my circle of acquaintances I have only discussed this question of sex with those who come to me because the mind is disturbed. Though, of course, the subject of sex does crop up

when men are together, the talk is too often rather abstract or of the nature of a joke. Very rarely does a candid discussion take place.

3. A man may have intercourse with a prostitute or amateur. This procedure is disgusting, and men who practise it are convinced that the game is never worth the candle.

4. A man may marry. This conforms to tradition and the Christian standard. But sex is, after all, just an incident in marriage which is companionship and friendship for life. Marriage also gives a man an opportunity to think outside himself; and when it is blest with children, there is the added joy of making contact with younger folk.

I am doubtful if sex does play as large a part in life as some are apt to think. In recent years we have allowed our views on the subject to be influenced by psychologists who, after all, do not deal with normal people, but with those whose nervous system being too sensitive somehow lets them down. To attempt to reason out the physiology of sex from such patients is dangerous. In a book written by a psychologist that recently fell into my hands, it was surprising to note the importance attached to sex in the life of man and how complicated the subject became. The symptoms of which the patients complained were so strange that at times I wondered whether the psychologist himself was not putting ideas into their heads. As my practice deals largely with genito-urinary cases, something of the sexual life and thought of my patients is at times revealed. What strikes me is the humanity of these people. Once upon a time they may have been unfortunate enough to have looked twice where it would have been better if they had not looked once; or there was a little weakness in the face of the temptation; or some side-slip that brought disaster in its train. But there is always a desire not to reveal their thought and a reluctance to talk upon the subject more than is necessary. Of one thing I feel certain, that it is almost impossible to reason out any physiological process from some functional disorder. Nothing about the function of the stomach or

intestine has been learnt in this way. In my own practice I have learnt nothing of the physiology of micturition. It is impossible to correlate the symptoms such patients put forward with our knowledge of physiology of such a simple process as the passage of urine. A painstaking history gives little help, and at the end I am left with the impression that the disorder is not in the bladder but in the central nervous system, and most of the symptoms are imaginary.

Now, no matter how puberty dawns, the state is always disturbing to boys of refinement, and one that most would prefer to do without. As life goes on, owing to the urge of sex one or two unchaste thoughts are likely to pass through the mind of a man each year. But it is only in so far as the mind is allowed to dwell on these or in so far as such thoughts lead to worry or anxiety that they disturb the health. There is a most intimate relation between the sexual organs and the central nervous system. When the latter is affected, disorder of the former arises, and symptoms are just as likely to be the consequence as the cause.

It is very doubtful if this subject of sex is as important as many now think, and I am very doubtful if it is often the cause of ill-health. We are apt to think that we are the first generation that ever really studied the subject of sex and that in past generations it was ignored. Yet it is to the essay of Paget on *Sexual Hypochondriasis* that I go for guidance on the subject of sex. His description of love in marriage is the best I know :

“ And this suggests a new figurative expression of the course of Love. . . . You know that it is not possible to grow the same corn on the same land for many years in succession ; the soil is in time worn out, unless there be what is called a mutation of crops. There must be barley one year, clover the next, wheat the next, and so on . . . and by this the same land bears each year the same full crop of some different produce. So in this, Love may begin upon beauty, but it will soon wear out if that be the only seed sown : beauty must after a few years be replaced by love for wisdom's sake—this again by love for mutual dependence

sake—and so on; and so a man may pass through his life, ever in love, as warmly and sincerely, if not so full of expression and gaiety, as he had begun.”

Thinking this over helps me to distinguish between love and lust.

Science has revealed to us little more about sex than she has about life. We know that life comes from life, and for this to take place sexual union is essential. But though Science has brought to our notice many phenomena associated with sexual union, this is not quite the same as telling us what sex is. Owing to the new knowledge that has come our way a great change in the teaching of sex is taking place. Even if the basis of such teaching is right, is it wise to direct the thoughts of young people along such lines? Are we certain such teaching will not eventually do harm? It is so easy to start a line of thought; it is so difficult to control it once it arises. In addition, a teacher can never be certain that a boy is properly appreciating in its true perspective teaching upon a thing so complicated and abstract as sex.

I have little difficulty in teaching medical students about disease. As this is so concrete it is easy to be explicit and dogmatic. But with the constitution and temperament the problem is different. After a long explanation it is obvious, from the replies of the students, that they have hardly understood anything of what they have been told. The subject is too complicated for them to grasp. For this reason I have ceased to give instruction. Experience has taught me that it is only as they get a knowledge of medicine that they can understand anything of the constitution and temperament.

I cannot help feeling that it is the same with sex. It is only as a man goes through life that he understands the problem, and then only as it affects himself. In later years he is aware of instruction that might have been of help had it been given in time. What he so often forgets is that even had he been instructed, he might not have listened or taken it all in. Or a line of thought might have been started that

would have been lingered over and in consequence would have influenced the subsequent course of life.¹

C. Visceroptosis

When ill-health was present and some viscus was discovered out of place, this was regarded as the cause. The

¹ In an age that is materialistic in its outlook and claims great conquests over life and nature, pretence is apt to be mistaken for knowledge. The dangers of this in such an abstruse subject as sex are very great. For desire is just an aspect of thought, and a man is given freedom to think as he likes. It is only if he is a danger to himself or to the public that notice is taken of him and he is declared insane. But I sometimes wonder if some of these sexual enthusiasts are not really maniacs or perverts. I feel sure that were they as enthusiastic over something that really disturbed the people, it would not be long before they would be shut up. When reading any work on the subject of sex, I keep before myself the following questions :

(a) By what authority does this man speak ?

(b) On what level is the subject discussed ?

I have had the most candid talks on religion, life, and death with men, and know, or at any rate think I know, what they believe. But I cannot recall one single talk on the subject of sex. Now and again a patient has to admit to some moral lapse ; it is of some isolated incident that he speaks. Two friends and I did once try to reason out the subject of sex. We had met before the War, and in a settlement in the East End had seen the tragedy that comes to a home when a young girl is seduced. Then an acquaintance made a disastrous marriage. We never knew whether he committed suicide ; but in Gallipoli he certainly made no effort to avoid death. When we met for a chat in the evening on the Salt Lake, the question of life and death was ever before our minds. It was not unnatural that the subject of sex crossed our minds. We decided that if we survived the War each year we would spend a little time trying to reason sex out. In later years, as we wandered through Europe, we recalled the majesty and grandeur of the setting in Gallipoli amidst which our thoughts had taken shape. Though we often smiled at the subtleties of sex, never once did we laugh at sex itself. For were we to do so, we would only be laughing at our existence on this earth and sneering at our father and mother. As time went on, the subject rarely cropped up ; we preferred to talk of life in general. I recall one of them telling me a short time before he passed on : " I now realise how true is the remark that the young person of fifteen knows about sex as much as his grandparent of seventy. Both really know nothing. But one thinks he knows and the other realises he does not know. I have reached an age when the subject of sex has ceased to interest me. But whether it is that sex is not worth thinking over or whether it is that it is insoluble I do not know." One day I hope to write down the conversations that took place. But strangely enough, though I know so much as to how my friends reacted to and were affected by life, I have not the slightest idea how sex affected them. Doesn't that apply

kidney being solid was easily felt, and at first considerable importance was attached to the movable kidney. It was assumed that, as the result of repeated trauma, the autonomic nervous system became played out. But as laparotomy was more frequently performed, it was found that other organs were abnormally mobile. Many theories were evolved to account for the association with ill-health and operations were introduced to fix the viscera in position. At one time abnormal mobility of the cæcum and ascending colon was held responsible for ill-health. Yet for an intussusception to develop it is essential that the cæcum and ascending colon should be unduly mobile; and previous to its onset, such children are perfectly healthy. Though at the operation the cæcum is only imperfectly fixed, very rarely does ill-health arise at any subsequent period of life. As methods were coming in by which the position of the viscera in the living was revealed, it was found that many of the data about the position and mobility of the viscera were inexact. Many were based on anatomical and post-mortem findings, where so to all one's friends? Therefore, by what authority does a man speak? After all, to-day we should be better than beasts.

Many men have seen beasts at work. But the act is too dirty, too beastly for anyone to wish to see it again. Men who have gone with a prostitute tell me that it is the urge and not desire that lays them low. After they pay her her price, they wash to try to make themselves clean, and wonder whether that woman ever can forgive the man that started her on that course. To the cad who boasts of his exploits with amateurs under the guise of conquest few men ever listen. Yet the occasion comes when a man chooses a woman to be his friend through life and he meets her with desire:

"For the love that is purest and sweetest
Has a kiss of desire on the lips."

On what level is sex to be reasoned out? Is it not like trying to compare the earth and the sky? Few of our works on sex have come from those who are quietly and happily married. Is it that these look upon sex as beastly, or is it that really it cannot be reasoned out? A practitioner is given an opportunity to see love in the home often at a time when the thoughts of people are elsewhere and they are taken off their guard. An outlook on life comes his way that he could have in no other way. Of one thing about life I am certain, and that is, that a man will not intentionally hurt the woman he loves nor will he do her a beastly act.

In the second chapter of Genesis we are told: "Therefore shall a man

much depended on the position of the body immediately preceding death. Though the position of a viscus conforms to a certain standard so far as the race is concerned, even with the individual the position varies from year to year. The position of a viscus depends upon the tonus of the abdominal muscles and the tonus of the muscle in the pedicle. When tonus is naturally poor as in the hyposthenic, the organ lies at a lower level and is more mobile. Here there is no question that the constitutional factor is primary and the position of the viscera is secondary to the want of tonus. For in the hypersthenic, where tonus is good, the organs lie at a higher level. Now with ill-health a want of tone in the surface muscles appears very early, and this no doubt applies to the muscle of the pedicles. As a result the organs begin to descend. The low position and the mobility are *post hoc* and not *propter hoc*.

If the mobility of an organ interferes with its function, with its blood supply, or with the function of some neighbouring viscus, symptoms will arise. But these are at first local. For instance, a movable kidney may lead to pain in the lumbar region due to the development of a hydrone-leave his father and his mother and shall cleave unto his wife ; and they shall be one flesh. And they were both naked, the man and his wife, and were not ashamed." If my memory serves me rightly, no other attempt is made in the Old Testament to explain sex, though much advice is given to the young man about avoiding the evil that lies in his way. In addition, we see how when people become depraved retribution follows. In the New Testament no attempt is made to explain sex. In the four gospels there is only repeated what was said in Genesis. It is a long jump to Shakespeare, whose knowledge of human nature was so complete. As Viscount Grey has said : " The impression produced upon me by his incredible power and range was really that of awe ; I felt almost afraid to be alone in the room with him—as if I were in the presence of something supernatural." Yet Shakespeare offered no explanation of sex. Then we come to the Victorian age when thought was so great. Men then did throw light upon sexual disorders, though they threw no light upon sex. Regarding the subject as insoluble, they thought it well to leave it alone. Then we come to a generation that is wiser than wise, with a great belief in its power to solve the universe. Nowadays they are so certain of their views upon sex that they are educating the young. I would suggest that they be careful how they proceed lest they do not make these little better than beasts. It is so easy to influence thought.

phrosis, to Dietl's crisis, or to vomiting from traction upon the duodenum. A movable kidney, however, does not by itself lead to ill-health. This statement applies to the viscera in general. They can lie in any position and be unduly mobile without affecting the health and without giving rise to symptoms. This is so well borne out when those who have Pott's disease of the spine or a large abdominal hernia are examined.

D. A Focus of Infection

The development of bacteria in the body may undoubtedly lead to ill-health, for an active tuberculous lesion gives rise to wasting and lassitude. These are seen during and after an attack of typhoid. They may be associated with an empyema or an appendix abscess and disappear when these are drained. Consequently, when ill-health is present, it is not surprising that every effort is made to find some focus of bacterial disease from which toxins may be absorbed into the blood. Some medical men believe that, if bacteria can be detected on a surface that is normally sterile, they are the cause of any ill-health that is present ; and, when ill-health is associated with disordered function in an organ normally containing bacteria, they regard the absorption of bacteria or their toxins as the cause. Cures are stated to follow the adequate treatment of such foci.

In my practice I recognise that iritis, arthritis and fibrositis can follow a gonococcal lesion in the prostate and clear up when this is treated. Occasionally ill-health may be associated with a gross pathological condition in some organ and may clear up when this is removed. But the cases where it has been definitely established that ill-health is due to a chronically inflamed organ and is permanently cured by its removal can almost be counted on the fingers of one hand. I have discussed this question with practitioners who live in country towns and who maintain contact with their patients for years. The majority are quite definite that, whilst improvement in health may follow if the organ

is seriously diseased, any improvement is just temporary when there is only a mild inflammation. When their patients have gone elsewhere for such treatment, they may come back improved and consequently are often regarded as cured. But when the ordinary routine of living is again followed, the ill-health soon returns. They point out that in addition, local treatment was often combined with other measures such as fresh air and good food, which all play their part. To these must be added the faith and hope that therapy inspires. In the circumstances it is difficult to know to what to attribute a temporary improvement.

Bacteriological work in recent years has shown us that the body can be indifferent to bacteria so long as the resistance factor is normal. When ill-health is present in association with local bacterial disease, the latter clears up when health is restored unless some obvious pathological condition has developed locally. Before advising local treatment, endeavour to answer these questions :

1. May not the ill-health be the primary cause of the persistence of bacterial disease, and may not this clear up if health is restored ?

2. May not the bacterial disease be incidental to living and be in no way related to the ill-health ?

During the War I was often amazed at the amount of chronic bacterial disease such as pyorrhœa that was found in recruits who were in perfect health. Now, if their health became impaired, it did not follow that this was secondary to the local disease. Even if ill-health persists, this disease should not be regarded as an aggravating cause. It might be treated on the assumption that the less bacterial disease there is in the body the fitter a man is likely to be. But nowadays I am more reluctant than I was a few years back to advise such therapy, so rarely does it bring relief.

E. The Bearing of the Mind

From time immemorial there has been a general impression abroad that the onset of disease and its rate of progress

is in some way related to the state of the mind. We have all heard of the man who was despondent and who, giving way, worked himself into a disease. On the other hand, we have also heard of the man who, being over confident, took no precautions and seemed to invite the disease that came his way. Yet, if we take into account the amount of despondency and over-confidence that prevails, the bearing of the mind has less influence than is often thought. This, after all, is to be expected now that we realise the great power of resistance inherent in man. During an epidemic, a mind, that is contented and has confidence in the powers of the body in which it resides, is an asset, and a mind that is anticipating disease does seem to predispose to its onset. But it is important to differentiate between the creation of disease and the creation of that state in which those elements that cause disease can become active should they enter the system. For instance, no matter how much a man anticipates tuberculosis, he will not develop the disease until tubercle bacilli enter the body. Again, in an epidemic of influenza a man will not develop the disease until he is in contact with the virus.

Now that the relation of disease to the constitution is more evident, the bearing of the mind is becoming clearer. For the hyposthenic is naturally despondent and the hypersthenic sanguine and confident. Each of these is predisposed to certain types of disease. But it seems that it is the constitution rather than the temperament that plays the greater rôle. Yet it is well to remember that the central nervous system is the basis of the constitution. And as the resistance and the reaction to disease are related to the central nervous system, there is no reason why at times thought cannot influence the onset and modify the progress of disease. But so long as the constitution is sound, a man can think as he wishes and yet suffer no harm, for his power of resistance is so great. If, however, he is hyposthenic and is unusually despondent, the disease to which he is predisposed is no doubt more likely to arise. And if he is hypersthenic this applies should he be over sanguine.

It seems most unlikely that a man by worry or forethought can develop any form of organic disease. But with functional disorders and ill-health, the mind has a more definite bearing. Here again it is unlikely that a healthy man with an equable temperament can think himself into a functional state. Nor does it seem possible for a healthy man to think himself into a state of ill-health. On the other hand, anxiety and worry can play havoc with the sense of well-being, and if continued long enough can lead to much impairment of health. And if a man is predisposed to functional disorders or if his state is bordering on ill-health, there is little doubt that the direction of the thought has considerable influence. Paget wrote :

“ For nervous mimicry is not very frequent among the evidently insane, and among the sane there are many who cannot bring about a mimicry of disease by any effort of imagination and direction of the mind. Among these I am happy to count myself. I have tried many times, carefully, and with good opportunities, but have always failed, and this applies to most men.”

But Howard Marsh, in a short biography, says :

“ Even when most severely overworked and exhausted by fatigue, he would deny, both to his friends and to himself, that he was even tired. Once, but once only, I made the mistake of saying, after he had been ill, that I was glad to see him looking well again. He turned upon me almost fiercely, and desired me never to make a remark of that kind to him again.”

That implies that at a time when his nervous system was receptive he could be influenced by suggestion.

In general it can be said that most men when fit are uninfluenced by remarks about their health. On the other hand, at times when the balance between health and ill-health is so slight that mere suggestion counts, the wrong remark can upset many. On page 167, reference was made to the connection between mood and tonus. It is possible that suggestion acts in this way.

An equable temperament has an important bearing upon

the progress of an illness. So has the disciplined life. Medical officers always preferred a battalion where discipline was good, for not only was there less malingering, but there was less sickness. Is it that discipline gives a man self-control or increases his power of adaptability? As a result he can react more easily to any strain that living imposes.

Suggestion acts in some strange way we do not as yet understand. The influence of a commanding officer upon the men is well known. So much depends upon whether they respect him or not. A patient who has confidence in a practitioner and in the therapy he practises does better than one who has not. It is strange to observe the change in a patient as confidence is restored. When I was a house-surgeon at St. Peter's, I used to think that some members of the staff could take liberties that would lead to disaster in the hands of others. Something more than technique came into play, but what that something was I never could grasp. To speak of personality is just to take refuge in a phrase. Later, when I was private assistant to Sir John Thomson-Walker, it was my impression that in certain nursing homes complications were extremely rare. Good nursing of course counted, but there was something more than that. Rather it seemed that some homes had in them the atmosphere that gave a patient confidence in all that was done. In one in which the patients always did well I recall how, when the front door would open, I used to feel I was face to face with efficiency itself. In my hospital I notice that, in the wards where the sisters maintain a quiet dignity and good discipline, patients do much better.

With a prostatectomy it was my practice to wash out the bladder twice a day. But as my belief in antiseptics waned, I did it just once. As a result the evening visit was not done unless the condition of the patient demanded it. Sister Arsène, of the Lord Ninian Hospital, in whose clinical acumen I had much confidence, told me that she was certain my patients did much better when I made the evening call. On thinking matters over, I had to come to the conclusion that

this was right. There is no suggestion of the transference of vitality, for I have never had any to spare. But probably a word of encouragement, feeling the pulse and saying that all is well, just putting a stethoscope on the chest and telling the patient that the heart is perfectly sound add to his confidence. The morning visit, done to see that all is well and that my instructions are being carried out, gives a patient encouragement to go through the day ; and the evening visit should give him that little bit of confidence that makes all the difference between a good and a bad night.

As the mind has got some bearing on health that as yet we do not understand, many are wondering whether all this talk on ill-health with the constant directing of thought to the subject is wise. For it is quite possible that thinking of disease rather than of health at a time when a predisposition exists may be sufficient to turn the scales in favour of its onset. What amazes me to-day is to hear mere children talk of ill-health and bacteria. Years ago boys rarely gave much thought to illness. If they were off colour, they were anxious to conceal it from their parents lest they should be stopped playing games. After all, good health is the prerogative of man. He should expect what is his right and in thought should anticipate this. He is then more likely to attain it.

F. The Strain of Civilisation

There can be little doubt that ill-health is on the increase. Hospitals are being erected all over the country and are full. Where there was one chemist's shop at the end of last century there are three to-day. Herbalists' shops are opening up in our cities and are visited by people in their 'teens and in the early twenties ; a few years back people of this age rarely took medicine of any kind. Buildings devoted to the cults are being erected in our towns. The number of people who visit them came as a great surprise to me a short while back. This increase in ill-health is attributed by many to the strain of living that the advances of civilisation entail. Surely

living to-day is less of a strain than ever ! The majority of inventions were introduced to get over conditions irksome to man. If at times these inventions are found to be troublesome, before condemning them, think for a moment of the conditions that existed before they were introduced. Was life really easier in the good old days ? If the telephone is a nuisance, it also has many advantages. Whom does the speed of travelling hurt ? Think of the journey in the old horse and trap or the slow journey by train when the carriages were heated by a foot-warmer. If the servant question does arise, compare the modern house and its conveniences with those that existed thirty years ago, when all the cooking and washing was done at home and few accessories were available for the table. Unemployment, too, is not something that has come in our day. At the end of last century many of the collieries in South Wales worked one day a week for months on end. Depression in trade was then expected, and when a boom occurred men gave thanks.

Nowadays we set our standards of work, which vary according to what we want or do. We forget that John Hunter slept for only four hours a night. Paget rarely went to bed before one o'clock and was down to breakfast at eight. At one time, lectures were given to students at Bart.'s at seven o'clock in the morning. We should remember that beyond their ordinary duties the Victorians put thought, self-control, and discipline as the highest things to which man could aim ; the acquirement of these requires much study and preparation, and each can be exhausting. This particularly applies to thought. For this reason many are inclined to shirk the knotty problem or the letter that requires care. So often they are left until the evening when the mind is clear. Owing to the need of energy, often they are never done. Years ago men were more sincere in their work. Lister, in a letter to his father after referring to an operation he was about to perform, wrote as follows :

" I felt this would be a fair trial of my self-command ; for the business was very much more trying than the amputa-

tion of a thigh. The theatre was again well filled, and though I again felt a good deal before the operation, yet I lost all consciousness of the presence of the spectators during its performance and did it exactly as if no one had been looking on. I feel, I may say, truly thankful I was able to go through it as I did. Just before the operation began I recollected that there was only one Spectator whom it was important to consider, One present alike in the operating theatre and in the private room ; and this consideration gave me increased firmness. . . . I trust I may be enabled in the treatment of patients always to act with a single eye to their good, and therefore to the glory of our Heavenly Father. If a man is able to act in this spirit, and is favoured to feel something of the sustaining love of God in his work, truly the practice of surgery is a glorious occupation."

Such a standard was extremely high. When men speak of the speed at which we work to-day they should consider whether the little thought that such work requires is not our gain, since so little energy is expended in its performance.

We assume that there was a day when life was easy and man had it all his own way. That surely was some mythical age that existed once upon a time ; for apart from that brief period in the Garden of Eden before man's first sin, there is no account of such a time in his history. Really the present is an easy time in which to live, and we should be thankful for the advantages that come our way. We should give up squealing and stop encouraging the development of that self-pity that is becoming a curse to the young.

Is there a Cause for Ill-health ?

Many diseases lead to ill-health, and when this is present all the organs are affected and disordered functions arise. The disorder becomes most evident in the organ which for that particular patient constitutes the weak spot. Though the weakness is inherent in the constitution the disordered function is secondary and is not the cause of the ill-health. If the investigation is thorough enough, it is possible to find disordered function in most organs. It is because this

is not realised that so much loose thinking takes place on the question of ill-health. And though the sense of well-being increases when the local disorder is overcome, the improvement in health is very slight and not permanent. For the ill-health is due to some factor that has yet to be treated.

As the practitioner watches one patient recovering completely from an illness and another getting over an illness and yet never regaining his former health, he must often wonder what is the basis of ill-health. For this is not something abstract that just wanders about the body. To put it down to a faulty direction of the imagination or to say that the tissues of one are very vulnerable whilst those of another are very resistant is just taking refuge in a phrase. Perhaps something might be gained by investigating that state of asthenia where, though ill-health and weakness persist, no disease arises. If patients are chosen, where previously the constitution was sound and the health was good, the following are among the chief causes :

1. Trauma to the head and spine, especially if associated with loss of consciousness.
2. Continued mental strain or sudden severe anxiety.
3. Some severe operation.
4. Sunstroke or heat-stroke.
5. The taking over long periods of alcohol, morphia, and cocaine, which are acknowledged poisons of the nerve cells.
6. Influenza, typhoid, and gas gangrene.

The possibility of some damage to the nerve cells from the first five is sufficiently obvious. The onset of influenza, typhoid, and gas gangrene is associated with marked nervous prostration. This is so definite and appears so early that it must be due to the action of some neurotoxin. Anyone who has gone to bed fit and who wakes up in the morning in the throes of influenza with all his energy gone can appreciate this. My last attack suggested to me that I had been bowled over as suddenly and as completely as if I had been punched on the jaw. In diphtheria and anterior polio myelitis neurotoxins are produced that have a preference for certain

motor cells. Is it not possible that the toxin of the bacillus of influenza have a preference for the nerve cells concerned with the production of vitality and energy? Such a toxin might act at any point, however, where the vital force comes into play. The following should be kept in mind:

1. Rhythmic activity is inherent in all life.
2. A certain amount of function is possible when the connection with the local autonomic system is maintained.
3. For this function to be devoted to a purposive end tonus is essential. This comes from a centre in the mid-brain. There is believed to be a special centre for the supply of each organ. The power of adaptability is dependent upon tonus.
4. Among the basal nuclei are three centres subserving contraction, relaxation, and rest. Upon these depend the vitality of man.
5. Beyond these is the centre of energy that gives to man his reserve of vital energy.

Assuming that the centre of energy were picked out, would not the state conform to the man struck down suddenly with influenza? He lies almost paralysed, mentally he is alert and he still can think, though he is not able to do so for any length of time. He can still make any single muscular effort, but he is not able to make a persistent effort. Adaptability is present; so is a certain amount of vitality, but the reserve of energy is gone. Asthenia I now regard as being due to some trauma or poisoning of the centre of energy.¹ Ill-health I regard as due to the persistence

¹ I cannot help feeling that an illness of this nature befell my father shortly before he died. I have no notes available and am just writing from memory. Apart from slight indigestion which came on only with certain foods, he never suffered in any way. His health was perfect. At the age of 72 he had his first attack of angina pectoris. At the time he had much anxiety and worry in his collieries. I was up seeing him one afternoon and noticed he looked a little grey and was quieter than usual. He was complaining of a feeling of discomfort over both sides of the chest and of distension in the abdomen. As I watched him, expecting an attack of angina pectoris, he was seized with sudden vomiting and diarrhoea and became seriously ill. The temperature was 100. There was marked auricular fibrillation and paralytic ileus and the following day he was drowsy and at times unconscious. My mother drew my attention to the

of this state. But a toxin that selects the vital principle for its action may act anywhere between the cell and the centre of energy. The centre for tonus may be picked out, or the local autonomic centre. In this way some explanation is forthcoming for certain disorders previously regarded as functional that followed influenza.

It is wrong to think that once the nervous system is damaged recovery is not possible. For lesions of the peripheral nerves show that the central nervous system is making every effort to restore the old order. It is, however, essential to distinguish between damage and destruction. If the nerve cell is destroyed as by a cerebral hæmorrhage, recovery is not possible. But where the cells are only damaged, experience teaches us that generally recovery takes place, though this may be a matter of years. It is the great effort that the central nervous system makes to regenerate itself provided it is given the slightest chance that is outstanding. The regeneration of a nerve that has been divided is the most marvellous thing I know. It shows that there is always an effort to preserve the constitution and this goes on so long as life exists.

marked asthenia and wasting that had set in within a week. The wasting was general and was evident even in the small muscles of the hand. As she said, "Isn't it strange to see so powerful a man reduced to such a state in so short a time? He can't move a limb." He was seen by Dr. Alfred Howell and Dr. J. P. H. Davies and recovered. But his case was by no means clear. We assumed that an attack of influenza had given rise to auricular fibrillation. But such an explanation could not account for the asthenia and wasting. There was some factor at work that we did not understand.

Nowadays I would reason out the illness as follows: The influenza gave rise to a neurotoxin which picked out the centres of energy and tonus. Its action was all the more virulent because the nervous system was predisposed. An explanation is forthcoming for the asthenia and wasting. Disordered function would be evident first and most markedly in his weakest systems—the gastro-intestinal and cardiac. I cannot help feeling that illnesses of this type are not uncommon in intellectual people.

CHAPTER XIV

THE TREATMENT OF ILL-HEALTH OR ASTHENIA

ONLY certain aspects are attempted here.

Prevention

This consists of living life wisely, in the proper treatment of disease, and in the wise expenditure of energy during convalescence. The asthenia, that is very apt to follow bacterial disease and particularly influenza and the common cold, is believed to be due to toxin that becomes attached to the nerve cell. The work of Billard on phylaxis is of great importance.¹ He showed that if certain substances are given in time the cells can be protected from the action of the toxins. In addition, even when neurotoxins are attached to the nerve cells, they can be displaced. This, if it can be established clinically, is a point of fundamental importance. The value of opium in the common cold and in influenza has been recognised since Dover introduced his powder. Its action is all the more marked if it is given in the early stages. The opium no doubt protects the nerve cells from the neurotoxins; in consequence, they remain in the blood-stream and are destroyed or excreted. Morphia has a similar action. So has hexamine. It is my practice to give small doses of opium and hexamine in an asthenic fever and morphia in a sthenic fever. These should be continued so long as the fever is active. It may be that their sedative action diminishes the reaction set up by the host. But in my experience this, if it occurs, is rarely harmful. Neither morphia nor opium should, however, be given during the stage of reaction.

¹ *The Clinical Journal*, 1933, vol. lxii, p. 359.

The Stage of Onset

May be acute or gradual. The patient should be nursed as carefully as if suffering from some serious disease. The absence of the usual signs is due to the nerve cells being paralysed. As a result a reaction is not possible. There should be complete rest in bed in a warm and darkened room. All work is forbidden. Even reading is best given up. No visitors should be allowed. Flannelette sheets should be used and the skin rubbed down with a cod-liver oil cream. Thomson, of Elgin, makes a suitable preparation. If the smell is objected to, equal parts of La Baume tranquille and eau-de-Cologne should be substituted. There is a tendency to force food upon the patient. I am sure that this is harmful. His wasting and weakness are due to the condition that is giving rise to the asthenia and not to want of food. The state of the organs is the same as that of the body as a whole. All are weakened. Even if food is digested, little of the end products pass into the cells. Much better if the patient has nothing but glucose for a few days. Any tendency to acidosis is overcome by giving alkalis. In asthenic states the sodium salts seem to be less depressing. If the patient's condition is serious, 10 per cent. glucose should be given intravenously combined with 10 units of insulin. This is the only nerve tonic I know.

The Stage of Reaction

This corresponds to the stage of decline in bacterial disease. Nature is working towards a cure. The paralysed state of the nerve cells is being overcome and recovery is setting in. The patient is now encouraged to take an interest in life. Glucose combined with insulin is continued. More food is given. Paraldehyde is given at night time. I believe that this acts as a nerve tonic as well as a hypnotic.

Some years ago a practitioner advised me to give spiritus chloroform at this stage. It has at times an extraordinary action. It was impossible to account for this until Billard published his work. He showed that in tetanus chloroform

can displace the toxin attached to the cell. It is possible that in *asthenia spiritus* chloroform acts in the same way. On the other hand, Sir Leonard Hill has shown that, if methylene blue is injected intravenously in the living animal, the nervous tissue remains unstained ; but, if the animal has been anæsthetised with chloroform, the brain takes on a blue colour. The chloroform has led to some change in the lipoid, as a result of which substances can now pass through.

On page 178 it was pointed out that before drugs can act upon the nerve cells they must be soluble in the lipoid membrane. Our failure to appreciate this is no doubt responsible for our inability to produce real nerve tonics. The suggestion was also put forward that drugs with the aldehyde and ketone group were likely to be soluble in the lipoid membrane. Acid hydrochlor. dil., acid sod. phos., and boric acid often do good, but not because they are acids. For the action of an acid is merely to diminish the alkaline reserve. Probably they act upon the nervous system and so give rise to the acid state in which ketones are formed. It is to the formation of these that the sense of well-being is due. In all probability, the ketones act directly upon the nerve cells, and so lead to a sense of well-being whatever the state. But drugs such as acid hydrochlor. dil. do good only if a reaction takes place. This may not be forthcoming if the general state is not good. Consequently, if no response follows their administration it may be unwise to continue them : it is certainly harmful to increase the dose. There are undoubtedly certain drugs that modify vital energy, but whether they do this by acting upon the centre of energy or whether they act upon tonus is not known. It is essential to differentiate between drugs that liberate or depress energy and those that create contractile and relaxile tonus.

Morphia is an excellent drug for depressing energy, but a thoroughly bad sedative. One of the essential differences between a depressant and a sedative is that the former merely lowers energy whilst the latter leads to a sense of well-being by creating energy. Caffeine acts upon the brain

and strychnine upon the spinal cord, but they are not true nerve tonics. Each increases the power of conductivity and so enables energy to be mobilised. They do not increase energy. The nervous system of the asthenic is very vulnerable and he can tolerate only small doses of these drugs. Whilst a little caffeine or strychnine may help him in the morning, neither should be prescribed throughout the day. For the present I divide drugs that create energy into three categories :

1. Those that increase contractile tonus.
2. Those that increase relaxile tonus.
3. Those that act upon the tonus of rest.

(1) *Drugs that Increase Contractile Tonus*

Those that I use for this purpose are the heavy metals: gold, nux vomica, the cup of tea, and tonic mixtures such as gentian and rhubarb. Mercury is one of our best drugs. Its fattening effect has been known since the days of Abernethy. Hutchinson said :

“Not only in the syphilitic but in the healthy, and not only in man but in the lower animals, mercury, if given in small enough doses, may be made to assist the formation of fat and muscle. Everything depends upon dose and upon the patient's idiosyncrasy. Whatever the idiosyncrasy, however, if the dose be reduced sufficiently, the drug may be made to agree. At the end of a year's course he may allege he never was in better health in his life.”

The improvement in health is not due to the mere introduction of mercury. It comes about only if a reaction takes place in the cells. It is not known in what part of the body this takes place, but there is a certain amount of evidence to suggest that the nerve cells play some part. A few years back it was assumed that drugs acted directly, and the greater the amount that could be administered, the better the patient would be. But now that we realise that good is forthcoming only if the cells can respond, much smaller doses are given. If good does not follow, this may be be-

cause the drug is not suitable or because the dose is too big. The state of the cells corresponds no doubt to that of the body. When the health was good the latter could respond to any stimulus: when the health is poor, as in asthenia, only a slight response is possible. This also applies to the cells. Therefore begin with small doses of a drug, $\frac{1}{20}$ grain of hydrarg. c. crete being large enough at the start. When a dose is found that appears to benefit the patient, it should not necessarily be increased under the supposition that twice the amount will do twice as much good. Increasing the dose may lead to over-stimulation, and if this is continued harm may result.

Throughout the ages gold has been regarded as having some action upon the nerve cells, and was at one time given in neurasthenia: 0.01 grm. solganol every other day is sufficient, and even smaller doses may be advisable. Nux vomica is an excellent tonic. That depressed feeling that comes on about eleven in the morning may be prevented if 1 or 2 minims of the tincture are taken before breakfast. Nux vomica does not act like strychnine, which increases the conductivity of the nervous system and the greater the amount given the greater its action. The beneficial effect of nux vomica is forthcoming only if a reaction is possible on the part of the patient. One or 2 minims may be sufficient. A cup of tea acts differently from caffeine, though what the difference is I do not know. Caffeine merely leads to excitability, but tea increases the sense of well-being. Again, the cup poured out when the pot has stood for three minutes is often most stimulating, whereas the cup poured out when the pot has stood for five to ten minutes can be depressing.

The old tonic mixtures in vogue at the beginning of this century are invaluable, and a return to that form of therapy will sooner or later take place.

(2) *Drugs that Increase Relaxile Tonus*

Of these the best is undoubtedly opium. Here, too, at first the dose should be small, 1 minim a day being suf-

ficient. Now, an increase of relaxation is not the same as depression of energy. We are all aware of the state to which the latter leads. Relaxation leads to a sense of well-being. It is something that has to be created and is forthcoming only if the cells can respond. This is obvious when the action of opium is studied. This differs from that of morphia. The latter is a depressant and acts whatever the state of health. For the sense of well-being that follows the administration of opium in the healthy is not so marked in those who are not well, and may be scarcely perceptible in those who are acutely or chronically ill. This is explicable only if it is assumed that the effect of opium comes from some reaction that takes place in the cell. Sodium bromide, valerian, and methylene blue act in the same way. If improvement does not follow a certain dose, it is wrong to increase it.

(3) *Drugs that act upon the Tonus of Rest*

Chloral is to be preferred for the hypersthenic, paraldehyde for the hyposthenic, and medinal for those who are highly strung, particularly if there is any disturbance of the gastrointestinal tract. In asthenia the threshold between consciousness and sleep is rarely marked ; and, if it is lowered only a little, sleep follows. Big doses of hypnotics are neither advisable nor necessary. A small dose repeated in one hour is often more effective. The improvement that follows the giving of moderate doses of the right hypnotic is often out of proportion to the benefit that is expected from good sleep. May this improvement not be due to some beneficial action of the drug upon the cells of the centre of rest ? Generally it is harmful to prescribe hypnotics regularly or in big doses. In asthenia, however, it is wrong to withhold them. It seems to me that hypnotics have at times a tonic action upon the nerve cell. There are two types of hypnotics. One such as morphia, that depresses the centre of energy. Another such as paraldehyde that promotes the sense of sleep. If the right hypnotic is found, it is surprising what a

small dose is required. If a hypnotic does not act, it does not necessarily follow that the dose should be increased. The practitioner should consider whether it may not be the wrong drug for this particular patient. For idiosyncrasy exists with hypnotic. It is not advisable to discuss the nature of the hypnotic with the patient. Just tell him what action is anticipated ; and, if the practitioner does not himself prescribe, the prescription should be sent to the chemist.

Can Tonus be increased ?

The suggestion put forward here is that drugs lead to the formation of tonus. This action cannot be proved or disproved. But drugs that promote the sense of well-being have to act somewhere ; they do not wander aimlessly about the body. If they do not increase tonus, how do they act ? Until we have some method by which tonus can be estimated, obviously our impressions are bound to be vague.

The bearing of the special senses and of the skin upon tonus have been pointed out. I am quite confident that in man tonus can be influenced by the attention he gives to the senses. If an effort is made to keep these active, tonus improves. A light friction to the skin can be invaluable in toning up the system, particularly when applied in the region of the spine. A warm bath, however, lowers tonus, and if magnesium sulphate is in the water, this lowering action can proceed to an alarming degree. The difference between a dry and a moist heat is noticeable. In certain hospitals where I operate, where the steam gets into the theatre, my energy is sapped early on. Work then becomes an effort. Whereas in private nursing homes, where the heat in the theatre is dry, I can operate all day without becoming tired. In a Turkish bath a few minutes in the steam is all I can stand, whereas it is possible to stay in the dry heat at a higher temperature for a long time. It may be that a dry heat acts in one way upon the lungs and moist heat in another ; but it is my impression that their effect is due to some change they create in tonus by their action upon the skin.

The Stage of Convalescence

Nature is endeavouring to restore the patient to his former state of health. Both he and the practitioner should be anticipating this. But it is well not to let the patient drift along. Some plan should be outlined. The following chart serves as a basis :

A Chart for the Convalescent

The patient should be called at five minutes to eight and he should get out of bed at eight o'clock sharp. Mental slackness is apt to arise during an illness, and is liable to persist during the period of convalescence. During the few minutes that he lies in bed, he should think over what has taken place on the previous day. In this way the memory is kept active. Whilst dressing he should give some thought to the plans for the day.

It is better for the convalescent not to take too many baths. A rub down with the hand or a rough towel after getting up is preferable. Light massage, if it can be obtained, is advantageous. After this he should dress slowly.

It is better not to take breakfast in bed. On the other hand, the rooms downstairs are at this hour cold and the convalescent is so liable to catch a chill. If the bedroom is warm, there is no objection to taking breakfast there, as he rests in a comfortable chair. With breakfast, as with all meals, it is important not only to pay attention to thorough mastication of the food, but also to spend a sufficiently long period doing so. It is better occasionally to time each meal with a watch. Only in this way can quick eating be avoided.

After breakfast rest quietly in an armchair for half an hour. The morning paper or some light literature may now be read.

At eleven o'clock take a glass of milk, Glaxo sweetened with glucose, or some patent food such as Allenbury's diet, Benger's food, or Horlick's malted milk. It is important

to spend fifteen minutes over this. There is no objection to a cup of coffee now.

After this it is advisable to go out for a walk or a drive if the weather is favourable. It is better to rest from time to time. In no circumstances should he feel tired. If this occurs, then the exercise is harmful.

Before and afterwards it is better to do some mental work, the nature of which will depend upon the patient's outlook on life. The amount is governed by the activity with which it is done and by the length of time for which it is undertaken. Short periods of concentration are to be preferred to a prolonged desultory effort. But there should be some definite plan of work. Any feeling of weariness that arises at the start disappears if the eyes are closed for a couple of minutes.

Before lunch it is better to rest and to relax in an armchair for five or ten minutes. During this time the paper or some light literature may be read.

The chief meal should be at midday. At least three-quarters of an hour should be taken over this. It is better not to read during this time, but whenever possible to indulge in quiet conversation. The convalescent should endeavour to cultivate this, for it undoubtedly improves the appetite and helps digestion.

After the midday meal, it is essential to rest for three-quarters of an hour. This must be taken in a quiet place away from everyone. There must be no reading. This is probably the most important routine of the day.

At three o'clock the procedure is similar to that at eleven o'clock, and the afternoon is spent in the same way as the morning. Places of interest should be visited and social engagements resumed. It is so easy after an illness to become disinterested in life.

Rest for thirty minutes before the evening meal in a quiet place and away from everyone. This should be taken at seven o'clock. Every effort should be made to prolong it, as in the case of the midday meal.

Active mental work may be undertaken until nine-thirty, when a rest of ten minutes may again be taken. After this it is inadvisable to undertake any active or sustained mental work, and it is better to avoid any exciting or controversial subject. Desultory reading and quiet conversation should be the aim. Sleep should be looked forward to, and the habit should be cultivated of recalling scenes of contentment that have occurred in life.

The hour of retiring should be fixed: ten-thirty is a time that is favoured by many. Lights should be put out at eleven.¹

This chart serves only for general guidance and must be modified for a particular patient. For instance, rest is advisable for the hypersthenic who has been an active worker. The hyposthenic tries to do too much early on and wants to get well too quickly. At one moment the practitioner is warning him that his health is not sufficiently good to do so much and at another encouraging him, as he has become despondent.

Sometimes improvement ceases and ill-health persists. The state of weakness now continues. Disordered function is likely to arise in one or more organs; and there is a tendency for bacterial disease to arise in some mucous membrane whenever the health becomes impaired. The practitioner will again and again be tempted to direct treatment to the last two, particularly as the patient or his friends implore him to do so. They feel certain that, if the organ could be removed or the symptoms relieved, health will follow. The practitioner, however, realises that the local disorder is secondary to the general state; and it is only

¹ There is perhaps too much time given to rest. The trouble is that after an illness a patient does not feel like work and becomes easily fatigued when attempting much. I am somewhat doubtful of the value of the long rest from eleven to eight. So often the patient gets up feeling a little more listless than when he went to bed. Now, for many healthy people, too long a sleep seems more harmful than too little. This feeling of listlessness might be overcome were the patient to make it a practice to do some reading between 3 and 4 a.m.

when this deteriorates that the symptoms become evident. He is aware that if the health can be improved the symptoms will disappear ; and if the health can be maintained the local disorder will clear up. The practitioner often wonders whether drugs should not be given to bring ease. But he should now and again put to himself this question : Assuming the drug brings ease by relieving the local condition, may it not do harm by depressing that vital response that is essential for recovery to take place ? On the other hand, tonus is in some way linked up with disease and is influenced by stimuli from the skin. We are now beginning to realise how surface applications work. There is no objection to their use, and blisters and the various counter-irritants often do good.

Now and again it is advisable to explain to a patient how symptoms arise and how at times they can be overcome by relaxing or altering the direction of the thought. For this purpose I use the following illustrations :

1. The greatest boon of health is that a man is unaware of his organs and is able to exert himself without feeling any ill-effect. For instance, if a severe strain is put upon the heart, it may lead to palpitation, which subsides as soon as he rests. But when a man is not well the action of many organs comes through to consciousness, even when he is at rest and certainly as soon as any strain is put upon them. Palpitation of the heart may now be obvious ; and, as soon as food is taken, abdominal discomfort may arise. Such symptoms do not mean that disease exists or will arise, but that the function of that organ is easily affected. These symptoms are more evident when the health is below par.

2. There is no doubt that discomfort and disease become more pronounced if the mind is directed to them. Most people are aware of this. A man in a theatre or a church finds he has not a handkerchief and then the nose begins to run. When the handkerchief is discovered the nose ceases to give trouble. Here fear alone comes into play. Or is it concern ?

3. A man who is ill has everything done for him, the secret of good nursing being that he makes no effort and that he is not disturbed. This also goes on during con-

valescence. And as a result sick people at times tend to become selfish. When things are not to their liking, they think other people are unreasonable and fail to realise that they are to blame. A medical man tells me that during a long convalescence he had moved from place to place dissatisfied and finding fault. Finally, he landed in a country hotel from which it was not possible to move owing to the breakdown of the car. Being unable to put up with the talk of other visitors he was driven from room to room. It then began to dawn upon him that he had become unreasonable and was developing into a replica of the peppery Indian colonel, so often depicted in novels, who was a nuisance to himself and to every club he entered. One of a large family of children, he recalled that as a young man he had cultivated the habit of reading whilst others talked, and was at the same time able to participate in the conversation. And during the War his reading was never disturbed by heavy shelling. He could not help feeling that his present state was due largely to his having had everything done for him during his illness and to his expecting this to continue. He realised that it was up to him to adapt himself to life. Keeping this in mind, he sat down that afternoon near others who were talking loudly. By relaxing he became indifferent to what was going on and was able to read with a contented mind. Working with this as a basis, he came to the conclusion that much of what he previously regarded as unreasonable was due to the wrong attitude he had taken ; and it was up to him to adapt himself to the environment in which he was placed. Thinking more of doing something to please others and taking less notice when things were not to his liking, he became less pernicky and his outlook on life was changed. As a result health and temper improved.

4. During and after an illness, wasting of the muscles is very evident, and some weakness is likely to persist. The ciliary muscle may be taken as an example. A patient who was able to read quite comfortably may, after some illness, complain of difficulty in focusing objects and of the print becoming blurred. This is due to diminution in the tone of the ciliary muscle, and as a result it becomes more difficult to accommodate. The muscle gives up the struggle, relaxes, and the print becomes blurred. This is particularly noticeable after 40, when there is normally an increasing

difficulty in focusing for near objects. Though this is trying, it tends to disappear as the health improves. It can to some extent be overcome by seeing that the light is properly placed, by keeping the book at the proper distance from the eyes (about 14 inches), and by closing and resting the eyes at frequent intervals. At times glasses give much relief and may be indicated. This does not necessarily mean that they have to be continued for the rest of life. In minor cases the patient has to decide whether he is going to have frequent intervals of rest, or whether he will wear glasses. The disordered function of other organs that arise after an illness is due to weakness of the muscle and not to disease, and often disappear on lying down and relaxing. The onset of the symptom may mean that the patient is making too big a demand upon his reserve of energy, and this becomes evident at his weakest spot. Rest may be indicated or treatment by drugs acting on contractile tonus, relaxile tonus, or the tonus of rest. No rules can be laid down and each case must be catered for on its own. Gentle massage to the skin, or a counter-irritant, at times do good.

5. Those who have suffered from headache and pain know that both tend to disappear if the mind can be diverted into some other channel. The value of the appearance of a friend or a visit to the theatre at such a time is well known. Some assume that the original trouble is imaginary. This is not the case. For when the mind dwells on a pain or disordered function, contractile tonus is increased, and as a result the symptom becomes more severe. When the mind is diverted into some other channel, contractile tonus is decreased or is replaced by relaxile tonus and pain is less. Everything depends on the severity of the lesion, the temperament, and the way in which the mind has been accustomed to work in times of health. Even when pain is present some can turn at will to work that needs concentration or to thoughts that bring contentment to the mind. Others are so overcome by slight pain or disordered function that anything that needs mental effort is no longer possible when there is a slight ailment. So much depends upon the sensitivity of the nervous system, the temperament, and the manner in which the mind is accustomed to work in times of health. Still, a willingness to persevere often works wonders. Even during an illness habit can be cultivated; and as a result

what is at first difficult becomes easy. The most extreme case is probably one reported in the medical press many years ago. A man had been captured by the Tibetans, who had tortured him by breaking his bones. These had set with marked deformity. On his return to England a surgeon was able to break and reset them without an anæsthetic. It was not that the man did not feel pain. But when the torture started he realised his only chance to survive and to retain his sanity was to let his mind dwell on happier things. Once having accomplished this, and having created a habit, there was no difficulty in doing it later. For this reason an anæsthetic was not necessary when the bones were reset. Now, only one man in a million has the temperament to accomplish this. Most would have been killed by the torture. Those who survived would have become nervous wrecks. Now, when lesser pains are present, the man with the average temperament can with a little perseverance deviate the mind into other channels if the spirit is willing. This was well seen in the firing-line during the War, when men of refinement were able to adapt themselves to the carnage and to the appalling noise. The majority must have felt, when first they got there, that under such terrible conditions they were certain to fail. Yet this occurred with very few. Small efforts that are repeated are advisable, for progress at the start is certain to be slow.

These instances serve to bring home to the convalescent the necessity for making an attempt to adapt himself to his environment. He must not let the mind dwell on his symptoms, but should direct his thoughts into some sphere of activity or should let them dwell on things that bring contentment and peace. A great effort is not advisable at the start. For effort needs concentration, and this uses up energy, of which the convalescent has too little. In addition, concentration is associated with an increase of contractile tonus, and as a result the pain and discomfort become worse. Consequently, frequent small efforts are advisable. As a habit is acquired the effort that is required becomes less.

It is obvious from what has been said that much import-

ance is attached by me to the bearing of the mind in overcoming ill-health. I go so far as to say that if a patient has lost confidence in therapy or in the practitioner, it is better for him to make a change. Hope is also essential. I recall so well the case of a man who was just slipping away after an operation, but who eventually made a miraculous recovery. It later transpired that having lost his money he had been deserted by his family. When he was at his worst, a boom occurred in a certain share he held, and he was again wealthy. Life was now a different proposition. But beyond confidence and beyond hope comes faith. And what faith is it would be idle for me to attempt to define. Faith is certainly dependent upon the direction of the thought. But faith is more than thought. Sometimes I wonder whether faith is not really the same as character, and sometimes whether it is not really the soul. It is not difficult to give a man confidence. Whether hope is retained depends much on what life means to him. Faith is something that comes to a man in some way we know not how. When it is restored his outlook on life is changed. But faith is something that it is not possible to give directly to a man. It is something that has to be created by him, and seems to be his response to some line of thought. Faith comes to him only in so far as he is qualified. It is because the cults give attention to the direction in which their followers direct their thoughts that at times they succeed where the medical profession fails. Though the bearing of thought upon disease is not so marked as some pretend, the direction in which thought is expended does modify the outlook upon life, and as a result some functional disorder or state of ill-health can be overcome. The possibility of this has always been recognised by medical men. Paget, in a letter to Sir Henry Acland, wrote of a patient :

“ What unsatisfactory and hardly manageable cases these are : this clever, charming, and widely known lady will some day disgrace us all by being juggled out of her maladies by some old quack who, by force of assertion, will give her

the will to bear, or forget, or suppress all the turbulence of her nervous system."

To-day, however, a broader view is taken, and the word quackery is applied rather to something that is insincere and is done merely for gain. If someone succeeds where a medical man fails, it is the duty of our profession to ascertain how the cure arose. For important as the diagnosis is, the patient is chiefly interested in getting well. Now, in all superstition there is an element of truth, and this applies to a successful cult. For no cult could survive for long unless it brought relief to some. Failures are disastrous, and mere bluff does not last long. Rather than condemn a cult simply because of those who advocate it or because of the methods they adopt, it is my custom to ponder over the underlying principle and to wonder what is in it that restores faith. For this at times occurs in an amazing way. It seems to me that the success of a cult so often depends on the importance that is attached to belief, the attention that is paid to confession and the stress that is laid on ritual. As these are inseparable from the art of medicine, and are only neglected by those who fail in its practice, a short reference is made to each.

Belief

When a man is unwell he feels ill, and when disease or disorder arises in an organ, sensations come through to consciousness. To add to this, as he convalesces the sympathy of those around and the references of friends to his illness, and so often to the illnesses of other people they have known, gives him little opportunity to forget. It is therefore not unnatural that one who before rarely gave a thought to his body becomes self-centred, and begins to think in terms of his organs and himself. It is essential, once the stage of decline or of reaction sets in, to get a man to think in terms of health and of his old ideals. But restoring confidence and giving a man a different outlook on life become too often just abstract conceptions, and particularly now that we speak of

a complex. At all times of life a man needs guidance, and after an illness it is important to give him something to grip. It is essential that mental activity should be resumed. How far would the muscles develop if no attention were paid to exercise? Does not the mind require just as much care and attention? The patient must take an interest in things outside himself, and try once more to give consideration to others and to be of service to them. Otherwise he becomes not only introspective but selfish. At this time something that leads a man onwards, something that lifts him up does help to restore the faith he once had in himself. For this reason a cult, by its knowledge of human nature and the attention it gives to details, succeeds where a medical man fails.

Confession

We are too apt to think that confession relates to some foul deed or some sin. But used in the sense of "getting out," confession can refer to anything that comes forth that is liable to disturb the mind. When this takes place it may be possible by reasoning to overcome the suspicion and fear of a patient, and to put the mind at rest. And no doubt by talking over something a proper conception of some thought is gained. For thought so often evaporates as it becomes concrete. What writer has not started an essay with some great conception in mind and, having written it down on paper, throws all away as being unworthy of pen and ink? This also applies to the things that worry or make us anxious. Once they are put down in writing or reasoned out, how trite and trivial they seem. Talking over something acts in some other way that is difficult to explain. This aspect is revealed in many of our common sayings. It is not infrequently said that something is "better out than in." Take for instance that little demon, temper. On a morning when the north-easter blows a man may feel out of sorts and his temper is on edge. All that can be said is that for some reason the devil is making contact with the soul. If he spots

what is happening, and if his health is fair and his mind nicely poised, the temper is subdued, and for the rest of the day all goes well. Or he may become riled, flares up, and suddenly breaks out. He feels a fool for having shown his feelings. But, provided no one has been hurt, somehow relief comes from this outburst, and soon he is his old self. But if the temper is neither subdued nor let out, it goes on irritating him the whole day, and soon he feels out of sorts. Though it is far better to subdue temper than to let it out, either is preferable to letting it just linger the whole day. If this state goes on for long the health becomes affected. What applies to temper applies in general to those other demons, the emotions. Confession appears a failing to the man who has the departmental type of mind that can forget or easily turn to something else. But if some thought is tending to recur and to irritate the mind, it may be advisable to let it out, and this applies to ordinary symptoms as well as to complex thought. Whether good results from confession depends so much on what follows. If the mind is content to leave matters to him in whom it has confided there comes peace. But if the mind tries to reason out the symptoms and to find some ultimate cause, little if any benefit ensues, for the symptoms do not then pass away. They just recur. The good practitioner by knowing how and when to listen and how and when to advise is invaluable at such a time.¹

¹ I would stress the need for the practitioner having a chat with those who are not well, particularly as they get on in years. This chat should take place when no other member of the family is present. The modern idea that the object of the visit is just to give encouragement is I feel sure wrong in the case of the aged. For old people often have fears that are all the better for being expressed. Too often these fears are laughed at, and on account of this they tend to be suppressed. Many years back a practitioner told me that he regarded it as part of his religion to be kind and considerate to the aged and to reason their fears away. A quiet conversation once a month with no other member of the family present was part of his creed. For just as there is a tightening of the limbs so is there a tightening of the brain. As a result there is often difficulty in grasping all that is said. Time should be taken to give them every chance and encouragement to express their views.

The mining valley where I lived seemed to be pervaded by a sense of

Ritual

When a man has health and the years are with him, he is guided in life by two events, New Year's Day and the day of his birth. In other respects life is just a matter of ease and enjoyment. A man suddenly struck with influenza is down and out. For him each minute seems an hour and each hour lingers like a day. During the day he yearns for the night and during the night he longs for morning to come. As the stage of reaction sets in life begins again to be pleasant. At this time a certain routine is adopted. This is done partly for treatment and partly to keep his interest alive. Those who look after the sick know the value of good nursing and the benefit that comes from routine. Where this can be properly applied in a nursing home or hospital, the patient does so much better. Half of the benefit that comes from a visit to a spa is due to the routine that is practised.

When ill-health persists, it means that the power of adaptability is not effectively restored. At such a time a man comes to realise how much a child of nature he is. Now for the first time he becomes aware of the amount of ritual he has practised in life. But who can say where routine ends and ritual begins? Are habits of the mind just routine or ritual? The purpose of both is not only to develop habit but also to practise concentration and relaxation. Ritual goes further than routine; but it is not possible here to give even a résumé of its bearing. It is not a matter of mere religion that the seventh day should be hallowed. Owing to the demands of civilisation, it is not possible for man to adapt his living to the season of the year as is the case with many forms of life. A steady average duty and the people in their consideration for others were second to none. During an illness or as a man got old there would be friendly visits from the parson, the family solicitor, and the doctor. Each regarded himself as a friend of the family. It was incumbent on him to find out if the sick person had something on his mind. After a death the three would meet together to see if something could not be done to help the family on. The spirit that then prevailed was very fine. If it did nothing more than serve as an example to the young, something was attained. What a change is seen to-day.

is needed from him. To compensate him for this a rest of one day in seven is advisable. The worship of the Creator is no doubt in the interest of man's body and mind as well as of his soul. Looking back on life I now realise how much I appreciated the Sabbath, not so much for any religious influence as for the quiet that came to the mind. I could not help noticing this Christmas the peace that came from the quiet in the streets. It seemed so strange, for rarely does it come our way these days. For a time it seemed as if I was in another world. Many of the religious feasts and fasts have ritual in view. They can bring peace and joy to the soul. When properly kept they make the passage of the year easier. Whatever plan is adopted, whether it is called doctor's orders, routine, or ritual, is not a matter of great moment so long as the patient has something that can be visualised.

When a man is healthy he can adapt himself so easily to all things. But when ill-health persists, he is so often in need of all the help he can get. At such a time belief, confession, or ritual may play some part in his restoration to health. A wise practitioner gives consideration to each.

A woman, aged 35, had had coli infection that was secondary to a want of care in living. The infection was regarded as the cause of the ill-health. Practically every conceivable form of therapy had been used, but the less that is said about this the better for the good name of our profession. For in the attempt to sterilise the urinary tract the nervous system had been undermined ; and she was reduced to a wreck consisting of skin and bones with no faith left in herself or in the medical profession. Her practitioner asked me to see her with a view to excluding serious disease. The bacillus coli was present ; so was a small degree of pyuria. As both kidneys were secreting freely, it was obvious that the infection was not the cause of the ill-health. It was unnecessary to advise living quietly, for she had lost hope. When I saw her three months later, there was marked improvement in the health ; she is now quite fit. Her restoration to health was the work of her practitioner. He prescribed three kinds of medicine of different colour containing small doses of

sedatives or stimulants for the treatment of the varying symptoms. When a fresh ache or pain appeared, he pointed out that it was to be expected, and was part of the cure. He was anticipating this, which was for the patient's good, and was an indication that the medicine was acting. When some other symptom arose, it was an indication for changing the medicine. Working along such lines he regained the patient's confidence, and restored her faith in herself. After which her health improved and a cure followed.

Some may suggest that practice of this kind is hypocrisy and quackery. To my mind the recovery of this patient was a great work of art. The practitioner pitted his brain against a brain that was worn and weary and that had lost hope and faith ; and in the long run he won.

Important as is the bearing of the mind and attention to the mode of living, it is wrong to think that drugs do not count. When properly administered they do much good. But it does require clinical acumen to give them to the right patient in the right amount at the right time. I recall one of our lecturers at Bart's telling us rather jocularly that Sir Lauder Brunton had a book with 500 prescriptions, and would vary the dose by a minim for a patient. How we laughed to think that greatness could be so naïve ! For in the golden age which we then thought was dawning in medicine, all eyes were turned to the laboratories that were being erected. We were going to reveal the nature of diseases, and science would provide us with the remedies. Some are beginning to wonder whether Sir Lauder was not right. Perhaps he treated a patient, not as a piece of flesh into which some foreign stuff was introduced, but as one having a constitution, a temperament, and a state of health, each of which could be modified by administering the right drug in the right amount.

When a practitioner tells me that some form of therapy invariably acts I want to know how he allows for idiosyncrasy. So often such a one has never heard of the word or regards its conception as of the nature of a myth. I first

became aware of this factor when a house-surgeon. A sister told me that a certain patient had reacted in a strange manner to aspirin. The warning was disregarded and I ordered the drug to be repeated. The patient collapsed and nearly died. Since that time I pay careful attention if a patient says a drug disagrees. In recent years I have been surprised to find how common is idiosyncrasy. It can be spotted only by trial and error. The following passage from Hutchinson should be kept in mind :

“ Let me add, in conclusion, and it seems to me of great practical moment, that the individual peculiarity of all patients should be carefully studied and that they should themselves be made intelligently acquainted with these. There are few of us without our idiosyncrasies, and their variety is innumerable. If it should become the custom for parents to record some sort of life-history of their children in permanent form from birth or infancy onwards, noting all the peculiarities in an individual by the aid of medical observation, not only would much be done in the way of preventing subsequent errors in the treatment of disease, but valuable contributions would be made to our knowledge of its real nature. It is not only as regards the prescription of our drug that a knowledge of our patient's peculiarity becomes important to us in practice. The advice we have to give in respect to places of residence, mode of life, and of general management is often of far more importance than the medicine prescribed. Its wisdom or the reverse may depend on our knowledge or ignorance of the individual peculiarities, and these peculiarities frequently do not display themselves in any of the existing systems, but can be recognised and revealed only by a correctly kept life-history.”

This advice is perfect, and when it is followed much suffering can be prevented. As idiosyncrasy is of such importance, I will record two instances that happened to me.

1. After my discharge from the army I placed myself in the hands of a practitioner who was insistent upon a certain routine and also had confidence in drugs. I disliked the former because it meant giving up things I took pleasure in

doing, but I had little objection to the latter. So anxious was I to be well that at first the treatment was rigidly followed. But whatever was done there was little if any improvement, and after an extended trial I stopped treatment. He always prescribed arsenic in the medicine. It was only later I found that I had an idiosyncrasy to this drug which is evident if I take as little as a minim of the liquor twice a day. My mother told me shortly before she died that in the house where she was brought up as a girl there was a room with green wallpaper. If she sat there for a few hours, she was always sick. This is the clue. This practitioner only had to substitute mercury for arsenic to give me perfect health.

2. As a boy I was good at rugby and boxing. In later years my stamina let me down. By careful training strength would come ; but the common cold with its impairment of health was certain to follow. If only I could overcome this tendency to the common cold I would become strong. Every possible remedy was tried, but none had the slightest effect. Many years later I happened to tell my father that whenever the north-easter blew the common cold came on. He replied that he was affected in the same way. This is the clue. The onset of the cold had nothing to do with my state of health, for my father's was perfect. Whatever therapy can do, it can never give a man more than this. Even if health had come, the common cold would still have arisen, for this was for us of the nature of an idiosyncrasy to a certain wind.

To be a practitioner great training and a special type of mind are necessary. I am doubtful if anything is more difficult than to be good at this work. A practitioner is not only the patient's friend but also his guide and philosopher throughout life. It is essential that not only should he be a student of nature, but he also must have a large and wide conception of life. My admiration for the good practitioner is very great. In his passage through life he has to work out a philosophy of his own. Little help does he get from books

or teachers. In recent years there has been a bigger change in our outlook in medicine than many realise. Sympathy is no longer the basis. This is clinical research. Now research is of the nature of experiment. Though this may at times be necessary and may do little harm in the hands of a few careful men, it is deplorable to note the extent to which it is carried. What the student sees to-day he applies in practice to-morrow. Owing to the love for operating and specialising that has arisen, few students give attention to the needs of general practice. The rise of operating and of specialising that is taking place is eventually going to do the practitioner, surgery, and specialising much harm. Each requires a different type of mind and few men have the time or ability to be good at more than one.

Operating is nowadays easy. Instruments by which cavities can be inspected are cheap and easily manipulated. As a result a certain amount of knowledge is readily accumulated. Men are confusing the power to operate with that experience that is essential to make a surgeon. I passed the examination for the final Fellowship a few months after qualifying. Much of the knowledge that had to be acquired had no practical bearing. In the circumstances it seemed just a waste of time to work for a university degree. The knowledge required for this was so academic. Questions bearing on some abstruse problem were likely to be set, and after going over the papers of the past years I came to the conclusion that were I able to answer each question perfectly, I should be little better at the bedside. Nor did one set a course that acted as a guide to the young surgeon in shaping his career. Habits of the mind as well as habits of the body can be developed, and I was anxious then as now to acquire the practical type of mind with its outlook on life. Now the Celtic mind finds difficulty in reaching a decision, since both sides of the question are so easily seen ; but once a course has been set the mind concentrates to an abnormal degree and fails to notice that it would be advantageous to make a change. As my decision

was bound to affect my subsequent career, I first had a chat with my father. He told me that over-education was taking place in mining. Owing to their want of practical experience many managers were not able to handle men. He found that the best-qualified men were often not the most practical. He suggested my consulting Sir Anthony Bowlby. I put all my cards on the table. Working for an examination was a waste of time. So far as practical work was concerned, operative surgery seemed easy. So was the diagnosis of disease. Yet at the bedside I did not make great headway. It seemed so difficult to apply knowledge once the patient left the operating theatre, and he took a turn for the worse. He looked at me with that peculiar look of his and said: "There is still hope for you. You Welshmen have quick brains and too often mistake the easy acquirement of knowledge for wisdom. At the bedside something more important than disease is dealt with; you there come face to face with life, of which we know so little. For this reason surgery will always be difficult with certain cases, however easy operative surgery and diagnosis become. Surgery is a pilgrimage to the end of his days to the surgeon who faces failures. These will always occur; and he can only hope to make fewer mistakes as his experience increases. In certain cases much depends upon judgment, and for this to be sound, experience is essential. There is no short cut to experience. It is as necessary for you as it was for me to spend ten years devilling in the meat shops and studying the masters."

A surgeon should have this experience before he is permitted to operate. For the first case may be the most difficult that comes his way and the life of this man is dear to him and to his relatives. After all, modern achievements make only 90 per cent. of surgery easier. The remaining 10 per cent. require judgment, often to a great degree. If a blunder is made, it is not the surgeon who goes into the coffin, nor does he have to linger on in life. When pondering over all the operating that is taking place throughout the country

I wonder where all the surgeons have come from. Is it not that men are operating without necessary experience? If Bowlby considered that ten years was advisable for my introduction to surgery, should not this apply to all? There is a difference in the surgery performed by the surgeon and the operator. A surgeon has had the requisite experience by devilling and watching and his outlook is governed by a great tradition. To him surgery is not merely a craft; it is an art as well as a profession. The operator gains his experience by operating upon patients. He develops the type of mind that believes that the noblest thing to do for a patient is to cut something out. The difference between the operator and the surgeon is not at first obvious since operating is nowadays easy and only becomes evident as judgment is brought to bear. The rise of the inexperienced operator is the tragedy of British surgery. Owing to a want of sincerity and of moral courage in our leaders, the betrayal of surgery is taking place. For under the conditions in which this is practised to-day, it cannot survive as an art.

Few words have been so misused as that of specialist. During the War I acted as assistant to Sir Robert Jones, who expressed the wish that I would continue to take up orthopædics as a speciality. The work interested me very much and I liked my colleagues. Unfortunately, some of the work was a little too heavy and it was with great reluctance that the offer had to be declined. The following week I became private assistant to Sir John Thomson-Walker. I was thus in the interesting position of being able to compare two such eminent surgeons in such different specialities as orthopædics and urology. It would be idle for me to attempt to express my admiration for their work and the great stimulation this gave to specialise. At the time I passed the examination for the Fellowship knowledge was accumulating at such a rate that it was impossible for one brain to keep in touch with the literature, much less to have a working knowledge of all that was done. This would be all the more difficult in years to come when social

ties would intervene. To reach perfection in surgery is well-nigh impossible. Nevertheless it should always be the aim. It seemed to me that it could be attained only by taking up a special branch. For this purpose I became house-surgeon at St. Peter's Hospital. I was soon aware that the standard of the work done there in urology was much finer than was that done by the general surgeon. This also applied to orthopædics in Liverpool. After my health broke down in 1921, there was that break in work that gave me an opportunity to think. There was plenty of time for this on a balcony in Switzerland. I realised I had not quite got the outlook of Sir Robert and Sir John. Granted that they had greater ability and greater experience, there was something more I had failed to grasp. Then it dawned on me that they were first general surgeons and it was only as work accumulated for which they had a special aptitude that they became pure specialists. That I am convinced is the secret of true specialism.

I hold that the surgeon should always have done two years in general practice. In this way alone can he obtain a knowledge of life. It is only as he shows aptitude or inclination in general surgery that he should become a specialist. Now this position is bound to limit his outlook. The knowledge of a specialist is special only to a branch of disease. He knows little of the constitution and of the temperament. For this reason the true specialist always works in association with the practitioner.

CHAPTER XV

CONCLUSION

I AM only too aware how fragmentary is this book. The problem of life is, however, so vast that the difficulty is to know what to include. Rather than attempt to give a résumé of life as a whole, I have considered it advisable to deal only with those aspects that have interested me. Reference is made only to writers whom I knew as a student or who were then quoted to me and in whose books I find pleasure in meditating. To have referred to all who have at one time or another made an appeal would in my hands have led to confusion. It has not been my intention to try to reach conclusions upon vitality and energy, and the impressions formed will no doubt be altered as time goes by. If I appear to be dogmatic in my views, this procedure has been adopted in the attempt to make the meaning clear. Chapters V-X are published almost as written in 1929, when I hoped to bring the subject to completion. But a long illness then interrupted the line of thought. And though considerable time has been given to its study, it is no longer possible to take up the line where it was cut.

The bearing of vitality and energy upon life should not be regarded as insoluble. The problem is no more difficult than was that of putrefaction and the miasma with which the Victorians were confronted. Yet the solution of this was easy once medical men thought in terms of bacteria. When some test is forthcoming by which vitality and energy can be estimated we shall no doubt be surprised to find how simple the subject becomes.

All is not well with medicine, and there is much discontent amongst medical men and lay folk. It is considered that too much is being claimed for the prolongation of life ; and that

too much attention is given to the study of rare diseases and not enough to the restoration of the vitality and energy that alone make living worth while. To attribute the ill-health that prevails to the strain of civilisation merely evades the issue. As I wandered through a city last summer, I could not help comparing the children in the streets with the swallows flying in the sky. The former looked tired and lethargic, though it was early in the day. Yet the latter were lively and gay. They had energy in abundance and were unaffected by all that civilisation had brought in its train. A little farther along the children were being brought *en masse* to have their tonsils and adenoids removed at a clinic. The crudity of the procedure appalled me and hardly conformed to the practice of medicine. Why should it be necessary to do these operations if our method of living is right? It is only when physiologists and research workers return to the investigation of the physis, inherent in which are vitality and energy, that much of our work will be of value to the practitioner in his effort to bring ease to the sick and to make living a joy for those who are not well.

The advance of knowledge is taking place so rapidly that it is becoming increasingly difficult to grasp what others are talking about. And, though we speak the same tongue, it may not be long before a state similar to that which prevailed at the Tower of Babel arises. This was made very evident to me when, in 1930, I decided to arouse myself from a period of lethargy and to resume reading with a view to participating in research. A start was made with bacteriology. Books were read as diligently as if an examination were in view. Though the fundamentals were grasped, much that was appearing in journals that dealt with research was difficult to understand. For few of the terms were used in the same sense in any two papers. The meaning of allergy, hypersensitiveness, etc., depended so much on the view each writer held. The subject was beyond my comprehension. At the time I was writing a paper on urinary tuberculosis, and on reviewing the literature found the term tuber-

culous nephritis cropping up. Now, a patient with phthisis can have Bright's disease ; albuminuria due to the toxæmia, or to amyloid disease ; or he may develop tuberculous disease of the kidney. But tuberculous nephritis did not correspond to one of these. Though much literature was perused, no solution was forthcoming. An important meeting of a British society was held at that time in Cardiff which was attended by men with an international reputation. An opportunity was thus given me to hear their views. One told me that by tuberculous nephritis was probably meant an allergic reaction in a patient suffering from tuberculosis. This took me no farther, for allergy was a term the meaning of which I had failed to grasp. Another was then approached, and my difficulty in interpreting tuberculous nephritis in terms of allergy was put to him. His view was that it should be regarded as a manifestation of hypersensitiveness. As this was another term I did not understand the position was no clearer. Now, here was a subject of which I had had some experience, for the greater part of the genito-urinary tuberculosis in South Wales passes through my hands, yet all that a perusal of modern literature had done was to confuse my mind. As good an opportunity as anyone could wish had been offered to me to solve the problem ; and yet I was left no wiser. I then approached another member, for whose common sense I had some respect, as to the practical meaning of allergy and hypersensitiveness. His view was that, as originally put forward, they had a practical bearing ; but, owing to the construction that had been put upon them in recent years, they were used in many senses, and had ceased to be of practical importance. Similar remarks could be made about much that is appearing in medical and surgical journals.

To add to our difficulty, medical research is becoming aimless, and the principles of the art of medicine are being forgotten. So many workers are out to discover something new. It is assumed that once knowledge becomes complete

something great is certain to ensue. Yet few great discoveries have come in this way. The majority have emerged from men who, retiring from the scene of activity, have pondered over the phenomena they have observed and have grasped some principle that has made knowledge more evident and the application of learning easier. Knowledge is now accumulating so rapidly that, if we are not careful, the power of the brain may be outstripped. Something will have to be sacrificed and, no doubt, the first will be the power to think. And instead of being in an age of great advance, we may slowly drift into a darkness as great as that which enveloped the Middle Ages. We must not think that in those days men did no work, and that there was no desire for truth. Rather was it that the accumulation of knowledge was regarded as the aim. And instead of facing the problems of Life and Nature, men became concerned with the problems in which they were interested. At the time of the Renaissance the thoughts of men turned to the great days of Greece when such a broad conception was taken of Life and Nature. And the problems then pondered over were again taken up. At the time of the Renaissance no sudden change took place in man, nor was he given greater power to work or think. Rather was it that thought assumed a new direction, and to this his great achievements were due. Perhaps another lesson for us is to be found in the thirteenth century. The times were turbulent, and the world was a difficult place in which to think. Men, therefore, separated themselves from its activities to seek truth. In this way came the time and the opportunity to think. From such bodies the universities arose. It was only later that these became converted into centres of education where degrees were conferred.

The advances of Science in the last fifty years have been colossal, and medical men have every right to be proud of the achievements of their profession. Diagnosis is now precise and accurate. Operative surgery has been rendered safe and painless. Preventive medicine has saved innumer-

able lives. Each of these is becoming exact and truly scientific. But how far have we advanced in therapy since Gee wrote :

“ All these doubts and all these sects relate to drugs and to hardly anything but drugs. They are the cause of our disputes and our differences. We agree, for the most part, upon the principles of hygienics and prophylactics ; and, speaking of therapeutics proper, there are no sceptics in dietetics and surgery. It is pharmaceutics which is the weak point of medicine, and which will probably always be its weak point. And yet it is that, unfortunately, upon which the mind of the laity is most strongly set. . . . Drugs are of use, sometimes they are of great use ; and all honour to those who seek for more knowledge in this part also of medicine, its most difficult, most backward, and most disputed part.”

Unfortunately, we have not a reliable test for prognosis, and consequently too much of our therapy is still empirical. Were a test available that could give some measurement of the resistance of the patient, we should be able to know more about the action of drugs. Until we are prepared to place the gaps in our knowledge side by side with our achievements, progress is going to be delayed. For men to-day, as in the past, prefer to do work where an advance is most likely. In this way it is easier to direct attention to what they achieve.

Whilst some maintain that we are living in an age of great advance, others think that we are reaching the end of an epoch and that we are confronted with considerable dangers. For though knowledge is accumulating at a tremendous rate, its practical bearing is not so obvious ; it is no longer possible to keep pace with what is appearing, and it is hard to discover what is truth. If we are not careful, that truth, which was handed on to us from the thoughts of men over a period of two thousand years, may be lost for a generation, if not for ever. This has happened to civilisations in the past, and our own is by no means exempt.

I was hoping that my failure to appreciate the claims of Science where life was concerned was due to my looking at her with rather a jaundiced eye. But on January 20th I was startled when it was suddenly announced on the wireless that the King's life was "moving peacefully towards its close." For this illness at the start was no more than a common cold. And the greatest Monarch that ever sat on the Throne of the British Empire died from so trivial an illness, when the power of this Empire was at its height and the claims put forward by scientists were immense. Those who waited for the bulletins could sympathise with his family as they stood by the bedside. That ticking of the clock was the strangest thing I have heard since the thud of the men who dropped dead in Gallipoli. But now the approach to death was slow, stately, and perfect.

"And in the dusk of thee, the clock
Beats out the little lives of men."

Thought in regard to life does not change.

Then over the wireless came the great service conducted by the Archbishop of Canterbury and the account of the funeral in which we were all able to take part. In this way came home advantages that ensue from the materialistic conquests of Science. But she was not able to stop that life passing on nor was she able to reveal what that life meant. We were all aware that our King was a great gentleman and was sincerity personified. But the greatness of his character will come home to us only as the years pass. Thought in regard to life is slow to take shape. Each has still to do his thinking for himself.

An effort to make knowledge more easily available was started before the War; this effort has been intensified in recent years and the work that has been accomplished is extremely fine and commendable. As a result a writer can easily become acquainted with what is going on in other parts of the world. But it was not long before this great effort to diffuse knowledge became confused with the desire to standardise this and to control thought. As it is difficult

to dissociate one from the other, the danger to our thinking power is extremely great. For bodies backed up by the power of finance are arising with the laudable object of stimulating thought, and it is not long before they desire to control the direction of this. The danger of such a policy where life is concerned is very great, for each generation cannot be certain that its outlook is right. So often some chance observation proves that this is wrong.

Before this idea of controlling and internationalising arose, there was such a thing as a national outlook upon life. America had her idealism, and her great power to organise ; Germany had her abstract mind and her thoroughness ; France her great cleverness ; and Britain her love of conservatism. Though the latter was slow in starting, in the long run she was most likely to think aright. But her hesitation and then her power to be first in the field is sometimes regarded by the foreigner as perfidy. Rarely do they make allowance for common sense. In each country few institutions thought alike. For in medicine, Bart's, Thomas's, and Guy's stood for a line of thought that was essentially their own, and during the War I felt I could tell from what school a medical man graduated. Such an independent outlook is of great value. The problem of life is so vast that it is mere vanity to attempt to control or to direct the line of thought.

It is the impression of many that the middle years of last century was the period when our Empire was at its greatest, if greatness is estimated by the power to think. Then men thought truly in terms of life. With the rise of industrialism came a materialistic outlook on life, from which time the power to think has gradually waned. It is, of course, impossible to compare the thinking power of two generations, but I will endeavour to explain what I mean by a reference to surgery.

Hunter placed surgery on a pedestal and raised it to the dignity of a profession. Not only did he introduce systematic research but stressed the theory of vitalism. Aber-

nethy was the psychologist in surgery. His works can be read with profit to-day. Sir Benjamin Brodie brought a philosophical atmosphere to bear upon his work. Paget brought philosophy and a wide knowledge of life to the bedside. Not only was he a great diagnostician but his knowledge of the constitution and the temperament has never been equalled. His conception of life was great and fine and was reflected in his work. In addition, his wisdom and ability won the respect of all. No other surgeon was the friend of so many eminent men. The distinguished audience at his Hunterian oration is proof of this. Hutchinson was a great thinker and a great clinician and his knowledge of disease was profound. But his writings and essays suggest that he had not the same knowledge of life as Paget. In them there seems to be a tendency to regard disease, the constitution, and the temperament as separate entities rather than as aspects of life. Such an outlook was probably necessary to make knowledge of these more complete. Then came that sudden increase in our knowledge of the nature of disease and of disordered function. Little of this has been brought to completion nor does it seem to me that this will come by pursuing research in laboratories and upon animals. We have knowledge in abundance. Our difficulty is to know what is truth. What we need are men who can think of disease in terms of vitalism as put forward by Hunter and of life as put forward by Paget.

Lord Haldane, in an autobiography, tells us :

“ With all this had come the further conviction that not only in philosophy but in science it was true that no systematic knowledge is sufficient in itself unless it leads up and points to first principles. This doctrine later became valuable to me even as a guide in work at the Bar.”

This doctrine he put into practice when taking over control of the War Office. As a result he became “ the greatest Secretary of State for War England has ever had.” That is the type of mind we need in medicine to-day. For the first principle in an art is really truth.

There is great need in our own day for bodies of men to arise who, prepared to forgo all honour and renown, are content to sacrifice their own interests so long as truth can survive. Amidst the clamour and the vain-glorious boasting so common to-day, the voice of such men will not at first be heard. But Honour and Truth are strange children. However silent they are, they only appear to leave us ; for like Life and Nature they do not die, and in every age somewhere come home to rest. And, sooner or later, the " still, small voice " is once again heard. Those of us who served in the trenches know how noble a creature is man and how self-sacrificing he can be. It is, however, essential for someone to set the example and to direct the line of his thoughts. To accomplish this in times like these, there is needed a return of that spirit that gave rise to the universities in days gone by. In these men met together to seek truth. Were the proper spirit to be revived, we might yet see arising in our own day the time for which the poet pined :

" Another Athens shall arise,
And to remoter time,
Bequeath like sunset to the skies,
The splendour of its prime :
And leave if naught so bright may live,
All earth can take or heaven can give."

APPENDIX A

THE FUNCTION OF THE TESTES AFTER PUBERTY

THE teaching in Britain has been that both testes should never be removed, as not only does this prevent a man from doing his duty by the race, but also depriving him, as it does, of some of the pleasure of living, there follows mental failure and early decay. French surgeons hold different views, for Légeu advocates removal of the testes when amputating the penis, and quotes the saying of Montaz : " That, if left, they serve as sad and silent witnesses of a function that has gone for ever." In recent years interest in the subject has been revived owing to the supposed rejuvenating action of these glands. It is assumed that the changes incidental to age are due to their atrophy and would not take place if their function could be preserved.

In 1926, through the facilities placed at my disposal by Dr. Alex Brownlee, an opportunity came my way to examine seven cases of castration, where both testes had been removed for tuberculosis. The findings were based on the clinical examination. Modern biochemical and psychological tests were not employed ; since, although at times useful in the diagnosis of disease, they are of little value in the estimation of comparative vitality, being so dependent on the mental state. Particular attention was paid to the following points :

- (1) Mental and physical power.
- (2) Sexual desire and potency.
- (3) Changes in secondary sexual character.

While there was no reason to suspect the honesty of these men, they might from a mere braggadocian spirit lay claim to greater powers than they really possessed ; as often a

cripple professes to greater power than a normal man, so the opinion of those who had known them for years was sought.

The investigation of sexual potency was difficult, and the statements of the men were accepted. As they came from villages far apart, there was no question of a conspiracy to delude. It was not easy to be certain whether there had been any change in the secondary sexual characters. When referring to these, most writers seem to have little doubt what is meant by masculine and feminine types. The former would be exemplified by Adonis and the latter by Venus, but variations are too frequently found. Everyone knows what is meant by the face of a man and of a woman ; yet to give a definition which would take in a whole class is not easy. It has always seemed to me that the supposed difference is to some extent a matter of fashion, and the mode of women in dressing the hair short, the Eton crop, made the close resemblance between the two more evident than ever. It is possible that many points in the bodily configuration previously regarded as sexual are due to the different upbringing of boys and girls. The modern sporting girl, the devotee to manly games, differs much in physique from the girl of twenty years ago, and approaches that of the boy. The breasts when typical are conclusive ; but those of woman may be as small as those of man ; and the latter, when associated with obesity or with hypertrophy of the pectoral muscles, may resemble the former. The hair appears over certain regions of the body about puberty and is considered a sign of virility. When found in women it is supposed to signify a reversion to the male type. Now, man is probably most virile between 20 and 30, yet when the difficulty which many young officers experienced in growing the regulation moustache during the War is contrasted with the ease with which a beard appears after 50, it does seem that such growth of hair may be as much a sign of senility as of virility. The growing of hair long on the head may have prevented its appearance on other parts. It is to be regretted that women did not persist with the short Eton

crop, as some were wondering whether in time they would not have to indulge in an occasional shave.

In fixing a standard to work upon, I took 100 pensioners, each of whom had been disabled by wounds and was a father. In this way a group of men was obtained who by their deeds on the battlefields and their prowess at home had proved themselves worthy of the race. They differed as much in the genitalia and the secondary sexual characters as in their faces. Consequently when an apparent abnormality was detected in the castrate, the possibility of its being a condition peculiar to the individual had to be excluded before it could be regarded as a reversion in type.

Seven Cases of Castration

Case 1. Aged 24. Machinist. Right testis removed in 1923, and the left in March 1924. No impairment in mental or physical vigour. Nocturnal emissions were very frequent immediately after the operation, and still persisted once a week and were accompanied by erotic dreams. He spent much time in the company of girls, desired to get married, and felt he could carry on. His general condition was good. The hair on the body was somewhat sparse and of the eunuchoid type, but he was most definite that this had been present before operation. He formerly shaved seven times a week, but now only five times.

Case 2. Aged 51. Labourer. Deaf and dumb since birth. Both testes removed in April 1925. It was difficult to obtain a history. He was anxious to marry. The attendant from the Institute stated that his general health had improved and the weight had increased. Both mentally and physically he was more active.

Case 3. Aged 39. Formerly a miner, now a traveller. The right testis was removed in 1919, the left in March 1922. Tuberculosis of the right shoulder in November 1925. Sexual desire and power were increased immediately after the operation. He was still able to carry out coitus once a week and had an emission, but was doubtful if he had the same relief (he had been married since 1914). No impairment in the mental or physical power. He now shaved seven times a week and formerly only twice a week. This he attributed to the necessity for more care in his appearance

owing to the change of employment. General condition was good. He had put on weight.

Case 4. Aged 30. A miner. Had phthisis in 1913. Was invalided from the Army, 1917, for hæmoptosis. Both testes had been removed in January 1924. He was somewhat pallid. No increase of weight. Mentally he was as active as ever, but was not quite so strong physically. Sexual desire was increased for some months after the operation, but was now not so great as before. Still carried out coitus, but had no emission, though there was some relief. There was fibrosis of both lungs.

Case 5. Aged 32. Salesman. Both testes removed in November 1922. Married in 1923. Sexual desire was increased after the operation. Still carried out coitus with a definite emission. Mentally he was as active as ever. Physically he was weaker and at times became hot and had night sweats. His general condition was good. The left kidney was enlarged and pus was present in the urine.

Case 6. Aged 45. Clerk. Married in 1912. One testis removed in 1914, and the other in 1916. Able to carry out coitus with a definite emission until 1924. No impairment of mental or physical powers. For one year there had been diminished sexual desire and power for which he consulted me with a view to "rejuvenation." When it was pointed out to him that such symptoms were not uncommon in normal men of his age, he was quite content. He had put on weight during the last four years.

Case 7. Aged 30. Shop assistant. One testis removed in 1918, the other in 1920. No impairment of mental or physical vigour. Soon after the operation there were frequent erections but no emissions. These had now completely disappeared and he prided himself that he had conquered all desire. The general condition was good and he had put on weight. The hair on the body was of the eunuchoid type; he shaved once a fortnight; the penis was small and infantile. The first impression was that these were retrogressive changes secondary to the operation. But he had served in the army during the War, when shaving once a fortnight was sufficient to prevent his being reprimanded; he disliked undressing in front of his comrades as they were apt to comment upon his genitalia. Consequently there was little doubt that they were *propter hoc* and not *post hoc*.

In 1932 I had an opportunity to re-examine three of these. They seemed to bear their years just as well as other men.

To none of them had castration come unexpectedly, so the shock of a sudden deformity did not come into play. The extent of the operation and its possible consequences had been put to them. When the cases are taken as a whole, apart from an empty scrotum and a possible want of tone that might be due to old tuberculosis, they did not differ from normal men. The one feature in conformity with our view of the function of the testes is that after castration no children were born. Though most had put on weight, there was no change in the voice. There was no deterioration in the mental qualities, and any impairment in physical power was associated with active tuberculosis. Sexual desire was less than in men of the same age, though when present it was always associated with potency. The increased desire immediately after the operation is probably due to the irritation of the spermatic nerve rather than to a want of balance in the endocrine system. A man is not constantly conscious of his fingers and toes. Yet after the amputation of a limb a feeling persists as if the digits were gripped in a vice. This is the result of changes in the nerve ends, and may last for years. In the same way the irritation of the spermatic nerve may set up sexual thoughts and lead to increased desire by reflex action upon the other sexual organs. The possibility of this factor has not been taken into account in operations upon the vas, for the heightened sexual vigour described by Ancel and Bouin after vaso-ligature might be due to a similar cause. There was no tendency to revert to a so-called neutral type and sexual desire was apparently natural in its direction.

Definite changes are seen after the removal of a vital endocrine gland, the main function of which is known. They invariably follow complete thyroidectomy, and some authorities contend that the whole gland should never be excised even in malignant disease. If the internal secretion of the testis maintains a certain function, it should disappear

after castration and changes due to its absence should become evident. Hypertrophy of other endocrine glands does not compensate for removal of the thyroid, and there is no reason why it should take place here.

There is little doubt that the internal secretion of the testis contributes largely to the development of the secondary sexual characters. But when once these are formed, it is doubtful if its persistence is essential for their maintenance. It probably has some action upon metabolism and in stimulating sexual desire. My series of cases shows that it has not that relation to the mental and physical well-being which is claimed by the advocates of rejuvenation, who have come to assume that, because the testis is the source of life, it is therefore responsible for the best of living. It is possible that we are still too much influenced by ideas handed down to us from the past, which are based largely upon the romance and mystery that have always surrounded the sexual organs.

The Influence of Sex-worship

Sexual activity has always played a great part in the life of man, who soon came to attribute to the organs certain mystical powers. Now, the worship of the penis played a prominent part at the festivals of savages, and phallism was the main rite in the worship of Dionysius, the religion of ancient Greece, and was carried on in Rome, where it was the custom for matrons and maids to wear models of the penis as amulets. The law of Moses emphasised the importance of keeping the genital organs intact, for it states, "He that is wounded in the stones, or hath his privy member cut off, shall not enter into the congregation" (Deut. xxiii. 1). Christianity has modified our views, but only to a certain extent. It was at one time the custom for men who were about to enter the priesthood to be castrated; this operation removed desire and thus preserved them from temptation. This practice did not receive the support of the churches and the Council of Nicæa, A.D. 325, prohibited the admission of

castrates, but did not view with disfavour any other deformity.

The Stigma of the Eunuchs

It was the custom to remove the genitalia of the vanquished to show they had failed in the fight—these were given as offerings to the gods. Later, the most intelligent children of the vanquished provinces were seized and taken away. They were castrated and given posts in the household. Such eunuchs had charge of the bedchamber. As removal of the testes alone was not sufficient to keep them quiet, the penis was also removed and the complete eunuch formed. Having little or no sexual desire, and being incapable of intercourse, they were careful and safe guardians of the harems. Later, the eunuchs were derived, not from the selected children of the captured provinces, but from the neighbouring races, such as the Assyrians, of which so often they were inferior specimens. Their origin as well as their physique must be taken into consideration, for even with the eunuch blood and breeding come into play. In more recent years the eunuchs are Nubian slaves who are sold to the Turks.

Cyrus held the eunuchs in great respect, and entrusted his person to a guard of them. Xenophen, in the *Cyropædia*, B. vii. Ch. 5, has the following passage :

“ Well knowing that men are at no times so easy to be attacked as while they are eating or drinking, or bathing, or upon their bed, or asleep, he reflected with himself what sort of people he could have about him, who might be best entrusted on such occasions ; and he came to the conclusion that no man could ever be trusted, who should love another more than the person that wanted his protection. Such men, therefore, as had sons or wives, that were agreeable to them, or youths that were objects of their affections, he deemed to be under a natural necessity of loving them best ; but observing that eunuchs were destitute of all these ties, he thought that they would have the greatest affection for those that were able to enrich them the most, to vindicate them if

they were wronged, and to bestow honours upon them ; and he thought that no one could exceed himself in showing them kindness. In addition to these considerations, eunuchs, being objects of contempt to other men, are, for this reason, in want of a master to protect them ; for there would be no man that would not think himself entitled to take advantage of a eunuch in everything, unless some superior power were to prevent him ; but nothing hinders even a eunuch from being superior to all in fidelity to his master. What most people are inclined to think, that eunuchs are destitute of all vigour, did not appear to him to be the case, and he formed his opinions from other animals ; for vicious horses, when they were castrated, give over biting, indeed, and being spiteful, but are not at all the less fit for service in war ; bulls, that are castrated, lose their fiery spirit and unruliness, but are not deprived of their strength and fitness for labour ; dogs, likewise, when castrated, cease to desert their masters, but are not at all less fitted for watching and the chase ; and men, also, by being deprived of this desire, become more gentle, but are not less careful of things that are given them in charge, or at all worse horsemen, or less able to throw the javelin, or less desirous of honour ; for they have shown both in war and in hunting, that they still retain emulation in their minds. Of fidelity, on the fall of their masters, they have given the strongest proofs ; for none have shown greater instances of attachment under the misfortunes of their masters than eunuchs. And if they be thought to lose something in bodily strength, arms are able to make the weak equal in the field of battle. Having adopted these opinions, he made all the attendants about his person, from the door-keeper upwards, eunuchs."

The Roman emperors, having suffered from the treachery of their followers, appreciated the loyalty of the eunuchs, who were given posts in the royal household and in the departments of the State. Being in power in the Empire during its decline, they were held responsible for the vices that permeated the Byzantine courts, and consequently have been denounced by writers of their own and other times. Claudian wrote a severe denunciation of Eutropius, to whose activities he largely attributed the decline of the Roman

Empire. His writings have been frequently quoted, and undoubtedly influenced later writers. Gibbon seems to have held no uncertain view, for he says, "The aversion and contempt which mankind has so uniformly entertained for that imperfect species appears to have degraded their character, and to have rendered them almost as incapable as they were supposed to be of conceiving any generous sentiment or of performing any worthy action."

But no one has attempted to explain how it was possible for those who suffered from such disadvantages of birth to rise to power and to become Roman magistrates and consuls; nor what the men with testes were doing at the time, as the eunuchs formed such a small minority of the Roman people. In these democratic days men who overcome the disadvantages of birth are admired. As the eunuchs took a prominent part in politics, all that has been expressed of them by contemporary writers and historians need not be regarded as true.

In all ages diatribes are resorted to by politicians. In our days, when we are supposed to be highly educated, the slightest difference of opinion may lead to the bitterest invective. As such men remain the best of friends, few pay much attention to what they say. A few years back two noble lords fell out with the leader of their party. As the amount of hair and the shape of the head were matters for serious comment in leaders in the press, many must have wondered what might have been attributed to a deformity, if one had so much as lost the tip of the little finger. If the eunuchs are not entitled to sympathy, in the interest of science let us be fair.

In later years the eunuchs were men of low birth who, having started life as slaves, were intended to look after the harem. Such training is not ideal for moulding the character of a boy. Promotion to the office of the State came only if special aptitude was shown. The eunuchs were not taught those duties of citizenship and that love of country which made the Roman mind so great; servility and loyalty to

their masters was the basis of their creed. Flattery and bribery were commonly practised by them, but should rather be assigned to their Oriental extraction and not to the absence of testes ; for the Eastern and Western minds have totally different methods of conducting the affairs of State. Any failure of duty or any degeneracy among them was ascribed to the want of testes. Gibbon seems definitely of the opinion that testes make the man, and in the respect he pays to these glands seems to have been a worthy forerunner of the rabid endocrinologist of to-day. He believes all that Claudian says of Eutropius, and does not think for a moment that the former may have been paying off some old score. May he not have been forestalled in a clandestine visit to the harem by the vigilance of Eutropius ? It is well known that frustrated passion can play the devil with a man's judgment. But character must not be confused with intelligence. It is not just the product of an internal secretion, for it is far more affected by heredity and early associations and training than by the mere presence of any gland. The intellectual qualities of the eunuchs were surely never in question, since in spite of all their disadvantages they occupied the foremost posts in the Empire. Nor, after all, did castration seem to interfere with the power to live life through, for many of them died at a great age.

The desire for power and fame was as great in the days of Rome as in our own. When the activity of the Roman citizens is examined it will be found that they were indulging too freely in the chambers that the eunuchs were guarding, and the rise of the latter to power took place in times that were characterised by debauchery and licentiousness. These have frequently accompanied the fall of empires where the eunuchs held no sway, but have never been attributed to the men having testes ; though there might be much truth in this.

Some eunuchs attained positions of great power and lived exemplary lives. Hermias, a governor of a province in Asia Minor, and Narses, an Armenian by birth, who quelled a

riot in Constantinople, and, after the defeat of the Roman armies, took command, and by his victories over the Goths saved the Empire, may be cited as examples. What would have been said had it been necessary in the last war to call upon a eunuch to lead our troops? At the march past some would have wondered whether victory was worth while.

It should be kept in mind that a man without testes in one age does not differ from such a man in another. It is probable that they are just like other citizens. In the time of Cyrus, Greece was great because her people were great and the eunuchs were kept in their position as slaves. The decline and fall of Rome were due to the degeneracy of her people. As a result the eunuchs rose to power. They played little part in her decline. After all, what would be said to-day if a body of slaves rose to power and took control of the State? Many might wonder if the young men were not in need of a spinal graft to make them worthy of their glands; though perhaps in an age of licentiousness the absence of testes has its advantages, since temptation is less.

The Work of Brown-Séquard

In 1889, at the age of 72, Brown-Séquard injected himself with the extract of the testes of young dogs and guinea-pigs to control the ravages of old age, which had much diminished his capacity for work and the enjoyment of life. He immediately experienced a return of mental and bodily vigour. He considered the possibility of suggestion, particularly as the work of Tuke on the influence of mind upon body had recently appeared, but came to the conclusion that it did not come into play. He later stated that these injections could "cure" tabes. As a result he became so overwhelmed with the application for treatment that he had to go to London for rest, a rare example of a man fleeing from success. This work is always quoted in support of the function of the testes. But nowadays few seem to try it out on themselves. These extracts are easy to prepare, and, as hypodermic injections require no skill and are not the

prerogative of one man, it is difficult to understand why such ailments are still so common, and still so difficult to treat. Protein therapy may have had some action; testicular therapy could have had none. Brown-Séquard admitted that for years he had noted the similarity between the feebleness of the eunuchs and of those who too frequently indulged in coitus or masturbation and that of old age, and had come to the conclusion that the feebleness of old people is due partly to the diminution in the powers of the testes.

From 1869 he had been convinced that if sperm could be injected without danger into old men, rejuvenation would follow. With so many years of belief behind, the question whether auto-suggestion ever did occur would seriously have to be considered, if no improvement had supervened. If anyone still doubts, let him prepare the extract, and, after taking into account the dangers of a hypodermic injection in those septic days, think whether a greater thing than faith would not be needed to carry out such an experiment on himself. Brilliant as Brown-Séquard was, his meteoric and erratic career shows that his temperament was essentially of that kind which is so liable to be influenced by suggestion.

The Effect of Castration on Man

Whenever any condition follows the removal of an endocrine gland, it is at once attributed to the loss of an internal secretion. But if 100 men were suddenly deprived of their right arm, one or two might become insane and some depressed. Such a mental state would be due to the shock of the operation or the resulting deformity and loss of power. It certainly would not be due to the loss of the internal secretion. When similar symptoms arise after castration, such causes should not be ignored.

In the treatment of tuberculosis of the testes the moral support of a full scrotum has always been given much consideration. That an empty scrotum has its vexation is shown by Guinard's case of an elephant hunter with undescended testes, who consented to the insertion of ivory

ones rather than put up any longer with the indulgent remarks of his comrades when he undressed to cross the streams. That a deformity here may give rise to mental symptoms is claimed by Hermance, who had a patient with only one testis. As he became demented from fear of being childless, one of silver was inserted. His mental symptoms disappeared, he became proud of his virile power, and his wife was later delivered of two children. Weir and others claimed that the mental symptoms after castration were psychical and did not arise if pear-shaped celluloid balls were inserted at the time of the operation; though, as it was well said, a man must be an imbecile who could not distinguish between his own and artificial testes.

The dread of loss of power must have some effect. A boy's entrance into manhood is associated with the development of sexual power, and manliness and potency come to be regarded by some as synonymous terms. Impotence may have dire results. Now there takes place in all men about the age of 45 a diminution in sexual desire and power, which may completely disappear. It is that time of peace and contentment for which many a bachelor yearns. When it appears, it is looked upon by the average Briton as a sign that he is growing old and is usually faced with an indifference, tinged perhaps with sorrow and regret.

Occasionally, and particularly when it appears at an earlier age, a man regards himself as being unfairly treated by the gods, and, having lost his manhood, as being no longer worthy of his sex; he may become depressed and even insane. There is the historic case of the man whose testes atrophied after an operation for varicocele, who, becoming incensed at the dread of impotence, murdered the surgeon Delpech. Such symptoms are purely psychical and are not due to any change in the internal secretion.

Certain forms of dementia are associated with loss of sexual desire and power, and have been ascribed to changes in the testes. Sexual power is so dependent upon a sound nervous system that any weakening in the latter must react upon the

former. For instance, in tabes, the cause of which is well known, impotence may be an early symptom. Dementia does not necessarily arise after castration, and consequently cannot be due to loss of function in these glands.

When castration was performed for the relief of prostatic obstruction, mental symptoms sometimes supervened. Similar symptoms are seen in prostatic obstruction, when no treatment has been instituted, and also at times after prostatectomy. They have a common origin in all three and are merely the cerebral manifestations of uræmia.

Mental symptoms arise after ovariectomy when the patient is not aware of what has been done. As suggestion can be excluded, they are attributed to the loss of an internal secretion, and the testis, being an analogous organ, is regarded as having a similar function. Such reasoning is extremely fallacious. Mental symptoms follow other gynæcological operations, for gynæcologists have never got away from the old Hippocratic idea that hysteria is due to a wandering of the womb and still hope to cure some of its symptoms by operating upon the female genitalia. The danger of operating when any neurotic element is present is realised by most surgeons, and it is possible that the sequelæ of ovariectomy are due to such a cause. Take, for instance, a varicocele, which is often associated with sexual neurasthenia. Attempts to cure the latter by operating upon the former have led to many a psychological upset which have not been attributed to the damming-back of an internal secretion.

The Relation of the Testes to Enlargement of the Prostate

Here there may be diminished sexual desire and impotence, or hyper-excitability and increased desire, which have been attributed to changes in the testes. Urinary symptoms with structural changes in the bladder and kidneys are a prominent feature, but are secondary to the enlargement. The earliest symptom is frequency, most marked at night. There is at this time very little difficulty, and relief follows micturition, and little or no residual urine is found. It

results from congestion of the prostatic urethra ; for it can be produced by the injection of silver nitrate into this region and is increased by anything that aggravates the congestion, such as a full rectum or bladder. As the enlargement progresses there is obstruction to the passage of urine and the bladder is never completely emptied. Two conditions may supervene. In one the bladder becomes distended and atony takes place, the patient being unaware of this and suffering merely from frequency or incontinence without any urgency or apparent difficulty. In the other, the bladder may become infected, and irritability with urgency and difficulty follow. Attempts to pass urine now bring but little relief.

The sexual symptoms are also explicable if they are regarded as secondary to the enlargement. Only two factors in the physiology of sexual activity need be considered, the excitability of the prostatic mucosa and distension of the vesicles. When sexual desire first appears at puberty, spermatozoa pass from the testes and the vesicles become distended. During sleep relief comes from nocturnal emissions, which may be associated with erotic dreams. Married men, and at times not a few bachelors, get relief from coitus. That the prostatic mucosa has some reflex activity is shown by the erections which occur when very hot or irritating fluids are injected. The enlargement of the prostate leads first to congestion and an increased desire, which, being gratified by coitus, does not come amiss to the old roué, who is apt to look upon this time as a second lease on life. As the pressure on the ejaculatory ducts increases, the vesicles do not become completely emptied ; either atony results, leading to distension and complete loss of sexual desire and power, or infection leading to much sexual irritability. That this is an irritability and not an increased desire is shown by the erection being rarely associated with any emission and by the little relief that follows coitus. Marriage is no panacea, for intercourse resembles a urinal in so far as the respective symptoms are concerned. Whilst each formerly gave immediate relief and still provides

all facilities, at the best only temporary ease is now obtained. This irritability makes the demand for relief very urgent and leads to the committing of most unseemly acts.

Prostatectomy might be expected to relieve the sexual as it does the urinary symptoms. The latter, however, do not disappear unless the urethra is kept open. Whilst the obstruction to the ejaculatory ducts can be removed, there is no certainty that they will not later become involved in scar tissue. It is therefore impossible to foretell what permanent effect prostatectomy will have upon any impotence or irritability that may be present.

In two cases where the prostate was of the fibrous type, improvement followed the destruction of the mucous membrane over the verumontanum by diathermy and ligature of each vas. Vesiculectomy would be necessary to give complete relief, but is too severe for the majority of cases.

Rejuvenation

While the regaining of lost youth has been the aim of mankind throughout the ages, it is somewhat singular that, notwithstanding the great advances which science has made in the twentieth century, no claims were put forward until Steinach suggested ligaturing the vas deferens and Voronoff the engrafting of the testes of the chimpanzee. Steinach considered that old age was due to lessened activity in the testes, as there is diminished sexual desire and power. He therefore ligatured the vas deferens, and assumed that, as spermatozoa were no longer formed, the internal secretion would be increased. He claimed amazing results, but his conclusions are based on wrong deductions. He excluded the possibility of suggestion on the ground that results were obtained in animals where this factor did not come into play. Such ignorance of animal psychology is lamentable, as animals are probably more influenced by kindness, attention, and suggestions than many human beings. Then there is no definite collateral evidence that the suppression of an external secretion ever does lead to an increase of the

internal. In addition, old age is a general affection that is no respecter of organs. There is at this period diminished activity in all, which is very obvious in the heart, stomach, intestines, and muscles. It would be equally rational to attribute its onset to the loss of an internal secretion in any of these.

Voronoff noted the want of physical and mental vigour in Egyptian eunuchs and its resemblance to that of old age, and therefore attributed the latter to diminished activity in the testes. But such eunuchs are Nubian boys, who are bought by the priests of the Coptic monasteries. About the age of 7 the penis and testes are cut away without any anæsthesia, and the bleeding is stopped by the application of sponges soaked in boiling oil. The boy is then placed standing in a pit filled with sand until the wound heals, a somewhat primitive if adequate application of treatment by rest. There is a mortality of 80 per cent. and the survivors become slaves. These slaves are highly prized in the Orient. Fit men were not found among those who worked long hours in the factories years ago; and it was the ill-health that prevailed that was largely responsible for the shorter hours. The life of a slave in an Eastern household would be infinitely worse. In addition, the suffering and shock from such a mutilating operation must have some subsequent effect even upon an Eastern mind. In addition, after such a brutal operation stricture of the urethra is likely to arise, and many of these slaves must suffer from uræmia. So there is undoubtedly sufficient cause to account for the ill-health of the eunuchs, quite apart from the importance of any structure removed.

When Voronoff's conclusions as to grafting are examined it is found that the persistence of a swelling is sufficient to stipulate that an internal secretion is being formed. This occurs when any tissue is employed, and signifies merely the reaction to a foreign body. In the case of an endocrine gland whose function is definitely known, such as the thyroid, a graft rarely takes on any activity. When the effects of

testicular therapy are studied, whether it is applied by grafting, by the injection of rams' testes subcutaneously, or given by the mouth, successes are always claimed. The affections treated are as varied in their pathology and cause as those put forward by Coué as suitable for auto-suggestion, to which they bear a close resemblance. Such claims follow all new methods of treatment, and are due to the failure to appreciate a fundamental principle, namely, that with all therapeutic measures there occur faith, hope, therapy ; and in the process of rejuvenation the greatest is certainly not vasectomy ; nor in treatment by testicular extract is it an internal secretion.

Our work and theories of to-day can be properly reviewed only in years to come. Posterity will probably be amazed and somewhat amused to find that a generation which supposed itself to be scientific, materialistic, and exact, should have allowed its imagination so much sway in the investigation of the functions of the testes ; when all that it had to do to confirm its views was to apply a principle which it had so firmly established and which in this case there was no difficulty in carrying out—namely, that when specific function is assigned to a particular organ, its removal should be followed by disordered function of a distinct type. The proper subject for the study of mankind being man, it is strange that this has been completely ignored when the function of the testes is considered.

We smile at attempts of bygone ages to discover the philosopher's stone and ridicule the powers attributed to the elixir vitæ. Yet if the claims put forward for the internal secretion of the testis by those who have advocated rejuvenation were only true, there has been found in our generation something greater, which for those who, taking their pleasures sexually, hold that living without sexual enjoyment is not living at all, would constitute the Open Sesame to the Elysian Fields.

APPENDIX B

EUTHANASIA

A SURGEON is at times consulted about a patient dying of some painful disease, since he or a relation is anxious to know if some operation cannot be performed even though it is very severe and is likely to give just temporary respite from the symptoms. So often my impression is that there is not really any desire on the part of the patient that life should be prolonged. Though his one wish is for relief from suffering, really he hopes that he will not recover from the operation. But an operation at this stage does not do much to relieve suffering. As the risk is very great and the subsequent pain is considerable, its performance is an abuse of surgery. It just adds to the distress. The performance of operations with a heavy mortality is sooner or later going to bring surgery into contempt. No surgeon should now consent to do an operation, for there are more pleasant ways of passing out of life than dying from this with the added pain and weakness. Pain can always be relieved by the administration of morphia. Though, strangely enough, some practitioners refuse to give adequate doses owing to the risk, occasionally one is found who yet may urge an operation, even if the risk is very great and the relief somewhat problematical. He seems to think that this is reasonable ; whereas the administration of big doses of morphia and allied drugs, which are certain to relieve the symptoms, is wrong.

Sometimes a patient is so distressed that he begs for a single dose of morphia sufficiently large to cause death. It is the impression of many that, though a patient may ask for this, he does not really mean it, as the following case seems to show :

Some years ago I attended a man dying from inoperable cancer of the bladder ; he craved for a dose of morphia that would put an end to life. For this he repeatedly asked, yet in a drawer well within his reach was enough morphia to kill many men ; he knew it was there, but did not make any attempt to take the drug. His practitioner was quite definite that he did not really mean what he said and felt that if he had gone to him with a syringe containing an overdose of morphia, the latter would not have consented to its injection. Following my advice, morphia was pushed and his suffering was relieved.

Now it is one thing to give a big dose to relieve a symptom even if there is a risk—this is constantly done in medicine and is quite in accordance with its ethics—but it is another thing to give a dose with the object of causing death ; this a practitioner should never do.

The word euthanasia refers to two things : (1) the practice of painlessly putting to death those suffering from distressing symptoms as an act of mercy, and (2) the practice of relieving suffering so that the going out from life may take place with little distress and pain. These are such totally different aspects that each should be considered separately. The state has never sanctioned the first, and a medical man is not given the right by any diploma he possesses to administer a drug to cause death. It is probable that, even were this permitted, the majority would refuse to carry it out, since they entered their profession to maintain and to prolong life, not to take it. It has been suggested that a body of men should be selected to act as a jury to investigate each case. This may become necessary for imbecility and other conditions ; but this question the State has not yet faced. It is our duty to point out to those who govern the State any suffering that goes unrelieved and whether an extension of our powers is needed. But we should be extremely guarded as to what we say. If we are not careful the name of the medical profession is going to be associated with the act of killing, for men of eminence are making public announcements on this subject which receive prominence in the press. They

forget this disturbs those who are old and infirm, whose will is weakened and whose power to think is on the wane. So often these put the wrong interpretation on what they hear, and come to the conclusion that much of what is said applies to them. Practitioners know full well how touchy are sick people and how much time they have to spend in overcoming their fears. The thing that makes me so proud of the medical profession is the great faith simple folk have in us. Anything that is likely to undermine this is going to do us much harm. No position can be more horrible than that the sick man should for one moment think that a medical man is in any way concerned about producing his end. It is no good saying that we intend to draw the line at a certain point. Once thought is started it goes on and on.

Sir Thomas More in *Utopia* has written the following :

“ When any is taken with a torturing and lingering pain so that there is no hope of recovery or of ease, the priests and the magistrates come and exhort them that since they are now unable to go on with the business of life and are become a burden to themselves and to all about them, so that they have really outlived themselves, they should no longer nourish such a rooted distemper, but should choose rather to die since they cannot live but in much misery. . . . ”

The point to note is that the patient is to be exhorted. It may be said that the State will not do this. But what about the relations. Sons murder their mothers just for sordid gain. Relations will exert pressure when the prolongation of a life becomes an encumbrance to them and the tendency will be to talk old people into euthanasia. This is only one of the dangers that is likely to result from legislation of this kind.

If this discussion on euthanasia once takes place in public, the faith simple folk have in the medical profession will certainly be affected. All practitioners and nurses with whom I have discussed this aspect of euthanasia are opposed to it. No one is prepared to carry it out. It is somewhat doubtful if there is any great need for it. It is

true that many people are nothing but an encumbrance to themselves and to their families. Yet strangely enough few of these wish to die. There are numerous cases where people desire the end and are chiefly concerned because it is so long in coming. It is doubtful if any of these would consent to be killed. We must distinguish between the patient who longs for a natural end to life and the patient who desires to be killed. There is a tremendous difference between these. It is unfortunate that in the mind of the public euthanasia has come to mean the right to kill and not the right to die. No man has the right to kill himself, but each has the right to die. If a man really wants to die because life is not worth living he can bring this about by not taking food. The relations can give him every encouragement in this. When a patient wishes to die it is cruel to place food or drink in front of him. Much finer is it to give him only that for which he asks. At such a time a practitioner is quite entitled to give sedatives to numb consciousness. When doing this he only prevents the act of dying from being acutely felt. He is not promoting dying.

The rest of this appendix deals with the second aspect of euthanasia, and is the only one with which our profession need be concerned. Euthanasia in this respect is a matter of interest to all, for death sometimes comes very slowly and its delay may be tragic to the patient and to those around. A medical man is permitted to give drugs to relieve pain and suffering, so that life may go on with as little disturbance as possible and death may take place peacefully. The amount that he may give has wisely been left to his discretion. He may give as much as he thinks a particular patient needs, provided the aim is just the relief of symptoms. The State has wisely not laid down any laws as to the dose which he can administer. He is guided by what is in the interest of that patient. But however much death may be desired by the patient, in no circumstances is a medical man ever permitted to hasten its approach. Now it must not be

assumed that the administration of drugs to relieve suffering necessarily hastens the end. For the health soon becomes undermined if pain persists ; and the depressant action of a drug may be less harmful than prolonged and severe pain. Up to the present the State has entrusted to the medical profession a tremendous power in regard to this aspect of euthanasia, not so much by establishing laws that enable its members to act, but by not establishing laws that limit their power. If medical men have been so entrusted, they can claim that this privilege has never been abused. If legislation is introduced to give medical men the right to kill, their power to prescribe dangerous drugs freely is going to be curtailed. For a patient will now need protection against the profession.

In recent years the medical profession has concentrated on the prevention of disease and the maintenance of health. As a result it has at times forgotten that one of its aims should be the endeavour to make the living of life and the passing out from life as easy as possible for the patient and his friends. The end should be made as pleasant as possible for the former and its recollection should not be just tragedy and misery for the latter. If a practitioner omits to attempt this, he has not kept faith with the patient or the State. For one of the privileges that a medical qualification gives is the power to prescribe dangerous drugs to any amount that may be considered advisable, so long as the aim is the relief of pain and suffering. With the humane practitioner the only reason why this is not done is that the patient does not wish it. There is, indeed, little doubt that a popular referendum taken on this question would show the desire that unnecessary suffering should not take place. But in my talks with nurses it is brought home to me that there is still far too much in hopeless cases. For although in recent years the administration of hypnotics has been brought to a fine art, attention has been given largely to relieving the strain and pain of an operation or the pain of childbirth, and but little to the relief of the sufferings of those who will soon

have to meet their end. When a practitioner is trying to come to a conclusion on the advisability of euthanasia as a general measure, it is well to discuss the subject with nurses who have such a large experience of these cases. I have rarely met one who does not agree with what is advocated here. The practitioner should remember that he is able to prescribe and to go away; whereas the nurse and the relatives have to stay all the time, and much goes on when he is not present of which he may remain unaware. The pain that a patient has to bear is all the greater towards the end, when the will and the desire to live have gone. It is the duty of a practitioner to see that no patient passes out of life delirious or in pain. With the drugs that are now available the end of life should not be distressing for the relatives and the patient should be at ease if the practitioner is humane. Before I would place myself in the hands of a practitioner I should want to know his views. If he were of the type who believes in carrying out active treatment to the end whatever the prognosis and whatever the age, he should not come near me.

A year or so ago I was asked to see in a hospital an old lady close on 80 who had inoperable cancer of the mouth that had ulcerated into the cheek. She lay curled up in bed, ashamed to be seen. Though, fortunately, it was not causing pain, mentally she was suffering acutely; and there was a strained look on the faces of the nurses and her relations. Old people are much prouder of their appearance than some think; and this old woman was aware that she was an eyesore to all around. I suggested to the resident medical officer to give her opium, so that she could go into the land of dreams. She would then be able to forget. Though her days were numbered, he would not agree. About this time I was called in consultation to a country town in West Wales. The practitioner was one from whom I can always learn. The point was put to him as to whether it was not advisable to give opium at such a time. On our way back he took me to see a woman who had a gastrostomy for in-

operable cancer of the œsophagus. She had only a few weeks to live and was allowed as much laudanum as she wished. The look of contentment on her face and on that of the relatives was so different from the case just described. There was no reproach from the patient. She could so easily go into the land of dreams. As the practitioner said : Her days are numbered, why not give it to her ? How much of a habit can she form ? What if it does hasten the end ?

Some may say that it is wrong not to let a patient face her Creator in full control of her faculties. Surely that was the attitude of the Victorians when anæsthetics were introduced. It is very few people who really die like this. When this point is discussed with those who have been near death's door, the majority are somewhat surprised at the indifference they displayed. Few seemed to realise that they were almost face to face with their Creator. So long as they were not in pain they did not care. When people die, a numbing of the faculties takes place naturally. All the practitioner has to do is to encourage this. He need not be worried about disturbing the conscience of a patient with this line of therapy. There is no suggestion that it be adopted as a routine nor that it be forced upon anyone. It is given only if it is in the interest of the patient and there is the desire on his part. What must be the feeling of some unfortunate patient whose end is so long and painful, if no attempt is made to give relief ? What is his state now that he is overcome with weakness and the will is on the decline ? To go to sleep at night time hoping that the end has come ; to wake up at dawn with the certainty of more suffering ; to be aware that those standing by can bring relief to suffering ! What a tragedy if the practitioner does not realise that it is his duty to give relief. This is expected of him by his profession. When after an attack in Gallipoli I could not get one of my wounded in, or it was not worth while sending him down the line, I had no hesitation in giving morphia in big doses to relieve pain. Why not do the same in civil practice ?

THE RELIEF OF PAIN

Now that so many drugs are available for this purpose, no patient should reach the stage when he desires an operation in the hope that it may lead to death, nor should he be allowed to linger on in agony with pain unrelieved. If drugs are properly given, the passing out from life should take place with little pain, and death would in no way be hastened. Unfortunately, it is difficult, when life is likely to last for years, to counteract pain all the time ; for, if drugs are administered over a prolonged period, they may eventually fail to act or may lead to demoralisation, which may ultimately be as distressing to the patient and his friends as severe pain. But this is a matter of little concern when the end of life is in sight. When pain becomes too severe for the patient to bear and is leading to demoralisation, and when the end is becoming distressing to him and his relatives, it is the duty of the practitioner to push morphia so as to prevent suffering, unless the patient objects. It is true that morphia does lead to some loss of self-control, and, if given too early in the disease, the patient seems to give more trouble than if it is withheld. But is the demoralisation really so much worse than that which follows constant pain ? And it is to relieve this that morphia is given. This demoralisation is not seen with opium. But this does not relieve pain to the same extent as morphia. A friend of mine who suffered from severe arthritis for years, during which he was compelled to take hypnotics, said that opium induced a beautiful sleep, relieved the pain, and did not lead to any bad after-effects. Morphia, on the other hand, was much more efficacious in relieving pain, but the following day a headache, loss of appetite, and constipation followed. The total alkaloids of opium have some action which prevents those harmful effects that are seen with morphia.

It has been known for years that opium has a different action from its principal constituent, morphia, but the work of Billard on phylaxis may offer the explanation. He has

shown that when sparteine sulphate is injected with a lethal dose of snake venom into a guinea-pig it does not die. This is due not to the neutralisation of the venom, as has been assumed, but to the sparteine combining with the lipoid of the nerve cells, as a result of which the venom cannot act. It is now destroyed by the cells of the body or is excreted. To this protection of the nervous system he gave the name phylaxis. This applies not only to toxins but to chemicals. Now the harmful effect of morphia is due to its action upon the nervous system. Opium contains seventeen other alkaloids. May not its distinctive action be due to one of these combining with the lipoids, as was suggested by Billard, as a result of which the morphia cannot now be attached and is destroyed by the tissues or is excreted? This would explain not only the different action of opium from morphia, but why a dose of morphia should be more dangerous than one of opium containing the same amount of morphia.

Whilst, generally speaking, it is better to withhold powerful drugs as long as possible, the patient should not be allowed to suffer. When faced with one of these cases, a doctor should remember that his first duty is to the patient, whose feelings are the one thing that should count. He should first have a talk with the relatives. If the patient is content to put up with the pain, narcotics should be withheld. But when the pain becomes too severe, they should be pushed to any extent the patient may desire, so long as the aim is to give relief. Aspirin, veramon, compral, or novalgin should first be given. One or the other will often act as a sedative in the early stages. Then nepenthe, hypnoid, opoidene, and opium should be tried in this order. When the pain becomes very severe, much morphia may have to be given. It is surprising what large doses a patient with severe pain can tolerate. I have given as much as a grain for renal colic. With inoperable cancer the ordinary pharmacopœal doses of morphia are useless. Thirty or forty grains may be necessary in twenty-four hours. De Quincey took twelve thousand drops of laudanum each day. It is

absurd to say that morphia ceases to act. It will always relieve pain if sufficiently large doses are given. And when pain is present I am doubtful if morphia does demoralise. It is extraordinary how contented are some of these patients as they die. This is illustrated by the following case, which was seen in consultation with Dr. T. Davies, of North Road, Cardiff, a few months back :

J., aged 69, had hæmaturia for two years, but had refused a consultation. When retention of urine supervened, he was seen by me. He was found to have cancer of the bladder which was inoperable. I pointed out that, whereas cystostomy would give relief, this was very temporary. Though life would be prolonged, it would be for a matter of only a few months and the end would be just as painful. My experience made me reluctant to do this operation, and I advised against it. Temperamentally the patient was not suitable for catheterisation. My advice was that morphia should be given in sufficiently large doses to relieve the pain. Dr. Davies and the relatives agreed to this. They did not wish the patient to be told. The retention passed over into overflow incontinence. The patient lived eight weeks and at the end was taking half a grain of morphia each hour. He never suffered any pain nor was he aware that he was dying or of the nature of the disease. Dr. Davies tells me that he was interested in life generally up to the day he died, and, six hours before this happened, he gathered the family around him and cracked jokes.

When I think how quietly this man went out of life, I wonder why I was reluctant to give drugs in past years. Was it a false reverence for life? Or was it that I was influenced by teaching that was wrong? A great surgeon and a thinker said that he was convinced that the less morphia a patient had after an operation the better he did. With that conclusion most practitioners agree. For there is always asthenia after an operation and morphia does lead to much depression in this state. Consequently, it should never be given for mere discomfort or insomnia. The indication for morphia is pain, the presence of which means

that some undue reaction is necessary and that some complication, however slight, is arising. In other words, progress is not smooth. This must be realised before attributing all the blame to morphia. After all, which is the most depressing, persistent pain or morphia? Look at the face of one who has just had toothache for one night! Is pain more bearable because it has to be borne as a man lies ill in bed? Another equally great surgeon, when going round a ward full of inoperable cancer cases, drew our attention to the greater contentment that came to a patient who was aware of the nature of the disease. He told us that morphia should be given only as a last resort, for the less a patient had the less trouble he was likely to give. This advice was supported by the sister. It was always followed by me until I sat the night through with a friend who was dying from cancer. I was so shaken I could never go to see him again. The cruelty of withholding morphia thus came home to me. Often since have I discussed this subject with practitioners. Many are doubtful of the wisdom of telling a patient, since some do not wish to know. The majority agree that none should be told unless he is insistent. As for the demoralising action of morphia, it is pointed out that this is given only when there is pain or delirium. When these are present, demoralisation is going to set in even if morphia is withheld.

Disease is the reaction of the body to some harmful influence. Experience tells us that one type of disease is likely to be painful and another painless, but we can never be certain how much pain there is going to be. Cancer we know can be extremely painful. Yet the majority of patients with this disease die with little or no pain. When some painful process is present the degree of pain experienced depends on the sensitivity of the nervous system. And beyond this comes temperament. And how the patient reacts to pain depends on his temperament, which, after all, is just an aspect of life. The problem of life is so vast that rules laid down serve merely for guidance. They

must not be rigidly followed. That is the reason why there is no "always" and "never" in medicine. But I would ask medical men never to let a patient pass out in pain and never to let him pass out aware of his delirium. If we cannot give him life, we can at least relieve suffering as he passes on.

THE END OF LIFE

It is strange to note the efforts that are at times made to keep back the departing soul. The following case, which came to my knowledge a little time ago, may serve to bring home the folly of this :

A man of great energy had a cerebral hæmorrhage at the age of 73. For seven years he was bedridden and a dotard. He then had another hæmorrhage, but by the administration of oxygen and stimulants night and day was kept alive for a week. It was difficult to see the object of this, because, if he could regain his state of a year before, he was nothing but a burden to himself and to everyone else. The tragedy was that he was a fine type of man and had he retained his faculties he would never have consented.

Though a practitioner may do nothing to terminate life, it is an abuse of the practice of medicine to go out of the way to prolong it uselessly. In my rounds of the wards I do ask my students to be humane in practice and not to go on sticking needles into those who are ill or old. It is easy for a man to try out this form of therapy on himself. It is not pleasant to have a needle stuck in when one is well. It is unfair to carry on this treatment when a man is ill and as he grows old.

I would ask my profession to be humane to the aged. Now and again the practitioner should put this question to himself : The relatives are anxious to keep this patient alive ; but it is not they who have to do the living, nor have they to put up with the suffering that each illness entails. Is it fair to put this patient through treatment ? Is it not kinder to let him pass on ? At times the position with which the practitioner is faced is not unlike that which is

said to occur in a family quarrel, when, so long as each member has his way, he is not concerned with the suffering of the parents. For now and again relatives do not mind how much a patient suffers, so long as life goes on. The relatives, after all, are governed by emotion. The practitioner should remember that he is in an impartial position. He must maintain a sense of proportion, and should remember that he is the friend of the patient, who is trusting in him. It is his duty at such a time to try to form a prognosis. If it is unlikely that life is going to be worth living, active treatment should not be carried out. What is the good of making a great effort to overcome an acute disease such as pneumonia when, even if the patient recovers, the health he can expect is no better than that which he had before when life was hardly bearable. Never confuse sentiment with reverence and respect for life. I would ask my profession to face this problem properly. There has got to be an end to life. It is at times immoral to attempt to prolong it. Now and again the practitioner should put to himself this question: Assuming this patient pulls round, from what is he going to die? For dying can be painful. Life has at times to go on for some reason none understand. But as a profession we must be careful we do not prolong it unnecessarily. Nor is it necessary to be thorough in treatment as the end is in sight. At this time the patient should be disturbed as little as possible. I tell my sisters in my wards that when a patient is dying I am more concerned about the smoothness of the passage than the cleanliness of the corpse. Often there is less disturbance if the body is washed after death.

If therapy cannot do anything to restore vitality in the young, it cannot do so in the aged. Those who put forward such claims forget the power of suggestion. Towards the end of an illness, as towards the end of life, a failing of the mental faculties takes place. This may lead to childishness or to a false hope similar to, though not so marked, as that seen in *spes pthisica*. It is easy enough to put suggestions into the brain at this stage that mislead thought. As a

result life is kept going. Such a form of psycho-therapy at the end of life is really an abuse of the practice of medicine, and I am convinced that in itself it can lead to delirium. It is our duty to keep faith and hope going when life is worth living, and a continuation of this means so much. When life is on the wane, it is totally opposed to the practice of medicine to make a promise that cannot be fulfilled should life have to go on. The basis of the practice of medicine is sympathy for the person who is sick. As a practitioner faces a patient he should put to himself this question : What is really in the interest of this particular patient ? What would I want done were I in his place ? I naturally sympathise with the relatives, but my duty now is to this patient who regards me as his friend.

Now that easily assimilable foods and diffusible stimulants are available it is not difficult to keep life going. If a practitioner employs faith and hope it is at times possible to bring back life almost from the grave. If at this time the so-called specialist practitioner makes claims, the patient has got no safeguard. A friend tells me that as his father lay dying a few years ago, a form of therapy was advised by the practitioner. This was declined, but the latter insisted that unless it was carried out he would leave the house. My friend tells me that to prevent a scene at the death-bed he consented to treatment being carried out, which was continued right up to the end. The nerve of my friend just snapped ; and he has never been the same man since. The truth of this I verified from the physician who was called in in consultation and who was totally opposed to what took place. What do the relatives now think as they look back on those last few weeks ? To force treatment upon a dying patient is a terrible thing. Practice of this kind is indeed extremely rare, but unless the profession is careful it is going to increase. The patient has no safeguard when the practitioner is the specialist. A consultant only gives advice ; never does he insist that this should be carried out. It is left to the practitioner to decide. If he

and the patient are uncertain, they can call someone else in. That is the safeguard for the patient. With so many spurious claims for therapy being put forward, it is essential to-day that this safeguard be preserved.

When an operation is discussed, the practitioner has to take into consideration not only the immediate risk, but whether the expectation of life is sufficient to justify the risk and suffering that the operation involves, and whether, if the patient lives, the health he is likely to obtain is sufficiently good to make life worth living. When these questions are faced, many operations now performed will be found not to be justified. Notwithstanding the advances in surgery, there is a risk and suffering with each operation. Even if there is little shock, the patient's vitality is going to be lowered for many months. After a simple operation such as appendicectomy it is doubtful if the patient is himself for at least six months. All these points must be faced before deciding upon an operation in one who is getting on in years. The surgeon should put to himself this question : Even if the patient recovers, is the operation justifiable ? If his vitality is lowered, is life going to be worth while ? There is nothing worse than post-operative asthenia. It is not the surgeon who goes through the suffering, nor does he have to linger on if the operation fails.

My whole outlook in medicine changed at the death of my father. I had somehow come to believe that the signing of a death certificate was the tragedy of life and that every endeavour ought to be made to keep this going. I cannot recall ever having been taught this ; in fact the teaching was the other way. But such a conception had become fairly general. My father was the great friend of my life whose company was becoming dearer as the years went by. As I was getting to know him and was anticipating the years to come, he died from angina and my world came to an end. Every effort was made to save him, and I was reflecting on his loss when my mother said, " I would prefer that he died rather than that he should have to go through another

attack." I could not help realising how noble and fine was her outlook on life ; for the great friendship of her life had come to an end. I was aware that if my father had lived he was going to be an invalid, and he would sooner be dead than live a life of that kind. I had not thought of it in that way until my mother spoke. I was concerned because we were losing him. How many patients would want to go on living if they were aware of the prognosis the practitioner has in mind ? When we try to maintain life our responsibility as a profession is so great because it is not always possible or advisable to put all our cards on the table. It is our duty to relieve suffering and in this way we may prolong life. It is not our duty to promote suffering by attempting to prolong life. I resolved that for that remark of my mother never again would I carry out treatment to prolong life unless life for that patient was going to be worth while. When I am face to face with a doubtful case, I always try to visualise what I would wish done were I in the patient's place. I wonder what would this patient want done if all the facts were before him and he saw the truth face to face. I do not suggest that this should ever be done unless the hand of the practitioner is forced. If the practitioner is merciful in his application of therapy, mercy is essential where the feelings are concerned. It is so easy to be blunt. But how a man can be hurt ! Never in my life have I banged the door in the face of a patient, and very rarely of a relative. It is one thing to give some encouragement and not to take away hope. It is another to give wrong impressions merely to create that faith and hope which are essential if therapy is to succeed. The former is practised by the good practitioner. The latter should be left to the charlatan and quack.

When an old person is beginning to lose ground, or when a man who has had a long illness is failing, it is equally unfair to prescribe stimulants unless the patient expresses a wish for them. For if life is now maintained, it amounts to little more than the prolongation of the act of dying. It is

my impression that it is rare for a man at such a time to wish life to go on. He comes to regard death as others look upon sleep, and quietly yearns for it as a happy release. So often, however, the relatives wish life to be maintained ; they attribute his weakness to the taking of little food and to his lying in bed ; they think that if only he would make an effort he would live. Consequently, they endeavour to get him to eat more food and to take exercise. To one who is nauseated by the mere mention of food and who is far too weak to exert himself, this but adds to his suffering. The practitioner should at this time consider the interest of the patient, who may need to be protected from his relatives, though they are trying to do everything for his good ; he should point out to them that the weakness is the result of age or disease. In this state the patient is better for rest and for taking little food ; attention might be drawn to the book, *Diet in Relation to Age and Activity*, by Sir Henry Thompson. The practitioner will ease the feelings of the relatives by pointing out to them that, if it is just a relapse, as they may be hoping, rest and little food will help him to recover ; if it is just the terminal break up, his suffering will not be added to nor will his end be hastened. Stimulants should be withheld. In a terminal illness or in advanced age a feeling of weakness is often present which is very trying to the patient. Tonics seem to be indicated. They are of little use, since the body is not able to respond. At such a time sedatives are indicated ; tincture of opium, or sodium barbitone give much relief. We are told that those who are ill need little sleep. On whose authority this is made I do not know. No one has yet suggested what old people are to do as they lie awake. My experience suggests that hypnotics do no harm in the aged and are indicated. In a terminal illness a hypnotic is often withheld too long or given in insufficient doses. The drowsiness and weakness that are seen the following day are attributed to the drug and the amount is then reduced, whereas really these symptoms are part of the illness. Nor should too much attention be given

to the fact that those who observe him say he closes his eyes and is not restless. So often the patient means by sleeplessness the disturbances caused by dreams which at times just fall short of delirium. It is kinder at this time to increase rather than decrease the dose.

Now and again I wonder how much the medical profession is to be blamed for the fear of death and the reluctance to die that are so prevalent to-day, for I am convinced that a change in our outlook has taken place. Is not this partly due to the astounding claims put forward by scientists about their conquests of life and nature? At times the reader is led to believe that immortality is imminent. Spinoza has said that the free man thinks of nothing less often than of death. And if the adjective free implies healthy this is no doubt true. But such a man does not think of health or illness and very rarely of religion. If one were asked, of what does the quiet man think, there would be much difficulty in replying. For this type of man, who forms the majority of mankind, so seldom lets us know what he thinks. Yet he thinks of life more deeply than many assume. But either he finds difficulty in expressing himself or he is afraid that were he to do so his effort would just lead to a smile. Now and again doctors make pronouncements about the way people approach the end of life as if this were easy to ascertain. The other evening a practitioner and I were chatting over the subject and it dawned on us how unaware we were of the views of the majority of patients who had passed through our hands. It is very rarely that people speak about life, death, or religion even towards the end of life. It cannot be that they do not think about these things. Rather is it that they seem unable to put their thoughts into words. A perusal of autobiographies suggests to me that people take a saner and fairer conception of life than we at times think. There seems to be a just appreciation of the advancing years and of the approach of death. So often does it seem as if this is looked forward to with contentment rather than with dread.

I cannot help feeling that we pay too much attention to the spectacular outburst or to the fears of a man who is about to die. We forget that at the latter time we may not be listening to the same man to whom we spoke a short time before. It is necessary to distinguish between the fear of being afraid and the fear of death. As we went up for the attack at Anzac a service was held on board. All attended. In the trenches afterwards it was with difficulty that a congregation could be got together on a Sunday. Yet death was as near us as before and equally vivid. But we knew what an attack was like and we knew what death meant. It is of the unknown that men are afraid.

A little anæmia or congestion can seriously affect the function of an organ. Either may arise as disease progresses. If the brain is affected, the personality and the temperament change. Do not say that a man is afraid of death because he shows fear towards the end. These are not necessarily the same. I recall my father, who was fearless, telling me after his first attack of angina. "Dying I am not afraid of ; I must be prepared for that. But I do dread another attack." I did not quite understand what he meant until I had an attack of anaphylaxis, when it seemed as if some centre of fear in the brain was being stimulated. I have been near death so often that I feel that when I meet him it will be just like renewing some old acquaintance. But on each occasion the approach was gradual. Never once did I feel as I did in that anaphylactic attack. Fear did not worry me overmuch in the firing-line. Yet in this attack it came *en masse*. But there was no dread of death. I was so frightened that I longed for this to put me out of my misery. Since that experience I have always believed that there is a centre of fear that can be stimulated by shock or anæmia. When the end is drawing near and a man is behaving in some strange way, do wonder, before openly stating that he has changed his mind, whether as a result of anæmia or congestion of the brain, some change in the personality has not taken place. At the front we used to

hear the cries of the dying for water. Yet when water was provided the man did not drink. His crying was just delirium of the brain. Rarely do I pay attention to what a dying man says. I listen merely to show I am not indifferent. So often his talk is rambling and amounts to no more than a mild delirium. That inexplicable cry from the Cross was probably of this nature.

As an illness progresses or a man grows older, allowance should be made for degenerative changes in the brain. Many of my patients are over 70 and their outlook on life has to be considered before operation is advised. It is not so easy as some think to ascertain this. I have at times noticed the change in personality that occurs as age progresses. This is revealed in the following case.

J., a man aged 71, was seen by me for undue frequency soon after the War, in which all his sons had been killed. We discussed operation, but he turned it down. He said, "What are a couple of years at this time of life? Remember that my best years have gone. It is not the same as if I was 30. When my time comes, I shall be happy to join my boys." Four years later he came to me and wanted the operation done. It was difficult to account for this, as the symptoms were not more severe. As we chatted he said, "I am a young man yet. I have much work to do." I was amazed. But a chat with his daughter revealed to me that he had changed in many ways. He died a few months later from degeneration of the brain. It would be easy to argue from this case that this man had begun to be afraid as death drew near. It was evident, however, that his personality had changed owing to degenerative changes that were taking place. Instead of having that broad outlook that previously I had admired, he had become childish.

These degenerations, that come on slowly as age progresses or more rapidly as disease appears, must always be allowed for when trying to reason out life.

The views put forward here on euthanasia were reached only after much thought and numerous conversations with those whose experience gives them the right to speak. It is

to the practitioner in country towns and villages with a knowledge of humanity and of nature to whom I have gone. If I have hurt the feelings of anyone who is getting on in years, this must be on account of our not looking at the subject alike. The problem is not one of years. Rather is it the outlook upon life. Euthanasia should be considered only when life has become a burden or the individual is becoming disinterested in life. With one man this takes place at 60 and with another never so long as life goes on. But I would ask my profession to consider, before instituting active therapy, whether life is worth while for that particular patient. Would he want to go on, were he to be told the truth? It is my impression that we are beginning to witness much unnecessary therapy for the aged. Now that medical men are being influenced by experimental work this kind of work is likely to increase. Research is becoming the basis of the practice of medicine. So long as life can be kept going, it is thought something has been achieved. Sympathy for the patient and for all he has to go through is given less and less consideration.

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