off, but sometimes, and especially in cases operated upon late and where the drainage is not really satisfactory, the paralysis after a time gives place to definite obstruction which is accompanied by all the results met with in cases of mechanical obstruction of the intestine. The bowel above the paralysed part becomes distended more and more, and finally the wall becomes sodden and no longer prevents the passage of organisms from the inside, so that a fresh cause of peritonitis may in this way be added to the original one. All this is accompanied by persistent vomiting, first of duodenal and later of intestinal contents, increasing abdominal distension, and a rising pulse rate.

The management of these cases is no easy matter, for it is difficult to say at any given moment whether or no the condition present is due to a degree of paralysis that will pass off or whether the condition has already passed this stage. Moreover, much depends upon the determination of this point, for on the one hand needless secondary operations must be avoided, and on the other hand it is important not to waste valuable time.

Unfortunately, I can give no very definite rules for your guidance, but the progress of the case and the results of treatment are the data upon which opinion must be based.

If several doses of pituitrin followed by enemata result in the passage of flatus, all will probably be well, but if vomiting continues, and no flatus is passed, in spite of these measures, and if, further, the enemata are retained entirely, the outlook is usually bad, and in this case the abdomen should be reopened under gas and oxygen, and several of the most distended coils of intestine opened, and thoroughly emptied of their contents and closed again. Except in the most advanced and hopeless cases this treatment will relieve the condition.

3. *Local collections* frequently form after a spreading peritonitis has been successfully relieved by suitable treatment, and must be carefully watched for.

The danger signal is usually a rise of temperature, and in the presence of this indication careful and repeated examination must be made for local areas of resistance and tenderness, not forgetting rectal and vaginal examination for collections in the pelvis.

If evidence of a collection is found there need not be too much haste to attempt to evacuate it, provided the general condition of the patient is good, for it is not always easy to find a small subphrenic abscess or a collection amongst coils of intestine, and, moreover, the attempt to do so may result in the formation of a faecal fistula from tearing a coil of softened intestine while separating adhesions. Again, there is no doubt that small collections may be absorbed, for a tender lump associated with a rise of temperature may persist for some days and then gradually disappear, especially in the later stages of convalescence. It must be remembered also that empyema is not an uncommon complication of septic peritonitis, so that the chest must be carefully examined from time to time, especially if the temperature continues to swing. This is illustrated in the second case I described to you, in which there was first a subphrenic collection and later an empyema.

4. *Faecal fistula* also complicates a certain proportion of these cases, and is due sometimes to the separation of a gangrenous appendix, at others to pressure from a hard drainage tube too long retained, and occasionally from the giving way of the wall of the caecum when greatly distended and exposed in the wound. In the majority of cases the fistula will close in course of time, but in a few the mucous membrane becomes continuous with the skin and a secondary operation is needed later.

Finally, *ventral hernia* must inevitably occur as a late complication in many cases, and may require an operation for its cure.

A COURSE in dermatology and venereal diseases, open to foreign as well as French graduates, is about to begin in the Faculty of Medicine, Strasbourg. It will consist of forty clinical and ten laboratory demonstrations. It will begin on May 1st and terminate on July 14th. Full particulars can be obtained on application to Professor Pautrier at the Faculty of Medicine, Strasbourg. The fee for the course is Fr. 300. Should a sufficient number of applications be received a further practical course on the Bordet-Wassermann reaction will be arranged.

A Lecture

ON

THE SOLDIER'S HEART AND WAR NEUROSIS:

A STUDY IN SYMPTOMATOLOGY.

DELIVERED AT THE CLINICAL INSTITUTE, ST. ANDREWS.

BY

SIR JAMES MACKENZIE, M.D., F.R.S., F.R.C.P.

(Concluded from page 494.)

IX. THE MECHANISM OF VISCERAL PAIN (THE VISCERO-SENSORY REFLEX).

THE remarkable difference between the sensitiveness of the external body wall and the viscera in response to mechanical stimulation brings out clearly the difference in function of the two divisions of the nervous system—a difference which it is necessary clearly to understand if the symptoms of disease are to be fully comprehended. It shows that when pain is evoked from the organs or tissues which are not supplied by the sensory nerves of the cerebro-spinal system some other mechanism must take part in its production.

The nature of this mechanism is revealed by the study of the symptoms produced in certain forms of visceral disease. If we take the symptoms that are present in certain simple diseases—for example, a gastric ulcer, appendicitis, or renal colic—the mechanism by which a number of symptoms are produced will become clear. In many cases of gastric ulcer there is pain, limited to a small area, in the epigastric region. This pain has a different location from the ulcer. Thus the pain may be situated in the middle line, as in Fig. 6, where the shaded area, A, indicates the site of pain, while the ulcer, revealed at the *post-mortem* examination, is situated at the pylorus, which was found at x in Fig. 6. Moreover, if a patient with this pain breathes deeply, the stomach, with the ulcer, shifts its position, but the site of pain remains fixed. With these facts before us, the mechanism of pain in visceral disease becomes clear. When the disordered sensations of toothache were considered it was seen that the only reasonable explanation was that from the offending tooth a stimulus had been sent into the central nervous system. The effects of this stimulus were not limited to the cells of the nerve supplying the tooth, but spread to the cells of sensory nerves in the immediate neighbourhood, with the result that there was pain and hyperalgesia in neighbouring teeth and in the skin of the cheek.

FIG. 6.—The shaded area in the centre shows the position of pain and hyperalgesia in a case of ulcer of the pylorus situated at x.

From the stomach a stimulus is conveyed by the sympathetic nerves into the central nervous system. But as these nerves are not "sensory" nerves in the sense that they are directly connected with any perceptor in the brain, no sensation is felt (Fig. 7). In like manner, so long as the impulses conveyed from the ulcer do not spread no pain is felt. When, however, the stimulus is of such a nature that it spreads to other cells, then we get a reaction peculiar to the cells stimulated. In this case the stimulus reaching the nearest sensory cells of the cerebro-spinal system irritates them, and the pain which results is referred to the peripheral distribution of the nerve stimulated—that is, the nerves supplying the area of skin as already described in paragraph V on referred pain. Fig. 8 illustrates the mechanism by which pain is produced in visceral disease, showing how an organ itself insensitive and supplied only by sympathetic nerves can produce pain by reacting upon the cells of the cerebro-spinal sensory system. The stimulus arising in the organ x passes to the central nervous system, where its cell, x', has no direct connexion with the sensorium, s, but when an adequate

stimulus arises it affects the neighbouring cell, B', which, being a pain nerve, gives rise to the sensation of pain which is localized at its peripheral distribution, B.

FIG. 7.

FIG. 7.—The normal movements of a viscus, X, pass into the central nervous system, X', but produce no sensation.

FIG. 8.

FIG. 8.—Shows the mechanism of a visco-sensory reflex. A stimulus arising in a diseased organ, X (as in gastric ulcer), passes into the central nervous system, X', and if the stimulus be of a particular quality or strength it will affect a neighbouring sensory cell, B', which is recognized as pain and referred to the peripheral distribution of the nerve at B.

X. THE MECHANISM OF THE VISCERO-MOTOR REFLEX.

Before dealing with other phenomena produced by visceral disease it is necessary to consider the mechanism of the reflex which produces contraction of voluntary muscles as a result of a stimulation from the viscera. When we carefully palpate the abdominal wall in patients with disease of some abdominal organ, we will frequently find certain portions of the body wall hard and resistant. This manifestly is due to a contraction of a portion of one or more of the broad muscles which form the abdominal wall. It is a reflex contraction produced by a stimulus arising in the diseased viscus and sometimes referred to as "protective rigidity" of the muscles, as its purpose is obviously to protect the diseased organ. Every doctor is aware of this hardness in the epigastrium in gastric ulcer, due to rigidity of the upper portion of the recti muscles. The manner in which it is produced is similar to that operating in the case of the cutaneous reflex contraction, and may be diagrammatically represented as in Fig. 9,

FIG. 9.—Shows the mechanism of the visco-motor reflex. A stimulus arising in a diseased organ, X, passes into the central nervous system, X', and affects a neighbouring cell, C', which causes a contraction of skeletal muscles, C.

a very instructive kind. Light is thrown on some functions of the sympathetic system at present obscure, and some characteristic features of muscular contraction which have been overlooked are revealed.

From the study of this contraction it can be demonstrated that the tone maintained by the flat muscles of the abdomen is partly dependent on the stimuli reaching the motor cells of the muscles from the viscera. If we carefully watch certain cases of visceral disease, such as gastric ulcer, we will often find a varying degree of muscular rigidity. It may be scarcely possible to distinguish this increased resistance from that of the normal

tone and resistance to palpation in unaffected muscles. This resistance often increases until the muscle is felt hard and board-like, and after a time it may subside and disappear. When the increased resistance is scarcely perceptible, it can be increased by rubbing gently along the muscle. Sometimes in walking the contraction of the muscle may be increased so that the patient walks with a stoop. The varying degrees of contraction are in all likelihood associated with varying degrees of activity of the disease, and I have at times found them of value in the management of such diseases as gastric ulcer. But the point I wish to make here is that this increase in contraction is evidently but an exaggeration of that condition called tone which is normally present in health.

Frequently these muscle contractions are associated with hyperalgesia of the skin overlying them, and the muscles themselves may be hyperalgesic. When this cutaneous hyperalgesia is present the cutaneous reflexes show some interesting variations. If the muscle is not contracted, or only slightly contracted, the reflexes may be much more lively in response to stimulation of the hyperalgesic skin. If the muscles are hard and board-like, the reflexes may seem to be abolished; little or no movement is obtained from stimulating the hyperalgesic skin, for the reason that the muscles are already contracted to their full extent.

It occasionally happens that we find the muscle distinctly contracted, with no cutaneous nor muscular hyperalgesia, as shown in Fig. 8. At other times we may find hyperalgesia of the skin only. Most frequently there is both cutaneous and muscular hyperalgesia along with a contracted muscle, as shown in Fig. 10, where the stimuli from X affect B' and C', producing in the one case pain referred to B and in the other contraction of the muscle C.

XI. MULTIPLE REFLEXES FROM VISCERAL STIMULATION.

So far, in speaking of reflexes I have referred to some as occurring singly. As a matter of fact, no stimulus produces only one reflex; there are always others. Some of these are so slight as not to be recognizable; others, quite a number of them, can be recognized.

If, for instance, we consider the symptoms provoked by the peristalsis of a hollow muscular organ the origin of a number of phenomena will be revealed. The presence of a small calculus in the pelvis of the kidney may set up a strong peristalsis of the ureter, giving rise to an attack of renal colic. With the onset of the attack uneasiness or pain is first felt, and the muscles of the abdomen become hard. In one patient the testicle was pulled up by the contraction of the cremaster muscle. The pain passes from the loins downwards into the testicle. It comes on in wave-like periods of intensity. Other symptoms arise—for example, vomiting, great prostration, with feeble action of the heart—so that partial loss of consciousness may follow. There is also pallor and profuse sweating. All these phenomena are produced by a stimulus reaching the central nervous

FIG. 10.—Shows the mechanism of a combined visco-sensory and visco-motor reflex. (See Figs. 8 and 9.)

FIG. 11.—Illustrates the mechanism of multiple reflexes produced by visceral stimulation. An adequate stimulus arising in an organ, X, passes to X' in the central nervous system and affects a series of neighbouring cells, thus giving rise to pain (by stimulating B'), muscle contraction (by stimulating C'), vomiting (by stimulating the centre for vomiting), cardiac depression (by stimulating the vagus), pallor and sweating (by stimulating the vasomotor centres, VM).

It comes on in wave-like periods of intensity. Other symptoms arise—for example, vomiting, great prostration, with feeble action of the heart—so that partial loss of consciousness may follow. There is also pallor and profuse sweating. All these phenomena are produced by a stimulus reaching the central nervous

system and there reacting on a number of special centres, such as the vomiting centres, the centre for regulating the vasomotor nerves, the centre of the vagus (Fig. 11).

When the attack passes off there is left a variety of phenomena, such as an area of cutaneous hyperalgesia with contraction of certain of the muscles of the abdomen. In addition there is usually ushered in a period of great exhaustion or prostration, lasting, it may be, for a number of days. I wish here to clear away one of those beliefs which does so much to darken understanding and hamper investigation. Phenomena, such as exhaustion and vomiting, when they accompany such an attack, are usually attributed to the pain. This is a pure assumption, for the centres which control vomiting and exhaustion are as distinct as the pain centres, and a stimulus which excites pain may, under certain circumstances, also excite those centres. When pain of great severity occurs without vomiting or exhaustion, it simply means that the stimulus which excited the pain did not affect those other centres. On the other hand, those centres may be stimulated, and vomiting and exhaustion may be produced without pain. Thus, it frequently happens that a sudden movement of the bowels resulting in the evacuation of a large loose motion is accompanied by vomiting and fainting without pain.

XII. DIMINISHED RESISTANCE TO STIMULATION (FOCAL).

I wish now to direct your attention to a feature of the nervous system which has not received from clinical observers the attention it merits—namely, the lowered resistance to stimulation which is produced by disease and other agencies.

In describing the phenomena of toothache, the well known facts of tenderness of the neighbouring healthy teeth and of the hyperalgesia of the skin of the cheek were commented on. A similar state of affairs is met with in connexion with visceral disease, for we often find in this condition that pressure over certain regions of the abdomen of a degree which in other parts of the body produces only the sensation of touch or pressure, gives rise to pain. In lightly pinching the skin, too, pain is caused over particular areas whereas no pain is felt in other areas. Frequently the skin itself is not hyperalgesic, but the deeper structures of the abdominal wall, especially the muscles, are painful on pressure.

In normal circumstances a stimulus has opposed to it a degree of resistance in producing pain. Its entrance into the pain centres is hindered, so that it must be of a certain strength or quality before it can pass. In these hyperalgesic areas which I have described the resistance to stimulation is greatly diminished, so that a stimulus much weaker than that which produces pain in other regions is sufficient to produce pain in these regions; in technical language, the "threshold of stimulation" is lowered. A similar lowering of the threshold is shown by the cutaneous reflexes. Thus when a hyperaesthetic area of skin is stimulated so as to produce a contraction, a slighter stimulus suffices for the work, and the contraction of the muscle produced is greater than in corresponding parts of the opposite side of the abdomen.

But the evidence of the diminished resistance is not limited to sensory and motor regions in the spinal cord. This may affect the whole nervous regulating mechanism of an organ. The phenomenon is best demonstrated in the circulatory system. In certain cases the movements of the heart and the vasomotor mechanism may respond to mild stimulation in an excessive manner—for example, an excessive rate of the heart on mild exertion or an excessive contraction of the blood vessels from some slight stimulus as, for instance, mental effort or exposure to cold. Thus, in a patient with aortic regurgitation, I have seen the blood pressure rise when the patient was engaged in a quiet conversation, and I have seen this rise followed by a violent attack of pain. Indeed, in certain sufferers from heart disease the nervous mechanism of the organ may become so sensitive to stimulation that this may provoke attacks of palpitation or of pain. This stimulation may consist of factors which do not directly affect the heart—for example, mental excitement, the excitation of the skin of the left chest by pressure of a stethoscope, or a mere movement of the left arm of the patient. Numerous instances of the lowering of the threshold of stimulation will occur. People in whom the fingers become cold, pale,

and numb, on exposure to a very moderate degree of cold, have an excessive sensibility of certain vasomotor centres. Some people, again, when worried or fatigued suffer from persistent vomiting.

XIII. DIMINISHED RESISTANCE TO STIMULATION (GENERAL).

The purpose of these illustrations is to call attention to a factor which has only been dimly perceived, but which is a very important element in the production of a large class of symptoms. This factor is diminished resistance to stimulation. So far instances of it have been confined to diseases of a simple kind—for example, toothache, gastric ulcer, disturbances of the heart and vasomotor system, and of the vomiting centre. It will now be profitable to inquire whether there are not conditions in which the diminished resistance may be of a much greater extent, for if such conditions be found we may find at the same time a clear explanation of the manner in which many symptoms are produced.

We know that when a patient becomes the subject of a microbic infection there is speedily induced a loss of the sense of well-being and the appearance of sensations of discomfort or suffering. The daily routine becomes laborious and difficult; it is accompanied by loss of appetite, and fatigue is easily brought on. Indeed, so readily may exhaustion be produced that, even with a mild infection, collapse of an extreme kind may occur—as, for instance, in the case of a youth training for a race who fell and lost consciousness in running a short distance. Before starting he felt seedy, but thought he could throw the feeling off by the exercise. He was found to have a slight rise of temperature; in a few days he was well and resumed his training, which he completed without mishap. If patients with a mild infection be observed it will often be found that their heart's rate is increased, and that their response to effort is accompanied by an undue acceleration of the heart's rate, while breathlessness and fatigue are more readily induced than in health. These facts are well known to every observing doctor, and their interpretation seems to be that something has occurred which has lowered the resistance to stimulation. As a result the heart is more readily stimulated to rapid action, and a disturbance of the vasomotor mechanism takes place which leads to exhaustion or loss of consciousness.

If an individual, the victim of a mild infection, persists in leading the strenuous life he may have pursued when enjoying vigorous health, other manifestations develop. The heart's exhaustion may proceed apace till breathlessness is readily produced on moderate exertion. Pain, too, may be experienced, sometimes of such severity that it is diagnosed as angina pectoris, while the skin of the left side of the chest may become extremely hyperalgesic.

The following experiences show what I am trying to demonstrate. A woman fell into ill health of a vague kind, but developed attacks of pain in the left chest, evidently of cardiac origin, of such severity that several experienced physicians diagnosed the condition as one of angina pectoris of a very grave type. Little relief was obtained, and the case dragged on for months. When I saw her I felt confident that the attacks of pain, though cardiac in origin, were not due to organic disease of the heart, but that she was suffering from some toxic condition, and a search was made for some source of infection. The only suspicious circumstance was an obscure swelling in the pelvis, whose nature an expert gynaecologist could not determine. After a few weeks an abscess burst into the bladder, and after the discharge of pus the attacks of "angina" gradually disappeared, and she made a good recovery.

A man fell into poor health. He became depressed in spirits; his brain was readily exhausted after reading a short time; he was short of breath on exertion, and easily tired. He flushed readily, and his heart beat rapidly on the slightest exertion. Nothing amiss could be detected on physical examination till, after some months, a certain degree of discomfort directed attention to his mouth, and he was found to have an abscess in his antrum. The evacuation of the pus was followed by a speedy recovery.

It is manifest, from a history of such cases, that the primary cause of trouble was an infection which poisoned certain structures of the body, in particular the nervous system and regulating mechanism of the heart and blood

vessels, and rendered those parts abnormally sensitive to stimulation, so that bodily or mental effort, which in health could be undertaken without distress, now induced the signs of exhaustion peculiar to each organ.

What is true of the circulatory system is true also of every other system. When we meet with symptoms of the disturbance of one organ a systematic inquiry will often lead to the detection of evidence of functional disturbance in other organs.

This matter can be illustrated by a consideration of experiences that have lately been familiar to most of you in the so-called "soldier's heart" and the neuroses of war.

XIV. THE SOLDIER'S HEART.

For many years before the war I had puzzled over the description of the condition called the "irritable heart of soldiers." Many years ago I had seen men in good health who had been invalided out of the army because of this affection, and I could find nothing the matter with their hearts. When the war broke out I seized the opportunity to find out the nature of this condition. At the suggestion of the Medical Research Committee a systematic investigation was undertaken by Dr. R. M. Wilson and myself, and we produced a preliminary report on the subject. The work was ultimately carried on at hospitals set apart for the purpose; but I continued my own investigations, and briefly the following are the conclusions to which I came: The condition which goes now under a variety of names—as the soldier's heart, the irritable heart of soldiers, disordered action of the heart, effort syndrome, and neuro-muscular asthenia—is not peculiar to soldiers, but is of frequent occurrence in civil life. The ill health or incapacity which is present is not limited or only due to the cardiac condition, for other organs are also affected, so that the cardiac manifestations form but a part of the picture of ill health. The main symptoms of which the soldiers complained were shortness of breath or exhaustion or palpitation easily produced on moderate effort. In some cases pain in the chest was felt, sometimes of great severity, coming on in response to effort or when at rest. An examination revealed in some an increased rate of the heart, and in many an excessive increase in response to effort. Occasionally there was a slight enlargement of the heart.

In the limitation of the response to effort (shown by breathlessness easily produced) and in the increased rate of the heart we get evidences of increased susceptibility to stimulation on the part of the organ.

A heart in this condition of undue excitability, compelled to do the same amount of work as it did when the health was good, will become sooner or later exhausted, and so we will find a series of symptoms arise which are the outcome of exhaustion.

While the over-excitability of the heart is brought about mainly by a disturbance affecting its nervous mechanism, in all probability the same injurious influence affects the myocardium itself, so that the efficiency of the heart may be impaired.

XV. WAR NEUROSIS.

The foregoing are, in brief, the chief manifestations of the irritable heart of soldiers. But if the patient be more carefully scrutinized other symptoms will be found. His face is often lined and drawn; he is often nervous in manner, and occasionally he shows fine tremors in his hands and fingers. Inquiry reveals a varying degree of mental disturbance, apathy, disinclination for exertion, mental depression, and irritability of temper. The memory is not retentive, and on mental effort—for example, reading—fatigue is readily induced. In many cases other phenomena are detected, but these are sufficient to show that in nearly all these cases there is a mental side to the ill health as well as a cardiac.

If one were to concentrate the attention on the nervous phenomena in a great many of these cases, the conclusion arrived at would be that the patient suffered from a neurosis. Indeed, this is what is constantly happening, for certain doctors would unhesitatingly class some soldier patients as suffering from neurasthenia, or some other form of war neurosis, while others would class the same patients as suffering from the irritable heart of soldiers.

If the inquiry be carried further definite symptoms of derangement of other organs can be obtained. Thus a

rapid respiratory rate, not due to any lung or heart affection, may probably, as Haldane pointed out, be due to an excessive irritability of the respiratory reflex. Digestive disturbances are present in the great majority. Did we possess the knowledge we might almost certainly discover signs pointing to the deranged function of every organ of the body. Indeed, some physicians have detected signs of hyperthyroidism in so many of these cases that they attribute most of the circulatory disturbances to this condition.

XVI. THE MECHANISM OF SYMPTOMS.

The inference drawn from such experiences was that a condition of diminished resistance to stimulation had been induced, and the attempt to lead the life and do the work of healthy vigorous men had proved unavailing. Health had given way from exhaustion. The manifestations of this exhaustion were exhibited by the different organs that had been submitted to the strain; in one case the heart and circulatory system were most affected, in another the nervous system. Thus we get the variety of phenomena which these soldiers exhibit.

This way of looking at the matter illustrates a method of investigation that has not been so fully appreciated or utilized in medical research as it deserves. It shows the importance of applying the "law of associated phenomena" in all medical examinations. This law is based upon the fact that in ill health there are a great variety of phenomena. It has been the habit to a large extent to give consideration to the more prominent signs and to label the disease by the names of such dominant signs. We constantly met soldiers invalided and pensioned on account of so-called aortic or mitral disease, because a systolic murmur had been detected, yet in the vast majority of these cases there was absolutely nothing the matter with the aortic or mitral valves. If the principles underlying the classification of symptoms and the law of associated phenomena had been understood such mistakes would not have arisen.

Physicians who have been engaged in war work are now publishing their experiences, and you will find in the medical journals that the old method of docketing the soldiers' complaints according to the organ supposed to be affected is pursued. Thus we have sick men described as cases of irritable heart, of neurasthenia, and of hysteria; that is to say, the complaints are attributed to the organ whose symptoms are most prominent to the observer.

XVII. PRACTICAL IMPORTANCE OF RECOGNIZING THE MECHANISM OF SYMPTOMS.

It may seem to you that this aspect of the matter is already recognized, and that the presentation of it in this way is unnecessary. But it frequently happens that what is supposed to be well known and commonplace is in reality so imperfectly known that its true significance has been entirely missed. In the cases to which I am referring it will be seen that the procedure usually employed in medicine, of describing diseases as limited to one organ or system, is misleading.

Recognition of this general lowering of resistance to stimulation enables one to perceive that the manifestations of the different organs are but an expression of the irritability of their nervous mechanism, and compels an inquiry into the condition which has induced it. In many cases such an inquiry will result in the discovery of some focal disease or in the detection of some infection—for example, malaria or dysentery, or tubercle.

Another important result of this recognition is that we are no longer so likely to be misled in the estimation of the significance of some abnormal sign. A large number of these cases of nervous heart are labelled "valvular disease of the heart" because there is a systolic murmur present, and the limited response to effort, breathlessness on exertion, or increased rate of the heart, is taken to be evidence of an organ impaired by mitral or aortic disease. I know that large numbers of cases have been invalided out of the army and granted pensions because of misapprehension of the significance of murmurs, particularly when these murmurs were associated with the phenomena I have described. The same thing applies to affections of the nervous system. We often find this type of case called "neurasthenia" or some other form of neurosis, and subjected to various methods of treatment based upon an erroneous conception of its nature.

Furthermore, the necessity of recognizing the nature of the phenomena which lowers resistance is seen in the tests which are recommended by the military authorities for determining the fitness of a man. To ascertain the functional efficiency of the heart certain exercises are enjoined. If, in response to these, there is an increase in the rate of the heart or of the breathing, it is assumed that the organ is impaired. The evil symptoms are taken as indications of such impairment. If the principles I have been enunciating be grasped, it will be seen that it is not the heart condition that is being tested by these exercises but the susceptibility of the heart to stimulation. In some cases the increased rate may represent cardiac inefficiency, but in the vast majority of cases it represents nothing of the sort, for the cardiac irritability is but one of many phenomena the detection of which would afford a clue to the real nature of the trouble.

XVIII. ILLUSTRATION OF HARM DONE BY IGNORING THE MECHANISM OF SYMPTOMS.

I have had plenty of experience showing the widespread harm of this limited study of patients' symptoms. I have been frequently consulted by men who have been rejected for the army and pensioned because of a misconception of their symptoms. I saw recently a man who was invalided out of the army and told he had got aortic disease, and that his heart was so damaged that he would never be able to undertake any occupation requiring physical effort. He was given a full pension. When I saw him he was leading a miserable existence, creeping about a few hours a day. He was easily tired, and he attributed his exhaustion to his heart complaint. His heart was easily stimulated to rapid action, and there was present a systolic murmur at the base. When I tried to assure him that there was no aortic disease and that his heart was perfectly sound, I found it was impossible to convince him. When in the army these sensations of exhaustion came on and the army doctors had detected the murmur and called it aortic disease and had treated him for a time in bed and then invalided him out. The pension doctors had repeatedly confirmed this view of his condition, and had backed up their opinion by giving the largest pension allowance. Is there little wonder that this man cannot be convinced as to the true nature of his condition? He is made a miserable wreck on account of a defect in medical knowledge—namely, ignorance of the nature and significance of symptoms.

XIX. THE ORIGIN OF ILL HEALTH.

In a careful inquiry into the origin of ill health in over 2,000 soldiers I found that in the case of about 80 per cent. the first onset of their illness began with some complaint of an infectious nature, such as measles, influenza, trench fever, typhoid fever, malaria, dysentery, or "P.U.O." In other cases one could gather that the onset was due to an ill-defined illness suspiciously like an infection.

In a number of cases there was no history of infection, and the onset of the illness seemed to be due to a variety of circumstances. Some of the men were weakly before they entered the army, and the unaccustomed strain had seemingly been the cause. Others, originally quite healthy, had been exposed to a long and continued bodily and mental strain; want of rest had evidently been the provoking agent in these instances.

The history of the origin of these complaints and the manifestation of ill health accorded with the experience of civil practice. We repeatedly meet with patients who, on recovery from a febrile illness, suffer in the same way for varying periods.

CONCLUSION.

I have given in this lecture a bare outline of one phase of symptomatology, merely to indicate the mechanism by which certain symptoms are produced, and the far-reaching inferences that can safely be drawn from the consideration of this phase. It will be seen that a large amount of work is necessary to complete the picture and to understand the nature of symptoms. The study also affords a guide to further research. For instance, a great number of diseases are only recognizable by the presence of their reflex symptoms—diseases like gastric ulcer and appendicitis. We want to know the nature of the stimulus capable of producing these symptoms, whether it is an exaggeration of a normal stimulus or a product of

disease. It can also be seen how important it is, in examining the sick, to be guided by the law of associated phenomena, while a definite object to be achieved—that of finding the agent which produces the diminished resistance—is held clearly before the investigator.

PUBLIC HEALTH ADMINISTRATION IN EPIDEMICS OF MEASLES.

BY

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DURING the twenty years I was engaged in active work in the Public Health Service the question of the best methods of administration in epidemics of measles came under my subconscious mind at more or less regular intervals. As I was not responsible for the field work, but only for the treatment of those suffering from the disease, there was no need for immediate decision, so that it was not until the end of my hospital experience that I seriously began to consider the subject in its different aspects. In actual practice nothing was being done to limit the spread of measles save to apply those general principles which seemed to offer a reasonable chance of success in combating the spread of all infectious diseases. These principles included notification, isolation of the infected person, and disinfection of the infected articles as a part of the process. They extended, however, much more widely, and included the destruction of unhealthy property, the prevention of overcrowding, and the improvement of general sanitation. It is one of the ironies of health administration that such obvious reforms were neglected year after year until an outbreak of typhus or small-pox brought the necessary stimulus to the lay mind to allow the medical officer to initiate these measures to control infectious diseases. The powers granted to limit infectious disease acted, however, much more to the advantage of the community in improving the standard of health than in the repression of infectious disease.

The present generation now possesses the kind of knowledge which enables it to recognize that the adequate administration of any infectious disease depends only to a small extent upon general principles and chiefly upon an exact knowledge of the natural history of the disease. Thus while the amount of typhus fever was undoubtedly limited through the application of general hygienic measures, these were definitely successful because the measures brought those possibly infected by the disease under such supervision as to ensure that both their houses and clothing were properly cleansed, and thus the louse, the active agent in the transmission of the disease, was eliminated. So also at the present day the control of malaria is found to depend upon measures which, though perhaps indirectly advantageous to the general health, are yet much more potentially disadvantageous to the agent by which the disease is spread—namely, the mosquito. A well-known example of a disease which isolation, disinfection and sanitation have proved quite powerless to control is scarlet fever.

The control of measles is a problem, therefore, to be considered solely with reference to the natural history of the disease. The disease is most infectious—in fact it is of the eruptive fevers the most infectious, except small-pox. In contrast to small-pox, no protection such as that afforded by vaccination has hitherto been found. The infection, again in contrast to small-pox, is present in a very intense degree at the first onset of the catarrhal symptoms, and as these precede the appearance of the rash by at least three days, this period passes in most cases before the cause of the symptoms present has been recognized. Through the coughing due to the catarrh the infection is spread through the air. As far as can be statistically estimated at present, all but a fraction of those persons who come within the range of infection succumb at the most to two exposures to infection of the kind experienced in natural conditions.

Only one means of protection exists for any but those gifted with special immunity, and that is a previous attack. Though this is, of course, well known, it may not be inappropriate to state that it was brought very