Rheumatism : some investigations respecting its cause, prevention and cure / by Percy Wilde.

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Publication/Creation

London : John Bale & Sons, 1893.

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Rheumatism:

SOME INVESTIGATIONS RESPECTING ITS

Cause, Prevention and Cure

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RHEUMATISM:

SOME INVESTIGATIONS RESPECTING ITS

CAUSE, PREVENTION AND CURE

By PERCY WILDE, M.D.

London
JOHN BALE & SONS
87-89, GREAT TITCHFIELD STREET, OXFORD STREET, W.
Bristol: J. WRIGHT & CO.
1893

PREFACE.

In the following pages I have explained the methods by which one of the commonest disorders affecting the inhabitants of this country can be prevented, and how its acute form may be deprived of its dangers and much of its distress.

The methods are simple, and can be conducted with no other appliances than are found in every house. They require attention to detail, but I have given those details as fully as possible. They entail trouble, but those who have helped me in the treatment of such cases find that the results repay the labour.

I would only ask that those who employ these methods will observe the directions I have given before they improve upon them. They are recommended as the result of many years of study and careful observation, and I have complete confidence that, when followed, they will yield the same results which I have had the good fortune to attain.

Percy Wilde.

23, *Circus*,
Bath,
September, 1893.

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RHEUMATISM:

SOME INVESTIGATIONS RESPECTING ITS CAUSE, PREVENTION AND CURE.

INTRODUCTION.

THE great *frequency* of this disease is indicated by the fact that out of 15,552 cases admitted to St. Bartholomew's Hospital during a period of six years, no less than 1,137 were cases of acute rheumatism, *i.e.*, 7.31 per cent. This does not include the large number of sufferers from the chronic and acute forms of the disease, who were treated in the out-patient department.

The *danger* of acute rheumatism lies in its remote, rather than its immediate, effects. The mortality was only 1.32 per cent., but no less than 70.86 per cent. of these patients developed heart disease as a result of the attack.[1] It is

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[1] In almost every case a blowing murmur was heard over the heart some time during the acute stage, but these disappearing murmurs are not included in the above statistics. The liability to heart complications increases with

when we consider the great frequency of this fever as compared with others, and the large share which an impairment of the heart's functions has in the mortality from all other causes, that its dangerous nature can be fully appreciated.

In its sub-acute and chronic forms, rheumatism is responsible for a greater amount of pain and physical disablement to the inhabitants of the British Isles than any other disorder. If an estimate could be made of the pecuniary loss which the country sustains as a result of the crippling effects of rheumatism on its working population, it would represent such a large sum that the consideration of means for its prevention and cure would be regarded as a *social* as well as a medical question.

The mortality and the suffering which attends it is infinitely greater than that of the combined effects of small-pox and cholera, in the prevention of which so much public money is very properly spent; but the *preventive* treatment of rheumatism is not at present regarded as a possible result of the advance of medical knowledge. In respect to its *cure*, I will only say that it was a study of the unfortunate results attending the ordinary methods employed which led me five years ago to a study of its nature and causes, with a view to finding some more satisfactory method of combating the disorder. As a result I was led to adopt measures for

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each attack; thus the percentage is 58.8 for first attacks, and this rises to 81.9 for third attacks.—Dr. Saml. West, *Practitioner*, 1888, p. 104.

the treatment of rheumatic fever which are the reverse of those ordinarily adopted. While watching the results of my earlier cases, it became evident to me that there were methods by which rheumatism could be easily detected long before its actual development, and that by very simple methods of treatment the attack could not only be prevented, but that the measures used for prevention were themselves a cure for a large number of intractable disorders, due to the same conditions which produced rheumatism, but which are not generally recognised as associated with it. I have delayed the statement of the results of this investigation until the observation of individual cases had extended over a sufficient number of years to enable me, not only to test the results of treatment, but to examine the value of indications afforded by persons who, while in apparently perfect health at the time the observations were made, exhibited signs which eventually led to the development of rheumatism or its allied disorders.

Causes of Acute Rheumatism.

The first question which suggests itself to us in the study of acute rheumatism is: What is the nature of the fever? Is it a continued fever, attended with swelling and pain in the joints as one of its most prominent symptoms, or is the fever produced by the acute inflammation of the joints themselves? The term "rheumatic fever" would pro-

perly represent the first condition, but "acute rheumatism" would be a more precise mode of expressing the latter.

The "Encyclopædia of Practical Medicine," published in 1834, tells us that "this disease is often designated by the trivial name of 'rheumatic fever,' which implies a constitutional disease as well as a local." The continued adoption, since then, of the term "acute rheumatism," to express what is commonly known as rheumatic fever, would indicate a general opinion in favour of the view that the fever is the result of the local symptoms. From this naturally follows the therapeutic induction, that if we cure the inflammation of the joints we can abate the fever, and that whatever reduces the fever will be likely to limit the rheumatic process and cure the disease. This view is not an unnatural one, but it gathers very little support from the results of clinical observation.

The following facts must be within the knowledge of every practitioner who has watched the course and progress of any series of cases of rheumatic fever :—

(1) The development of very high fever may take place before the joints become inflamed.

(2) There is no direct relation between the degree of fever and the number of the joints affected.

(3) Articular rheumatism may exist in a very large number of joints without the existence of fever, and it is not uncommon in rheumatic fever for the joints to remain acutely affected after the fever has subsided.

But further and very important evidence is afforded on this point by the results of the use of salicylic acid and its salts in this disease. For many years the treatment of rheumatic fever in our large metropolitan hospitals has been synonymous with the use of salicylates; we have in consequence an amount of statistical evidence which proves the undoubted power of this drug in controlling the fever and in limiting the painful inflammation in the joints. But we have also learned that although it is a powerful antipyretic, cases of hyperpyrexia are as common under its use as they were under the older methods of treatment.[1] We find that convalescence is retarded, and that patients remain in hospital longer than before. That, according to various statistics, no less than 50 to 70 per cent. of the patients treated develop heart disease.

I have stated only the most prominent of the facts which may lead us to question whether the fever of rheumatism can be regarded as a result of the local inflammation of the joints, and this led me to consider whether remedies which act as agents for subduing the pain or controlling the fever, are of necessity the best that can be chosen for curing the disease which gives rise to them. If we seek for further guidance on the subject by making a study of the causes

[1] See paper by Dr. Donald Hood, read before Medical Society of London, Feb. 13th, 1888, in which the results of treatment of 9,850 patients at Guy's Hospital before the introduction of salicylate treatment were compared with 1,145 cases treated by salicylates at Guy's and St. Bartholomew's Hospitals.

which give rise to this particular form of fever, we are brought into contact with many apparently contradictory phenomena.

(1) The attack is most often due to a chill or exposure to damp, but it may occur in persons who have for a long time been confined to their rooms or to bed, when such causes have not existed.

(2) It is common among men exposed to muscular fatigue, but it occurs among delicately nurtured girls, who are not placed under such conditions.

(3) It is commonest in youth and middle age, but it may occur at a very advanced age, and it is noticeable that in its chronic forms this disorder is most common among elderly persons.

The only condition amongst those usually stated to which it is difficult to find an antithesis, is the combined effects of cold and damp in causing this disease. Even here we have to remember that out of a certain number of persons exposed to this condition only a small minority will develop rheumatism. To establish a connection between certain conditions and the symptoms to which we have given the name of rheumatism, leads only to paradoxical results, because we are working without a knowledge of the immediate causes from which these symptoms spring. If we except the "nervous theory" of rheumatism, ascribed to Canstatt and Seitz, but which is practically a modernised version of the views of Cullen, we may take it there is a

general agreement in favour of the existence of a poison which is the direct cause of the symptoms of rheumatism.

Whether this poison is admitted into the blood in the form of micrococci (Hueter), or exists there in the form of a vegetable organism (Salisbury), or enters the system in the form of a miasm, which resembles the effect of malaria (Maclagan), or is lactic acid which has accumulated in the blood or the excretion of which is prevented by the effects of a chill—according to the views of Prout and adopted by Todd, Richardson, Fuller, and most modern writers,—it appears probable that we shall be guided to a clearer understanding of this subject by considering the relation of causes to this poison than by trying to directly connect them with the symptoms it produces.

The symptoms of rheumatism are of a very marked and definite character, and it appears a proper line of enquiry to seek some substance which, introduced from without or manufactured from within, is capable of producing symptoms on the healthy body resembling those of rheumatism. I will venture, at the outset, to throw aside the consideration of poisons introduced from without, as there is no clinical evidence to support the theories which adopt them.

We know that the chemical laboratory of the human organism is capable of producing poisons, instead of beneficial products, as a result of derangement of its functions. We can produce an impairment of function followed by symptoms indistinguishable from a form of rheumatism, by

causing a person unaccustomed to great physical exertion to undergo excessive muscular fatigue. On the next day we shall find that the muscles which have been especially exerted are swollen, tender to the touch, and that every movement causes sharp pain. We shall usually find also that the reactions of the saliva and of the perspiration have become acid instead of alkaline, just as we find them in rheumatism. These symptoms are more temporary than those which follow the effect of a chill in a "rheumatic subject," because the disturbance of function in the healthy subject more readily tends to rectify itself; but the character of the symptoms is the same in both.

From the familiar experiment of the effects of muscular fatigue on the muscle of a frog, we know that the result of the over-stimulation of the motor nerve is to produce an accumulation of lactic acid in the muscle, the effect of which is to prevent the muscle reacting to the stimulation conveyed to the nerve. Before this fatigue took place, each contraction of the muscle was followed by an act of perfect combustion, in which oxygen was used up and carbonic acid gas and water liberated. But under the conditions produced by exhaustion the combustion is incomplete, and lactic acid is produced as an intermediate product of oxidation. If this lactic acid is washed out of the muscle by means of a weak solution of common salt, the muscle again responds when its nerve is stimulated. It is usual to explain the defective oxidation by which the

lactic acid is formed by saying that all the available oxygen is used up. This view is not entirely correct, because if instead of washing away the abnormal product we gently manipulate the muscle between the finger and thumb, we can complete the oxidation of the acid, and the muscle will again respond to stimulation. This tends to show that it is not the absence of oxygen, but of the power to liberate it, which is the cause of the imperfect combustion. This point is of considerable importance, because while it is demonstrable that the symptoms of muscular fatigue are due to the accumulation of sarco-lactic acid in its tissues, it is none the less true that fatigue of nerve, by preventing the liberation of oxygen, may be, and is, a direct cause of the production of this acid. There is, therefore, no direct antagonism between the "nervous" theories and the "poison" theories of this disorder. The fault of the former theory is that it does not take into account the many other causes which may produce defective metabolism.

We should not be right in saying that the rheumatic pains from which a person who has undergone over-fatigue suffers are directly due to lactic acid; all that we know of the direct effects of the excessive accumulation of the products of tissue waste in the muscles is that they cause a feeling of fatigue and loss of power, and this is not of necessity followed by the pains I have described, as we may gather from the study of such athletic feats as require the over-fatigue of muscles for many days in succession.

It is here that this enquiry brings us to the consideration of two sets of conditions and symptoms. The first has reference to the production of excess of products of the lactic acid type in the tissues, the conditions causing it, and the symptoms it produces. The second, to the manner in which this condition may lead to the symptoms of pain, inflammation and swelling of the affected parts, with or without fever. The increased manufacture of these products involves so slight a departure from ordinary function that the symptoms resulting may be so slight as not to attract attention; it is when this production is excessive and continuous that it causes definite symptoms. The conditions which give rise to the formation of lactic acid, instead of carbonic acid gas and water, and of uric acid instead of urea, are any which are capable of causing defective oxidation.[1]

There may be a defect in the supply of oxygen owing to the condition of the blood, or owing to impairment of its circulation in the tissues. In respect to the defect of circu-

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[1] The type of chemical change here indicated is well illustrated by Dr. Golding Bird. Starting with 1 atom of protein (which represents the ingredients of all muscular and fibrous tissue), and adding to this 91 atoms of oxygen, we obtain 1½ atoms of uric acid, 33 atoms of carbonic acid gas, and 30 atoms of water. The uric acid from its insolubility may be the exciting cause of a pathological condition, but if we add 6 atoms of oxygen and 4 atoms of water to 1 atom of uric acid, we obtain 6 atoms of carbonic acid gas and 2 atoms of urea, both of which are readily eliminated.

lation, it may be equally due to disuse or over-use of the muscle, to the influence of cold and damp, or to any cause which depresses the activity of the peripheral or central nerve centres. Thus the causes which appear conflicting when considering the symptoms of "rheumatism" are found to be acting in the same direction, when regarded as sources of imperfect oxidation. This condition is the cause of many troublesome ailments which the physician is called upon to treat, and which remain intractable because the nature of the ailment is not recognised. It is essentially a debility which leads to the production and accumulation of acids in the tissues.

Asthenoxia.

I shall speak of this condition as asthenoxia—a name derived from the Greek words Ασθενεια, debility, and Οξυς, an acid. It is not uncommon to find "an acid condition of the blood" described as an essential condition in gout and rheumatism, but this name does *not* imply the existence of this condition; on the contrary, I have examined the reaction of the blood in a wide variety of cases, including many of rheumatic fever, and the blood has been invariably alkaline. Acid products may be discovered in the blood in minute quantities both in health and disease, but the whole of my investigations go to show that the acids are not conveyed to the tissues by the blood, but are manufactured in the tissues

themselves, and that their destruction *in situ* is both the ordinary physiological condition, and the one which should be the aim of treatment.

When there is excessive accumulation of acid in the tissues, symptoms are produced corresponding with the action of a depressant poison on the system. A feeling of *weariness and indisposition to muscular exertion* is a prominent symptom. This symptom may be due to physical debility or to neurasthenia, but in both these cases exertion will be followed by exhaustion. In asthenoxia, *vigorous exertion will most often give relief.*

There is this peculiarity respecting exercise—an ordinary walk would cause fatigue, but cycling, riding or any form of exertion which raises the heat of the body, and causes vigour of circulation, temporarily removes the weariness previously complained of. In some cases mental depression is more marked than muscular inactivity. The patient either worries over matters which would not otherwise cause trouble, or recognises that there is no reason for depression, but is still profoundly depressed.

The *skin* commonly presents symptoms which point to defective circulation or disturbance of its nutrition. Instead of its natural transparency, it presents a dull opaque appearance, and sometimes we notice that unhealthy pasty look which is associated with the formation of comedones. Irritation of the skin, especially about the eyes and forehead, which sometimes passes into a low grade of erysipelas,

is invariably attributable to the condition of asthenoxia. Another very frequent symptom is a remarkable *sensitiveness of the skin to cold.* That chronic and oft-recurring skin eruptions are due to the condition of asthenoxia, and can be readily cured by removing this condition, is a fact worth noting, but I am not yet in a position to say more than that when these conditions are found in conjunction, measures should always be employed to remove the accumulation of acid from the tissues.[1]

Asthenoxia often occurs in association with *anæmia*, and renders this disorder very intractable; there is a reason for this to which I will presently allude, and which shows that the removal of the acids from the tissues should take priority over the remedial measures used for improving the condition of the blood.

An excessive accumulation of acid in the tissues sometimes causes *difficulty of breathing* which may be of a very urgent character. This may be proved by the immediate relief caused by methods used to remove the acid products. The relation of asthenoxia to *asthma* is of considerable importance in considering the treatment of the latter affection.

Before entering upon the study of the process by which the acid products of the tissues are converted into a poison

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[1] The so-called "gouty" eczema of adults, and the persistent and intractable eczema of infants is almost always due to asthenoxia, and yield readily to treatment when the acid products are removed from the tissues.

capable of producing active inflammation, I will mention one or two symptoms connected with the digestive system, which, standing mid-way between asthenoxia and rheumatism, are not ordinarily traced to their cause, and which prove very intractable to ordinary medicinal measures.

There is a form of gastrodynia which is associated with a decided tenderness over the epigastrium, and which closely resembles the symptoms of gastric ulcer, but it will be found that the tenderness is more diffuse and more superficial. It does not readily yield to the treatment or dietetic measures used for gastric ulcer, or if it is relieved by the effects of careful diet it readily recurs. An examination will often prove that the patient is suffering from asthenoxia, and the rapid and permanent improvement which follows the removal of this condition will afford proof of the cause upon which it depends. It is not uncommon to find a localised tenderness over other parts of the abdomen, unaccompanied by symptoms which would enable us to name a definite cause, and sometimes accompanied by symptoms, such as vomiting, which might lead to a very grave diagnosis. It is the absence of symptoms associated with the graver disorders, and the detection of the condition of asthenoxia, which will enable a diagnosis to be made and rapid relief given.

When asthenoxia is general it may be readily detected by the acid reaction presented by the saliva and the perspiration when tested with blue litmus paper. When it affects

only limited tissues, as a result of a chill, strain or injury, it presents no symptoms by which attention is called to it; but when a joint, or a limb, or any portion of the body has been exposed to any condition calculated to lead to local asthenoxia, the following symptoms may generally be elicited :—

(1) A comparison of the surface temperature of the part with that of the corresponding portion of the body will frequently show depression of temperature over the affected part.

(2) If the temperature of the whole body be artificially raised, the lower temperature of the affected tissues is frequently made evident to the patient, and a feeling of coldness in these parts is complained of.

(3) If the artificial raising of the body temperature is followed by perspiration, the reaction, while neutral over the remainder of the body, may be acid over the affected area. This frequently occurs, but is not an effect invariably produced.

The Nature of "Rheumatism."

A very extended series of observations confirms me in the belief that the condition of asthenoxia invariably precedes the manifestation of rheumatism, but that it is a disorder which may continue for months or years without the production of symptoms which would be recognised as rheumatic. It is necessary, therefore, to consider the

manner in which the acid products in the tissues may become changed so as to produce the rheumatic poison. If we refer to the results of overfatigue in the human subject, we find that it is not until some time after the actual exertion that the symptoms resembling rheumatism are produced, and then only in a marked degree in those whose muscles are feeble. The conditions presented, therefore, are an excess of lactic acid in muscles reduced to a low state of functional activity by the effects of over-fatigue. It is obvious that the muscle is not in a condition to remove the excess of lactic acid by combustion, and that some chemical changes must take place. It appeared to me that the effect of lactic acid on tissue in a low state of vitality might be studied on the muscles of a recently killed animal. If a portion of such muscle be placed in a concentrated solution of lactic acid, we shall observe that it is capable of entering into chemical combination with the muscle without destroying its structure. The muscle becomes semi-transparent, and exhibits an almost gelatinous appearance. The complete chemical transformation which has taken place is rendered evident by the fact that if this muscle is kept for weeks exposed to the air in a warm room, it will not undergo putrefaction or any observable organic change. It will be observed that the transparency of the preparation is increased by exposure to the air, and that such exposure is almost necessary to complete the chemical transformation.

Two fish which I have treated in this way and after-

wards exposed to the air in a warm room for four months, well illustrate this. In one of them the process of oxidation was rapidly completed by immersion in a solution of peroxide of hydrogen, with the result that the tissues are preserved in their natural state and are permanently preserved. When the oxidation is left to the action of the air, the tissues become more friable and less adapted for preservation as anatomical preparations; but both specimens represent the fact that acids such as are formed in the tissues are capable of entering into chemical combination with tissues when their vitality is lowered, without alteration of the anatomical structure of the latter, and during this process oxygen is used up, although destructive oxidation with the evolution of carbonic acid gas does not take place.

It is of very great importance to a clear understanding of the phenomena of rheumatism, that the process of oxidation which takes place in animal tissue should be understood. We are apt to think of oxidation as a process of combustion attended with the evolution of carbonic acid gas; but there are conditions of incomplete oxidation, when any carbonic acid formed is not given off, but re-absorbed, so that the addition of oxygen serves to form a more acid product than before.

Thus, if a piece of muscle which has been combined with lactic acid be placed in a bottle filled with a weak solution of permanganate of potash, and this bottle is connected by a glass tube with another containing lime water, it will follow

that if the process of oxidation which takes place is accompanied by the liberation of CO_2, it will pass along the tube, and cause the formation of a milky precipitate in the lime water. But the experiment may be watched for hours, and it will be found that no gas of any kind is emitted from the bottle, in fact, there is a greater tendency for the lime water to rise in the connecting tube, showing that there is some exhaustion of the air in the other bottle. The permanganate solution shows by its loss of colour that it has yielded up its oxygen, but neither this nor the CO_2 has passed away, and the only alteration observaable in the muscle is an increase of its transparency.

While lactic acid in its pure state is rapidly oxidised in the presence of an oxidising agent, we notice that when it has entered into chemical combination with proteid matter it is capable of using up oxygen to form a body, which I can show, but into the complex chemical nature of which I will not enter, but which has a more intense acid re-action than lactic acid itself. While free lactic acid may be regarded as a depressant to tissue functions, its combination with proteid matter and with a quantity of oxygen insufficient to produce complete oxidation causes the formation of an intensely acid product capable of acting as an irritant to the tissue, and producing those symptoms which we associate with the name rheumatism.

It will be understood, that by continually adding even a weak solution of an oxidising agent we shall finally reach

the stage of complete combustion; but it does not make too great a demand upon the imagination to suppose that under the conditions which tend to produce the accumulation of lactic acid in the human body, and the causes which lead to the imperfect oxidation of this acid, with the formation of the more acid product, the destruction of this intermediate body may not proceed faster than its manufacture, and this may explain the condition presented in cases of chronic rheumatism.

The previous experiment may be performed in another way. The lime water is replaced by some coloured fluid, and is connected with the other bottle by a fine capillary tube. Here the coloured water will be seen to pass along the tube in the direction of the bottle where the chemical process is taking place. Its passage not only indicates that there is no gas passing off from the bottle containing the acid muscle and permanganate solution, but that there is *no increase of temperature as the result of the chemical action.* Because if the temperature of the solution was only raised by the slightest degree, the effect would be to drive back the fluid, which steadily rises towards it along the capillary tube. This can be demonstrated by placing the hand on the permanganate bottle, when the fluid in the tube will immediately flow back again, owing to the expansion of the air caused by the slight heat conveyed to the bottle.

But it is quite possible to cause complete combustion in this experiment by still further *raising the temperature of*

the bottle in which the process is being conducted. The same result may be accomplished by adding a stronger solution of the oxidising agent. It is not only the *quantity* of oxygen, but the *energy* with which it is supplied which determines complete combustion. When we cause this energy in either of the ways I have mentioned, phenomena are produced resembling those of acute rheumatism. While the process is taking place, intensely acid products are formed which undergo combustion, and are given off in the form of CO_2 and water. The process occupies some time, and while it continues, there is a decided rise of temperature in the solution.

If in the light of these investigations we again approach the question of the cause of fever in rheumatism, we have before us the following data:—

(1) A person suffering from asthenoxia, whose tissues are charged with excess of lactic acid, is exposed to a chill; the primary effect is to diminish the force of the circulation and the amount of oxygen to the tissues, the secondary effect is an increase of both.

(2) The result is to render chemical change in the tissues more rapid—to cause, in fact, the rapid oxidation of the products of tissue waste. It is known that active chemical change produces a rise of temperature, although it is a very slight one; thus if I add a solution of lactic acid to one of carbonate of soda, active effervescence takes place and the thermometer will show a rise of temperature equal to a frac-

tion of a degree, but if, instead of using carbonate of soda, I employ a solution of permanganate of potash (*i.e.*, an oxidising agent), there is again brisk effervescence, and the thermometer will show a very decided rise of temperature. (The experiment was performed and the temperature of the solution rapidly rose from 60° F. to 140° F.)

It would be impossible to discuss here the relation of the constant oxidation of lactic acid, or it would be more correct to say, the chemical bodies which it represents, to the maintenance of the body heat, or the general relation which its more rapid oxidation bears to fever as a symptom; but this fact will be constantly observed: A patient who suffers from an ordinary chill, with no symptom but fever, or perhaps one of the forms of tonsillitis, or some other slight affection which enables us to give a name to the disorder, will usually exhibit (my experience is not sufficient for me to say, invariably) an acid state of the saliva and perspiration, which will continue during the continuance of the fever, but which *will disappear when the fever abates.* The exception to this is that the acid reaction may continue after the fever has abated; in such cases, it is my experience, that convalescence is delayed, and I treat such patients for asthenoxia, and directly the acid reaction disappears they make rapid recovery. The method of testing this point is so simple that I prefer to wait for the accumulated experience of others before asking that my view should receive a too extended application.

My own clinical observations leave no doubt upon my mind as to the fact that if four persons suffering from the same degree of asthenoxia each contract a chill, probably only one of these would develop rheumatic fever; and that while the other patients would show a degree of fever out of proportion to their inflammatory symptoms, that of the rheumatic fever patient would be comparatively lower, although the fever would be of longer duration. He exhibits the symptoms of rheumatism because the functional activity of the tissues is not sufficient to completely oxidise the acid products, but permits it to enter into that combination with the tissues which I have already explained.

The addition of permanganate of potash to lactic acid represents the first three cases—a process of rapid oxidation with a high temperature is produced. The addition of a weak solution of permanganate of potash to muscle treated with lactic acid represents the rheumatic case. With the addition of heat produced by fever, active changes take place which finally destroy the acid, but they are slower and less vigorous than the former reaction.

General Treatment of Rheumatism.

From the experiments we have made it will be seen that the quantity of oxygen required to decompose the rheumatic poison is in inverse ratio to the amount of the heat supply. These facts bring us to an obvious conclusion. The

fever which attends rheumatism, and the acute fevers from which an asthenoxic subject suffers, represent the destruction of a poison; and the result of such attacks should be followed by an improvement in the general health, if the process is helped by the physician, rather than that every effort should be made to check the salutary process. It is well known that all the ordinary antipyretic remedies, the salicylates and quinine, serve to *diminish* tissue metabolism. By offering a temporary check to the imperfect process of oxidation by which the rheumatic poison is formed, they may effect an improvement in the external symptoms; they leave however the acid products undestroyed, and the vital powers in a worse position than before to complete their destruction. Convalescence is delayed, a greater tendency is shown for the disorder to pass into the chronic form, and relapses are frequent. This is precisely what our studies would lead us to expect, and from the results of the use of such drugs they receive their strongest confirmation. In respect to the deplorable frequency of heart complications under the use of salicylates, it appears probable that when the tissues are charged with the rheumatic poison, and the natural processes required for its combustion *in situ* are checked, the poison is taken up by the lymphatics and is thus conveyed to the heart.

While rheumatic fever is regarded as due to an acid condition of the blood, little importance will be attached to the necessity of its prompt removal from the tissues; but

having proved that acidity of the blood is not a normal occurrence in rheumatism, and that the poison is formed and decomposed in the tissues, then the great importance which I have learned to attach to its active destruction and ready elimination will be appreciated.

Both in asthenoxia and rheumatism the presence of acid products in the tissues, by depressing their vitality, favours further production. Their removal, therefore, is the first indication for treatment. It is obvious that all methods which favour increased metabolism assist the destruction of the poison. The most rapid method of increasing metabolism is by raising the temperature of the body, by simulating, in fact, the process which occurs in fever. The effect of heat applied to the body is threefold :—

(1) It directly facilitates chemical change.

(2) It causes an active circulation, and therefore an increased supply of oxygen to the superficial tissues.

(It is worth noting that while a rheumatic patient may exhibit a very high temperature, the appearance of the skin usually shows defective circulation in the superficial tissues, which do not receive the full effect of the brisker circulation caused by the fever. This explains why "natural" fever is less effective in increasing metabolism in the superficial tissues than the application of heat to the surface.)

(3) It aids the elimination of waste products by means of perspiration.

In reference to this point it is important to observe that

the act of sweating is not in itself a cure for rheumatism. Continued sweats are common in both acute and chronic cases, and experience shows that they do not give relief. They are due to an almost paralytic condition of the vaso-motor nerves, the result of the poisoned condition of the tissues; thus while it favours the elimination of waste products it also favours their production, with the result that no benefit results to the patient. The application of external heat in such cases gives immediate and appreciable relief, and its subsequent result is to *limit the amount of sweating*.[1]

In cases of asthenoxia and the slighter forms of rheumatism, a wide choice of methods for raising the body temperature is open to the practitioner; but in acute cases, or when there is some debility, we are practically restricted to those which can be administered while the patient is in the horizontal position. Bearing in mind the fact that the secondary effect of heat is to diminish tissue metabolism, it is desirable to use no greater amount of heat than is necessary to raise the body temperature, and at the same time cause perspiration. The raising of the body temperature without the act of perspiration would cause discomfort to the patient. Hot water baths are *inadmissible* in acute inflammatory condi-

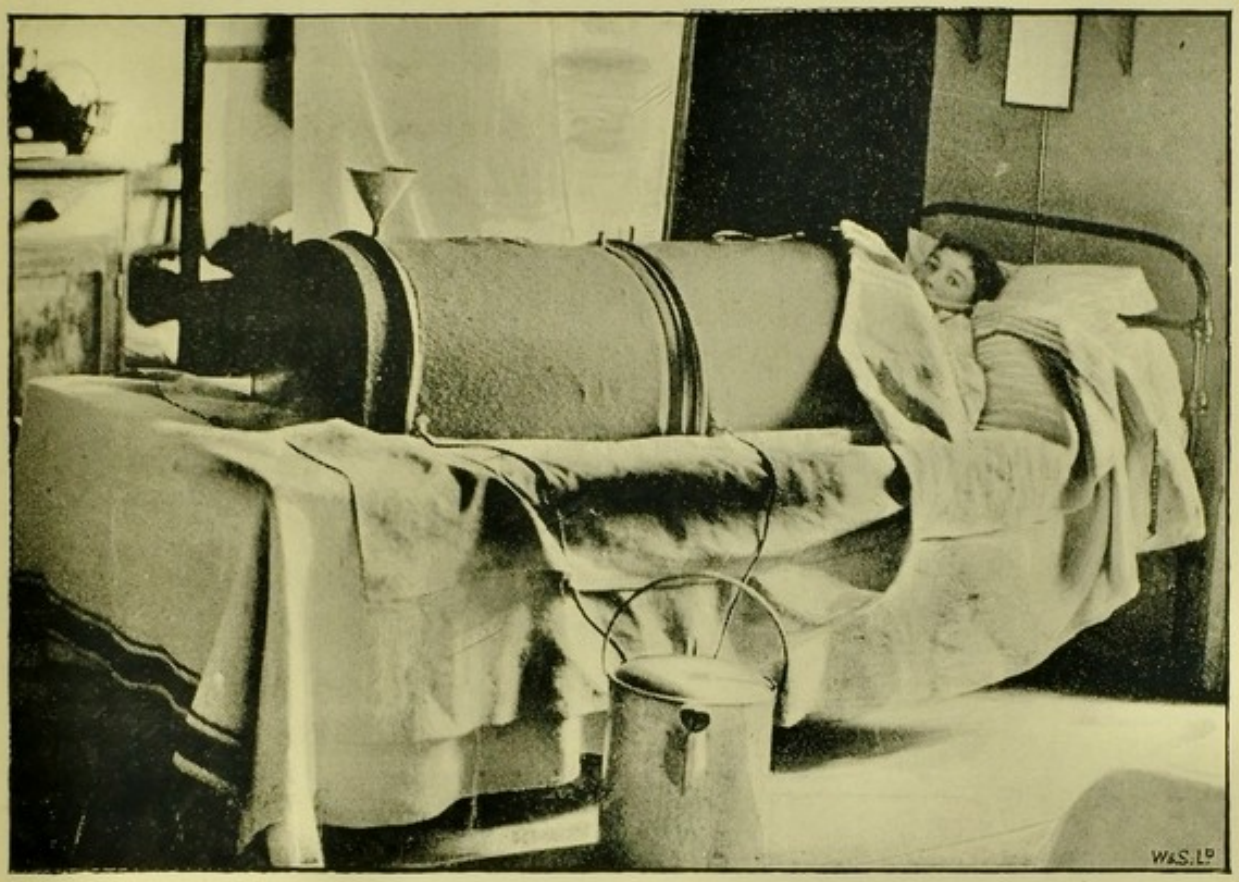
[1] It is worthy of notice that the skin eruption which frequently occurs in rheumatic fever, and which is due to excessive sweating, did not occur in any of the cases treated by artificially raising the temperature of the body.

tions, because they cause too much arterial excitement; they are valuable for the same reason in the chronic forms.

One of the most satisfactory methods, and one which need never be omitted because of a difficulty in obtaining appliances, is the "hot moist blanket pack."[1]

The only objection to this in the treatment of acute rheumatism is that it requires a certain amount of lifting the patient or his removal from the bed. The same objection applies to the other methods in ordinary use. To obviate this difficulty, and to remove that sense of restriction which many patients find unpleasant while packs are being given, I invented an appliance which I have called "the Vaporarium." It consists essentially of a metal cover, large enough to form an arch over the patient while lying in bed, and to extend from the shoulders to the feet, at which end it is closed. This cover is double, so that a space of a little less than half-an-inch is left between the outer and inner surfaces. This space is filled with boiling water, and it is the heat radiated from the metal, in addition to that given off from the patient's body, which forms the means of raising the body temperature. As moisture is necessary, this is provided by simply wringing a piece of flannel out of hot water and enclosing it inside the appliance—practically it is laid upon the patient's body. This appliance can be recharged without removing it from the

[1] For details of the method of employing the hot pack, see p. 47.



The Vaporarium.

patient's body, but this is never necessary, as it will retain its heat for a longer time than is required for any single process. For convenience it is made in two halves, and it is when these are used separately for a prolonged vapour bath to the upper or lower part of the body, that the advantage of being able to refill them, or keep a constant stream of hot or cold water circulating through them, makes itself apparent.

The effect of raising the body temperature in cases of asthenoxia and rheumatism differs from that which follows it in fever arising from other causes. Its use in such cases is usually followed by a marked fall of temperature, which can be made permanent if the process is repeated daily, or oftener if necessary. The effect is not that of an antipyretic, but that of an agent which checks the inflammatory condition, and the fall of temperature is accompanied by improvement in the physical signs. In cases of asthenoxia or rheumatism attended by a febrile condition but no actual pyrexia, the effect of artificially raising the body temperature is frequently to cause a permanent increase of temperature which may last several days. I do not mean by this that a single temperature is maintained, but that the daily rise and fall is higher than that of the preceding day, and under the influence of daily applications of heat this rise will continue for a certain number of days, when there will be a sudden fall of temperature after the use of artificial

heat, and the temperature speedily falls to normal, at the same time the reactions which were acid become neutral.[1]

No stronger indication could be afforded of the general correctness of the views which this investigation led me to adopt than the observation of one of these cases. The effect, so far as the temperature chart is concerned, is to produce a mild attack of rheumatic fever, but apart from the indications afforded by the thermometer there is nothing to show a febrile state, on the contrary the patient feels better each day, the symptoms formerly complained of abate, and the whole appearance manifests improvement.

Although the aim of the treatment I have adopted for some years is to convert all sub-acute and chronic cases of rheumatism into acute ones, the expression must be taken to represent the symptoms exhibited by the temperature chart, rather than those of which the patient is conscious. The pain in the joints or the feelings of general malaise are always mitigated from the first day of treatment.

It would appear to follow from these results that in cases of acute rheumatism, attended with marked pyrexia, the same treatment would tend to increase the fever to a

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[1] It will be remembered that while the normal reaction of the perspiration and saliva is alkaline, the first is mixed with the acid secretion of the sebaceous glands, and the latter with the acid mucus of the mouth, and that therefore as we examine them clinically, the normal reaction may be said to be *neutral*. But when either of the mixed secretions leaves blue litmus paper unchanged, we may take it that the pure saliva, or pure secretion of the sweat glands, is *alkaline*.

dangerous extent. But it does not happen to be so in practice. The reason of this appears to be, that as the fever is simply the product of a more rapid process of oxidation, and as there are limits to the degree to which this process can be stimulated, depending upon the supply of oxygen, a natural safeguard is interposed between excessive oxidation and the production of such a degree of heat as would endanger life. Experience shows that antipyretics and the use of extreme cold, which check tissue metabolism, do not reduce the fever in cases of true hyperpyrexia, but that the temperature will continue to rise when all the vital powers are at their lowest ebb. If it is due to the direct effect of the poison upon the heat-producing centres, this will account for its comparative frequency under the use of antipyretics, which arrest the destruction of the poison, and its absence in the 107 cases of rheumatic fever which I have treated by raising the temperature of the patient.

Another source of anxiety which the practitioner may have in adopting this method, is the propriety of doing so when the patient is very debilitated or has a weak heart. If this debility is due to the presence of unoxidised products in the system, or is maintained by them, I can affirm from the results of the use of this process many thousands of times, that it is not only free from risk, but that it will yield speedy and more permanent results than any tonic which could be selected.

It is time to mention that although I have spoken only

of the use of heat, each of these applications is followed by the use of tepid water to the surface of the body. This consists in uncovering one limb at a time, sponging with water at 75° F., and rapidly drying with a towel, which is not wiped along the surface of the skin, but lightly and briskly rubbed to and fro over it. It is then covered up and another portion of the body treated in the same way, until the whole body has received both the application of water and friction to the surface of the skin. The object of this is obvious. Heat forces tissue metabolism, but its after effect is to diminish it. Cold[1] and friction of the skin stimulate the natural production of heat, and increase therefore oxidation in the tissues. It would be possible, when the vital reaction is good, to use no other agent but cold to obtain the object we have in view by the use of heat, but the result would be slower, and the great relief to pain which the method I adopt gives would not be obtained. But so soon as the neutral reaction of the perspiration shows that the acid products have been removed from the tissues or reduced to a low ebb, then the use of heat can be abandoned, and the "Cold friction" which I have described, but carried out more vigorously, becomes the main treatment necessary. This is done

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[1] As explained in my article on Thermo-therapeutics (*Medical Annual*, 1890), heat and cold are relative terms. The physiological effect of water at 75° F., following that of vapour at 105° F., is that of "cold," although it is "tepid" when considered in relation to the normal temperature of the air.

by lowering the temperature of the water to 65° F., and finally to 50° F., and using more prolonged friction.

I attach immense but not too great an importance to this simple process, not only in the cure of asthenoxia and rheumatism but also in other forms of debility, and in none so much as persistent *anæmia*. By it all the good effects of cold baths can be produced, without shock, risk or danger, no matter how delicate the patient may be.

When the patient's cutaneous circulation is so far restored that ready reaction takes place, the third stage of treatment may be commenced. This consists in the use of various physical manipulations and exercises to restore tone to the joints and muscles which have been affected by the disease.

There is a natural difficulty attending the preparation of statistics bearing on the treatment of rheumatism, because the disease is always variable in its course and termination. In respect to the frequency of heart complications, in the 107 cases of acute rheumatism I have mentioned, by which I mean cases accompanied by continued fever, no cardiac complications have taken place.[1] I do not take this as evidence that such complications will never occur in patients treated according to the method I have described, but that such a proportion as seven out of ten should have heart complications is quite impossible.

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[1] Since this paper was read the number has risen to 111, a record unique in the history of the disease

As regards the pain and inconvenience caused by loss of power during the acute attack, I think that the testimony of my nurses is more eloquent than any statement I could make. The treatment I adopt gives more labour to the nurses than the administration of medicines at stated intervals, but they are all of opinion that the actual labour of nursing a case of rheumatic fever is far less under my method than in ordinary cases, because throughout the attack the patient is better able to assist himself, and suffers so much less pain.

In respect to convalescence and after effects, we have learned to expect that the patient will be in *better health* after the attack of rheumatic fever than before it. When it is remembered that this acute attack is Nature's effort to free the system of a depressing poison, there is nothing extraordinary in this result, although it is contrary to ordinary experience. One point we are careful to impress on patients dismissed from the hospital, and that is to return for examination in six months. If the symptoms of asthenoxia are present, although the patient is in apparently good health, we give treatment to remove this condition, which usually occupies a week, and saves the patient from an attack of acute or chronic rheumatism.

I claim that rheumatism is one of the most *preventable* disorders as well as one of the commonest from which the inhabitants of this country suffer. It is only necessary that the physician should detect the very common condition of

asthenoxia, and employ the simple method I have described for its removal. Let it be understood that I do not assert that the discovery of this condition indicates that the patient is "rheumatic," but it means that if this condition is allowed to continue, rheumatism is one of the forms of disorder from which the patient may be expected to suffer; but there are many others beyond those to which I have already alluded.

The removal of the excess of acid may not take more than three days, and in many cases the relief from its depressing conditions enables the *vis medicatrix naturæ* to assert itself, and the condition does not return; but when it depends upon a debility of circulation, of muscle or nerve, we must only regard the patient as cured when these conditions are removed.

While these investigations explain why physical methods which have been held in certain estimation in the treatment of rheumatism produce these effects by overcoming mechanical obstacles which hinder the cure of the disease, they do not prove that remedies are useless—on the contrary, they make it the more clear that all medicinal agents which act as specific stimuli to the tissues affected by rheumatism, or act by augmenting the general metabolism of the body, must be of value in removing the cause of the disorder. No object is to be gained by claiming too much for one or the other. The method of physic and physical methods are most powerful for good when they act to-

gether, and both are useless unless properly selected and judiciously administered.

As a general remedy for the asthenoxic condition, I have found none answer better than a liquid extract made from the common Shepherd's Purse—"Bursa Pastoris." Its effects upon tissue metabolism are usually rapidly manifested by the increased deposit of urates in the urine of patients taking it. I usually employ a dose of two or three drops in half a tumbler of water, three times a day.

PART II.

PRACTICAL NOTES ON THE DETAILS OF TREATMENT.

SINCE the previous pages were read before a Medical Society, I have seen paragraphs in the press which state that it is by the use of special appliances invented by myself that I have attained so much success in the treatment of rheumatism. Although it is a fact that I have used such appliances during the past three years, I should be sorry for the impression to remain that their use is essential to the successful treatment of rheumatism.

In hospitals, and in a practice like my own, where the process of raising the temperature of the body has to be carried out many times a day, the Vaporarium has many advantages, both on account of its convenience and the greater comfort it affords the patient, but the hot moist pack, *when properly administered*, answers most practical purposes. I have seen also the statements of some medical men, who already propose to improve upon my method by the use of appliances which would either fail to raise the temperature of the body, or do it under circumstances very disadvantageous to the patient. I do not wish to assume that no better methods than those I have described can

be invented, but there are certain general principles which must be complied with if the operation is to be carried out successfully, and with due regard to the safety and comfort of the patient, and it may be as well to state them.

(1) *Local applications of moist heat have only a transient effect in raising the temperature of the part to which they are applied.*

When heat is applied to a portion of the body, the temperature of the skin is raised to that of the substance applied, but this lasts but a few seconds, and is followed by a rapid fall. The temperature of an ordinary poultice is generally below that of the body within eighty minutes of its application. The time taken for the reduction of temperature to normal does not depend (as is generally supposed) on the amount of cotton wool, oil-silk, &c., placed over it to retain the heat, but upon the *thickness* of the poultice itself and the amount of water at a high temperature it is capable of retaining. The reason is, that the poultice does not lose its heat by radiation, which is limited, but by conduction; the blood-stream coursing through the part to which it is applied acts as the conducting medium, while the remaining part of the body, which is uncovered, permits free radiation of the heat taken up.

To raise the temperature of the body it is necessary that means be taken to check the radiation of heat from as large a surface as possible.

The raising of the temperature of the body does not depend only on the amount of heat added, but upon the degree to which radiation is checked; thus hot air is not suitable because it favours the radiation of heat. Lamp baths and vapour baths, in which the patient's body is exposed to the products of combustion of a lamp, are objectionable, because we surround the tissues with carbonic acid gas at a moment when we are trying to eliminate carbonic acid gas from them and increase oxidation. The capacity of the skin for the absorption of gases is known, and while I am quite prepared to admit that under the circumstances the exhalation may overcome the cutaneous inhalation, I think it is a method which should be avoided except under very exceptional conditions.

In the *Vaporarium* a metal surface surrounding the patient at once provides the obstruction to radiation and the source of heat in the Pack, the blankets check radiation, while the hot moist blanket provides the necessary heat and moisture.

While moisture is necesary, the quantity should not be excessive.

In the Russian steam baths the quantity of moisture deposited on the skin more closely approaches the effect of the hot water bath, and while it is suitable in chronic cases, it is too exciting when the joints are inflamed. In the use of packs, too great a quantity of moisture entails *loss* of heat, as the heat of the superfluous water has to be maintained

by the body. This is not so important when the temperature of the body is already above normal at the time of application.

The patient should be in the horizontal or semi-reclining position.

The first effect of the application of heat is to cause a relaxation of the superficial blood-vessel, with a consequent abstraction of blood from the internal viscera; the heart is stimulated to increased effort, and it is easy to understand that persons who have a feeble cerebral circulation or a weak heart may feel faint or exhausted if the process is administered in the sitting posture.

The ordinary vapour bath as used at our public bathing establishments, where the patient sits in a chair, with his head through a hole in a box, provides a graphic illustration of the manner in which such baths should NOT be given. First used by persons without knowledge of ordinary physiological principles, it has been copied and recopied by the various establishments both in this country and on the Continent. I have met with a large number of persons who declare, from experience, that they cannot take a vapour bath or similar application without suffering or subsequent exhaustion, but both in these cases, as well as in those who suffer from organic disease of the heart, I have never seen anything but beneficial results from such baths when properly administered. I believe I am the only physician who has given patients suffering from both acute and

THE PACK.

FIG. II.—Shewing the first position of the patient during the application of the moist blanket.

chronic heart disease, baths of this character once in twelve hours for fourteen to eighteen days in succession, and therefore I do not speak without experience. It must, however, be understood that such applications are made with every care as regards details, and that the position of the patient is amongst the most important of these. I trust that this statement will not induce other practitioners to try the "same" treatment, omitting some of the details upon which I think it so necessary to insist, or to try other methods which will do "as well or even better."

The Administration of the Hot Moist Pack.

The following description is given in detail at the wish of several physicians who have written to me since my paper was read.

(1) Four blankets are laid upon a bed; the upper edge of these should be six inches above the lower edge of the pillow. A mackintosh sheet can be conveniently substituted for the upper blanket when "packs" are given systematically.

(2) The blanket to be moistened should be somewhat smaller and thinner than the rest; a convenient length is twelve inches longer than from the neck of the patient to the feet. An ordinary "under-blanket" answers very well.

(3) This blanket should be folded as follows before it is moistened. One side should be rolled tightly, over and over until the centre line is reached; the other side is treated in

the same way until the two rolls meet in the centre. The roll is then folded in four for convenience of moistening.

(4) It is now put into a hip-bath or small, tub and *boiling* water poured over it. I find by experience that it is not advisable to economise the water, as the more thoroughly the blanket is permeated the longer the heat is retained.

(5) The blanket is more easily wrung out by two persons. A towel (the ordinary "round towel" is the best) is slipped over the free end of the blanket (which is too hot to hold in the hand) and twisted until it has a firm grip, and then held, while the other person passes a short stick through the loop formed by the fold of the blanket and twists until the superfluous moisture has been removed.

(6) The roll is now laid lengthways in the centre of the bed, the upper end being on a level with the lower edge of the pillow. It is now ready for the patient, and is unrolled sufficiently for him to lay in the centre, with the head resting on the pillow in the ordinary position. The advantage of the rolling of the blanket is that it ensures that the patient occupies the exact centre of the moist blanket, and also prevents the radiation of heat should any delay take place while the patient is getting into position.

(7) Directly the patient is in position, he is directed to raise both arms above the head, and the blanket is at the same time unrolled.

(8) Standing on the right side of the patient, the left upper corner of the moist blanket is carried across the

chest and under the right arm-pit, and tucked smoothly behind the shoulder blade. The lower part of the blanket is drawn firmly over the chest and abdomen, and tucked under the body on the right side. It is drawn less closely over the legs, so that after it has been tucked in, the side of the hand drawn between the legs brings it in contact with their inner surface.

(9) The patient now lowers the arms to the sides, and the right corner is brought well under the chin and *over* the shoulder, and tucked smoothly under the shoulder blade; the lower part of this side of the blanket is treated in the same manner as the other, except that it is drawn tightly over the legs.

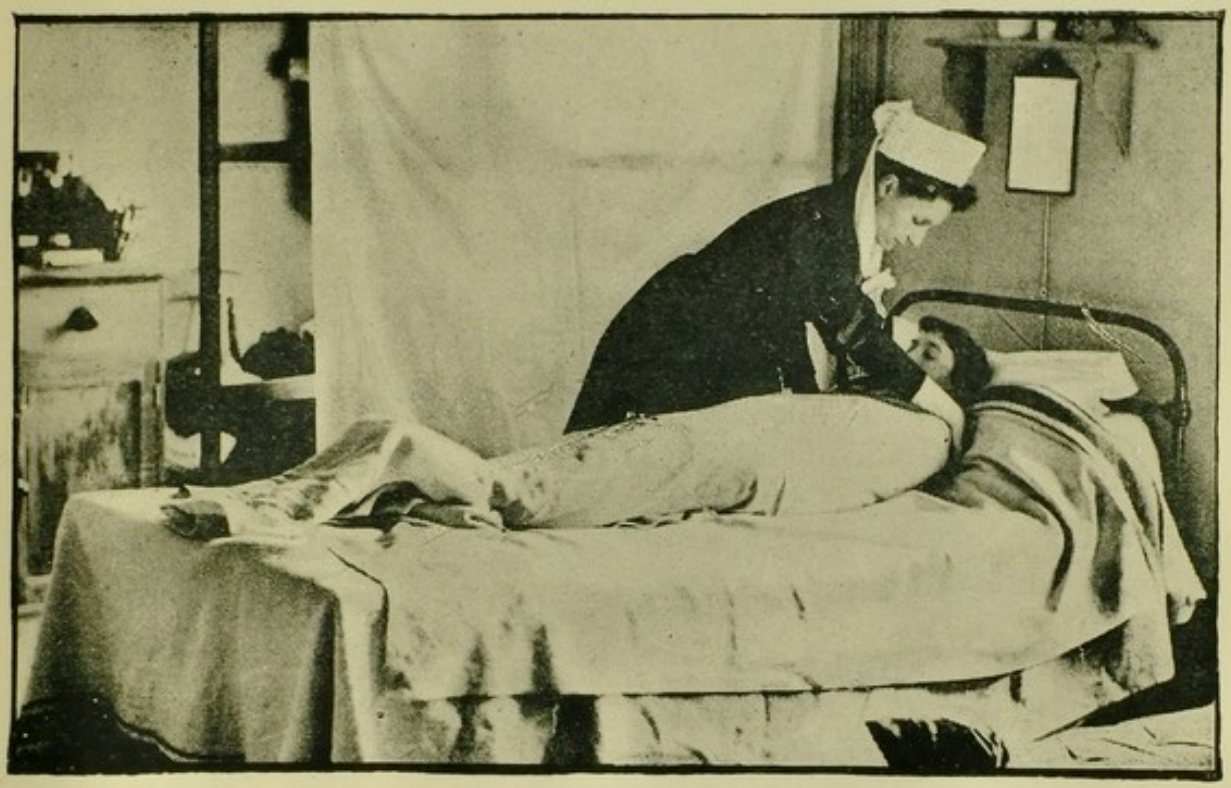
(10) The dry blankets are each *separately* applied in the same order, care being taken to bring the upper corners well under the chin and pack it closely under the opposite shoulder, so that no open space is left about the neck, and the blankets are packed as closely and as smoothly as possible under the opposite side of the body.

(11) A space now exists at the feet beyond which the blankets project rather more than twelve inches; an ordinary hot water bottle or tin should be placed in this space, against the feet, and the free ends of the blanket folded over the feet and secured.

(12) The patient is now left in the pack *until perspiration makes its appearance on the forehead.* This usually takes from twenty to thirty minutes. It is not advisable to fix the

duration of the pack by time, but by the symptom of the appearance of perspiration. Should there be no sign of this after twenty minutes, it may be hastened by giving the patient a cup of tea by means of a feeding-cup. There is no advantage to be gained by prolonging the pack after perspiration has commenced, as the object of treatment is not to produce sweating, but to stimulate oxidation. On the other hand, if the temperature of the body is raised without producing perspiration, discomfort is caused to the patient.

This may be witnessed every day at British and Continental Mineral spas, where a "hot pack" is a part of the regular routine adopted. The pack consists in putting very hot towels about the limbs and body of a patient who has just emerged from a hot bath, and then wrapping him round with a single blanket. The result is that a large proportion of the patients are simply over-heated, and come away from the bath with flushed faces and frequently a throbbing headache. The effect of the hot towels is to dissipate the moisture already on the skin, so that the patient is practically dry when the blanket is applied; the single fold of blanket is not sufficient to check the radiation of heat, and so only the more feeble and relaxed, perspire. In either case the patient receives no cooling or cleansing process after the pack, and is allowed to dress and go home under conditions which are not without danger; and the result is so invariably followed by feelings of weariness and fatigue that the bath physicians, in their wisdom, recommend that the bath should not be repeated oftener than once in forty-eight hours.



The Pack.

Fig. III.—Shewing the second position of the patient during the application of the moist blanket.

When the patient is suffering from fever or other condition which prevents removal from the bed, the pack is applied as follows :—

The dry blankets and mackintosh (which are warmed previously) are spread in their proper order on the floor of the room and rolled up as tightly as possible, from side to side, until they form one large roll. The nurse, standing on the right side of the bed, directs the patient to turn on the left side, towards the edge of the bed. The roll of blankets is now unrolled, starting from the right edge of the bed to well up to the patient's back ; the patient turns over on the right side, and in doing so comes on the other side of the roll, which is now carried to the left side of the bed. The night-dress is then removed, and the wet blanket is applied precisely in the same manner, except that it is rolled in the manner directed on page 47.

In the case of a patient too ill to turn from side to side, the application is made in practically the same manner, except that the blankets are rolled lengthways instead of from side to side. The roll is then applied, commencing at the feet, each part of the body being lifted separately as it is rolled towards the head.

Application of Vaporarium.

When this appliance is used, the lifting and turning of the patient is unnecessary. A small under-blanket is wrung out of boiling water and laid upon the patient's body. The

two halves of the appliance are filled with *boiling* water, and are placed over the patient.[1]

The Removal from the Pack.

(1) The three outside blankets are unfolded and laid on each side of the patient; it is then convenient to take a spare blanket and lay it over the patient while the wet blanket and mackintosh are being removed.

(2) The patient is now directed to turn on to right side, and the wet blanket and mackintosh are rolled up towards the body. The patient then turns over on to the left side, and in doing so the body falls naturally over the roll of wet blanket and comes on to the dry ones. The wet blanket is then removed, and the patient turns again on to the back. This little manœuvre is done under the spare blanket, which has been placed over the patient as before indicated.

(3) The sides of the dry blanket are now again turned over the patient, and he is ready for sponging.

Tepid Sponging.

(1) Standing on the right side of the patient the face is first sponged with water at 75°F. and dried.

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[1] These appliances cost me about £8 each. The copper of which they are made requires to be especially rolled, and I have had some trouble in getting them properly made. When manufactured in larger quantities the cost will probably be less.

(2) The blankets on the left side are raised sufficiently to expose the upper part of the chest and left arm. This is rapidly sponged over and dried, and immediately re-covered with the blankets.

(3) The blankets on the right side are now raised, and the right chest and arm are sponged and dried.

(4) The lower part of the chest and abdomen are next treated, first the left, and afterwards the right side.

(5) The lower limbs, thighs, from hip to knee, are then sponged in the same manner, and afterwards the legs, from the knees to the feet.

(6) The patient now turns on to the left side, so that the back is facing the nurse. The upper part of the back is sponged and dried, and re-covered; next the lower part is treated in the same manner. The backs of the legs and thighs are usually sponged while the patient is lying on the back, but if the limbs are very much crippled, this part is done while the patient is lying on the side. The rule is to always sponge the part furthest away, first, and re-cover the limb immediately it is dry.

Cold Friction.

When "cold friction" is ordered it is performed precisely in the same way, except that the water used is cold, and the friction of the skin is continued after the part is dry, until the skin is reddened.

Selection of methods and frequency of application.

In most disorders of the rheumatic and asthenoxic class, the hot and the cold methods of stimulating oxidation have to be employed either separately or in conjunction at various stages of the treatment, and success depends on knowing when one should be used or the other should be chosen. The ordinary symptoms presented by the patient afford very little guide, but by classifying the results of a very extensive series of observation I have been able to lay down certain rules for my own guidance, which not only afford the requisite indications for treatment to be pursued from day to day, but which enable me to give a decided opinion upon the course and probable duration of the case at a very early stage. The series of observations upon which I rely are those which I have made on the effect of heat and cold on the temperature of the body under varied conditions of the individual. I do not propose to enter here into the full consideration of this new field of clinical enquiry, but will give such indications as are necessary for our present purpose.

CLINICAL OBSERVATIONS.

It has been always accepted as a fact that if the body is exposed to a certain degree of heat and to conditions which check the radiation of heat from the body, there will be a uniform rise of the body temperature depending on the physical environment of the patient. Thus Leibermeister has shown that a man placed in a bath at the temperature of the body, will show a rise of temperature of 1°C. in one hour. This is in consequence of the water surrounding the body preventing the natural radiation of heat. If the temperature of the water was higher than that of the body, we should have a greater rise of temperature during the same period, and it should be possible to construct a table showing the precise rise of the body temperature which would take place under different degrees of heat, and according to the time during which the patient is exposed to such conditions. But as a result of repeated observations I found that the rise of the body temperature in patients exposed to precisely the same conditions, not only presented wide variations, but the temperature of the individual patients varied from day to day. This shows that the rise of temperature does not wholly depend upon the physical environment, but upon processes due to the condition of the individual. I have

already shown that a process of oxidation can take place resembling that which occurs in the body, without any rise of temperature taking place. I have also shown that the same process taking place more rapidly was accompanied by the evolution of a large amount of heat.

I further found that when the re-action of the saliva and perspiration is intensely acid, showing that the tissues are charged with incompletely oxidised products, the rise of temperature which occurs during the hot pack is very much greater than in the same individual when excess of free acid has been got rid of. Therefore the rise of temperature which takes place as a result of the pack affords an indication of the amount of free acid in the tissues.

It will be found in cases of acute rheumatism, that the rise of temperature which takes place after the pack on the first two days is greater than that which takes place at any other period of treatment. If the use of the pack was continued too long or too frequently, an actual *fall* of temperature may take place during its administration. It is not uncommon in cases of rheumatic fever, where packs are being given twice a day, for a fall of temperature to take place during the application, and under the same conditions an alkaline re-action of the saliva and perspiration may present itself. This only shows that oxidation is being stimulated more rapidly than the tissues can perform the work of metabolism. I have before mentioned that the metabolism of the tissues can only be stimulated within certain limits, and this will

explain why a patient with a temperature, say, of 104° F. will only show a rise of temperature of ½° F. during the pack, while in a patient with a temperature of 100° F., a rise of 3° F. occurs under the same conditions. But the same patient, with a temperature of 100° F., may show a fall of ½° F. during the same process repeated a few days later. These remarkable variations afford a graphic proof of the influence of tissue metabolism on the body heat, and show that the use of artificial heat will stimulate this process, providing that there are *imperfectly oxidised products* to be consumed.

We are so accustomed to associate rheumatism with an intensely acid re-action of the perspiration, that I think it would astonish many physicians to examine a patient during the height of an attack of rheumatic fever and find that the re-action was neutral, and it might also create some surprise to find a patient surrounded with vapour and a temperature of 105° F., and the radiation of heat from the body checked by blankets or hot metal, and yet an actual fall of temperature being produced as a result of the process. Yet such conditions can be produced at will, by frequent repetition of the process. There is no object in doing this, but the fact that it *can* be done demonstrates the completeness with which the theoretical views advanced in the first part of this paper can be demonstrated by the bed-side.

There is another point of great interest which arises as a result of observations of the temperature of patients, and

the reactions. I have previously distinguished between the accumulation of unoxidised products of the lactic acid type in the tissues, and the same products after they have entered into chemical combination with the tissues themselves. I have spoken of the first condition as asthenoxia, and the second as that of rheumatism. In rheumatic fever we have both these conditions, and we may say that there is always a greater or lesser degree of asthenoxia in all cases of rheumatism. It will be remembered that free lactic acid is readily soluble in all proportions, while acids in combination with proteid matter are separated with much more difficulty. The quantity of fluid necessary to remove the acid reaction of muscle which has been exposed to the action of lactic acid, is very great, and it is surprising what a large quantity of fluid a small piece of such muscle will acidulate. We have therefore in rheumatism the free acids in the tissues which give the acid reaction to the perspiration, and also the latent acids, which, while they remain in combination with the tissues, do not cause any acid reaction of the saliva and perspiration, but directly the process of metabolism causes the breaking up of the chemical combination, the tissues become charged with free acid. Thus, although by frequent repetition of the pack we can cause the reaction of a rheumatic fever patient to become neutral in forty-eight hours, if we leave the patient for twenty-four hours the acid reaction again recurs, and this will continue until the *latent* as well as the *free* acids have been got rid of, when the reactions remain neutral.

We may sometimes observe this in cases of rheumatism, when, although there is decided rheumatic pain in certain joints or muscles, the reaction of the saliva and perspiration is neutral; but after the first administration of the pack they become acid, and remain so until the whole of the latent acid has been removed. But the most marked illustration of this occurs in gouty disorders. We have heard so much of the acid condition of the blood in gout that it may appear remarkable, at first, when I say that not only does the blood, but the saliva and perspiration usually present a neutral or alkaline reaction in gouty subjects. But it is less remarkable when we remember that the assumed cause of this "acid condition," is uric acid, an acid which is so sparingly soluble that it would be difficult for it to give an acid reaction to an alkaline fluid such as the blood. It will be further remembered that urate of soda is found in gouty patients deposited in those tissues where the circulation of blood is most feeble, and that it is found outside the sphere of circulation. It is difficult therefore to accept the view that this is deposited *from* the blood. All the facts of pathological research give confirmation to my view, that the products found in the tissues are formed *in situ*, and are not the result of the effect of the blood upon the tissues, but the absence of the blood which should convey the oxygen necessary for the complete combustion of this product of imperfect oxidation. These deposits may remain for months without causing any symptoms which would indicate their

presence, and then, as the result of their accumulation causing local irritation, or to some cause which produces unusual activity of the circulation, metabolism takes place in the tissues, swelling caused by the outpouring of serum takes place, and the deposits are removed partially by a process of oxidation, which is seldom complete, and partly by the serum taking up and removing such products as are soluble. If we take a patient subject to attacks of sub-acute gout, but at the time of treatment free from any disorder, the following results will be noticed. The reaction of the saliva and perspiration may be normal for the first four to six days of treatment, and the temperature caused by the pack may be slight. Then the reaction becomes acid, and the rise of temperature higher. The acid reaction now continues, while the rise of temperature after the pack shows a gradual fall until a neutral reaction is reached.

These observations will, I think, demonstrate the fact that latent unoxidised products exist in the tissues of gouty patients without the production of any symptoms, and that by stimulating the circulation and raising the temperature of the body we can break down these combinations. As we do so, and the latent acids are brought into the tissues in a free state, we obtain a higher range of temperature during the administration of the pack. There is this difference to be noted between the allied disorders of local rheumatism and local gout. In the first, the acids are in combination with tissues in which the circulation is normally

active, and has only become feeble in consequence of functional disorder; in the second they occur in tissues which are normally feebly supplied with blood, and are also for the most part outside the sphere of the circulation. While, therefore, in the rheumatic patient, the first pack may cause a neutral reaction of the perspiration to be changed to an acid one, in gout this may not happen until five or six packs have been given.

As gout, like rheumatism, depends upon defective metabolism, it is easy to understand that we may have a condition of general asthenoxia in either, but when this occurs in gouty subjects it appears incorrect to say that the tissues are charged with uric acid, and that the acidity is due entirely to this cause. The asthenoxia, with its attendant symptoms of depression, mental and physical, may be removed in forty-eight hours, but the uric acid products in the tissue, require a longer period of treatment, and it is frequently necessary to assist the process by physical manipulation, or by causing artificial effusion of lymph at the site of deposit.

From watching the effects of heat upon the temperature of the body in a wide variety of cases, it is made clear that the degree of temperature produced by the application of heat affords a very precise indication of the amount of free acid products in the tissues, and therefore when the degree of temperature produced steadily declines with each successive application we know that the disorder will be of

short duration. In cases of acute rheumatism, when the natural temperature of the patient is steadily rising, this fact must be taken into account in estimating the degree of artificial rise; thus, if the morning temperature is 100° F., and a rise takes place of 3°F. during the pack, and the evening temperature of the same patient is 103° F., and a rise of 1°F. takes place, this would not indicate a great diminution of the free acid products since the morning, but that the maximum rate of combustion had been reached. If the next morning the temperature falls below 100°F., and the rise in the pack is only 2°F., then we know that the free acids are diminished, and that the disorder will run a rapid course.

If it is above 100°F. on the second morning we know that there is a large amount of unoxidised products in the tissues, and a rise will take place each day until all the free acids have been consumed. Directly the temperature in the morning is lower than that of the previous morning we know that a rapid convalescence will take place. When we find at this stage that the reaction becomes neutral, we may predict a fall of temperature to normal within twelve or twenty-four hours.

The great variations which are exhibited by the ordinary temperature chart in cases of rheumatism, and also in the effects of heat upon the body are apt to impress one with the irregular nature of the disorder, but when examined in the light of these investigations it will be seen that there

is a distinctive rhythm in their irregularity, and it is possible to judge of the exact condition of the patient with almost mathematical certainty. The rise of temperature in the pack affords an indication of the degree to which combustion may be *artificially* increased, but by another series of observations it is easy to determine the degree of *natural* oxidation taking place in the tissues.

If, directly after the pack, the patient's body is sponged with water at 70° F., and the temperature of the patient taken one hour afterwards, it will be found that the fall of temperature below that artificially induced by the pack presents considerable variations, and it will be further observed that in the course of an ordinary case of rheumatic fever, these variations observe an almost rhythmical course. The temperature of rheumatic fever may be divided into three stages :—

(1) The period of rising temperature, when the tissues are charged with unoxidized products, and natural oxidation is feeble.

(2) The period of maximum temperature, when the evening temperature remains at the same level for two or more days, when oxidation is progressing most rapidly, and the supply of products for combustion continues.

(3) The period of falling temperature, when, although oxidation is taking place rapidly, the products necessary to raise the heat of the body above the normal are diminished, and continue to diminish daily until all are removed,

when the reaction becomes neutral and the temperature falls to normal.

The result of the reaction of the cold sponging is precisely what might be expected under these conditions.

During the first stage the fall of temperature one hour after the pack may be only $\frac{3}{10}^{\circ}$ F., but after each pack the fall is greater, until the temperature goes back to the point at which it was before the pack was given. During the second stage there is either no fall of temperature at all one hour after the cold sponging, or there may be an actual rise of temperature, and then, as the third stage commences, the temperature begins to fall after the sponging, and the amount of fall increases until it is equal to the temperature before the pack was given.

The following are the deductions which I draw from this series of the results :

The first pack sets up a vigorous process of combustion, which is only effected by cold in a moderate degree. As the excess of combustible material is removed, cold exercises a greater effect, until the temperature is restored to the same level as before heat was applied. But as the removal of the acid products from the tissues goes on, the tissues recover from the depressing effect of the poison, and natural metabolism takes place. At this stage the period of maximum morning and evening temperatures is reached, and the temperature one hour after sponging shows a rise or remains at the same point as during the application of the pack. This is the

period of the most vigorous metabolism, because the effects of artificial heat are aided by the natural reactive powers of the body. It is well known that rheumatic patients are always most "sensitive to cold," or, in other words, suffer from a defective reaction of the skin; and it is at the stage which precedes the fall of temperature, and the disappearance of the free acids from the tissues that we find this reactionary power return. There can be no doubt that defective metabolism is not only a cause of the accumulation of acids in the tissues, but that the acids accumulated depress the normal oxidising powers of the tissues.

With the diminution in the amount of combustible material the temperature begins to fall, and cold causes a lowering of temperature which gradually increases until it again reaches the point at which it was before heat was applied. It will be observed that the reaction after cold does not raise the temperature at this stage, because the amount of combustible material is limited, and the temperature is already above normal. On the other hand, if a patient's tissues are charged with unoxidised products, and there is good reactive power, the use of "cold friction" may cause a rise of temperature of 1° to 1½°F.

Thus it will be seen that all the apparent anomalies and variations which present themselves in the treatment of rheumatic subjects have a definite reason, and if we interpret their meaning correctly we can at any stage of treatment determine the exact condition of the patient, and

decide how far we must depend upon the artificial methods of oxidation, or whether we shall do better to stimulate the natural metabolic powers of the tissues. Both on theoretical grounds and as the result of practical experience, it is found better to stimulate oxidation as rapidly as possible. It is during the intermediate stage of metabolism that the acid products are most irritating to the tissues, and when we find in an asthenoxic patient that pains are developed as a result of the first pack, or in a rheumatic patient that pains are increased after the first or second pack, it is an indication to repeat the application within twelve hours. In fact, during the acute stages of rheumatism it is always advisable to repeat the process every twelve hours, until the temperature observations show that the free acids have been removed, and that natural metabolism is taking place—then the use of cold friction may further stimulate the process better than the use of heat. These are points which must be decided in reference to the individual case, but by following the indications I have given no difficulty can arise in determining the proper course to pursue.

The only point where I diverge somewhat from scientific lines is in the case of rheumatism when the joints are acutely affected, but the natural reaction has been sufficiently restored to permit of the use of cold, I gratify the wishes of the patient sometimes, and give the hot process on account of the relief to pain which it affords. In chronic

forms of rheumatism the use of cold with friction, either generally or locally, is more often indicated than the use of heat, especially after the free acids have been removed from the tissues.

In order to preserve the heat of the body during this process, I use a bed, the under surface of which is artificially heated ; by this means more active reaction is secured in that part of the body to which cold is being applied.

EXERCISES AND MANIPULATIONS.

When a tissue has been long exposed to any rheumatic process it remains in a condition of debility for some time after the attack. When a joint is affected, it is not only the joint but the muscles concerned in moving the joint which are weakened by the attack. If the patient is allowed to carry out active movements as best he can under such conditions, there is an unconscious effort to save the weaker tissues, and especially is this the case when the movement involves pain. Instead of the proper movement being performed, another is substituted for it, and as a result we have the halting gait and awkward movements of the rheumatic subject, which grow worse until the victim becomes permanently crippled. This is the commonest cause of the physical infirmities of the aged. It is easy to

prevent this condition occurring, and possible to cure it after it has existed for many years, providing that the structure of the joints have not become disorganised. It is only necessary to give systematic exercises so designed that the weaker tissues are brought into a condition of functional activity. Simple passive exercises are only of slight value, because it is not merely the joint which is weakened but the whole of the mechanism concerned in its movement. The nervous centres in the brain and spinal cord which control the muscles, the nerve which conveys the stimulus to the muscle, and the muscles which move the joint—all require exercise. Neither is it advisable to depend upon active movements on the part of the patient, because, however desirous they may be of carrying out the instructions, it will be found that they perform the movement in such a way as to escape that part of it which either causes pain, or is difficult. The patient having been placed in a suitable position, a passive movement, such as will bring the affected muscles or joint into action, is made by the operator. He then grasps the limb, and directs the patient to repeat the movement, and as the patient does so he gently resists the movement, and at the same time guides the limb in the proper direction. This not only secures that the part actually affected is brought into play (instead of the sound muscles which the patient will endeavour to employ), but it also steadies the joint and renders the movement less painful. When the patient is unable to complete the movement the resistance of the

operator is changed to an act of assistance; but force is seldom necessary or advisable. The breaking down of adhesions which have caused a stiff joint in cases of pure rheumatism is sometimes required, but the adoption of this proceeding in cases of rheumatoid arthritis and osteo-arthritis is as useless as it is painful. Systematic exercises in the early stage of these diseases are of very great value. There is an impression in the minds of some physicians that movement in a painful joint is injurious. My own rule is to employ such exercises regularly in all forms of rheumatism and gout directly the acute inflammation has subsided. Thus in acute gout, movements of the joint would be usually commenced on the second or third day of the attack, with the result that the pain and tenderness of the joint is got rid of very much sooner than when absolute rest is observed. The value of systematic exercises in chronic rheumatism cannot be over estimated. Skill in the use of such movements requires, in addition to accurate knowledge of anatomy, some amount of technical knowledge as to the best position of the patient and of the operator.[1]

The value of "friction" in rheumatism has been recognised since the earliest times, and it is obvious that by stimulating the circulation in the affected part it has a direct effect in increasing oxidation. I prefer the dry hand to any

[1] I have considered these points in fuller detail in my work on "Baths and Physical Treatment," now in the Press.

of the oils or liniments usually employed, and if, instead of merely rubbing the skin, the hand is pressed firmly down on the tissues and is then moved in a circular direction so that the skin and superficial tissues move with the hand, much better results are obtained, than when the skin is rubbed in the ordinary manner.

In manipulating a tender joint, the natural tendency is to touch the joint as gently as possible so as to avoid causing pain. This is not only useless, but it is unpleasant to the patient. The palms of the two hands should be placed so as to lay as evenly as possible over the surface of the joint and cover as much of it as possible. The steady pressure should be used until the joint is firmly compressed between the hands. Then, and not until then, should one hand make a circular movement in which the superficial tissues are made to move with the hand, the other hand remaining stationary but maintaining the pressure. After a little while, the action of the two hands is reversed.

In cases of "rheumatic gout," it is sometimes advisable to produce artificial effusion around the joint by constricting the circulation above it, at the same time a hot fomentation is applied; then the ligature being removed, the joint is manipulated in the manner previously described. In cases of rheumatoid arthritis, where there is a large quantity of viscid exudation about the joint which resists absorption, I abstract this fluid with an ordinary hypodermic syringe, inject sterilised distilled water and abstract it again by

means of the syringe. It comes back the first time in a semi-viscid state, and charged with products of the urate of soda type. I repeat the injection and abstraction of distilled water until the water comes back clear. The needle remains *in situ* during the operation, the syringe being simply disconnected from it, to discharge the abstracted matter and refill with distilled water. It is surprising how much benefit results from this treatment in cases of the most apparently intractable character, but it is one which should only be employed in those cases when the condition exists requiring it.

DIET IN RHEUMATISM.

I do not place the rheumatic fever patient on an exclusive milk diet, and must confess that I have never understood the rationale of this proceeding, nor observed any advantage follow its adoption. When all the tissues are charged with acid it is difficult to understand how large quantities of milk can be absorbed without undergoing acid fermentation, with the production of lactic acid. The coated condition of the tongue and the functional disorder of the liver which invariably accompany the rheumatic attack, appear to me to contra-indicate the use of milk in large quantities. I, therefore, give mutton or veal broth as the principal food during the early stage when the patient swallows solids with difficulty, but I also allow a moderate quantity of milk and

lime-water. I do not force food at the early stage, but encourage the patient to drink as freely as possible of water, which is slightly acidulated with lemon juice if the patient likes it better. So soon as the patient feels inclined for solid food I give ordinary diet, except that the quantity of fish and meat is increased, and the amount of bread and milk diminished. I attach the greatest importance to the amount of fluid taken by the patient during rheumatic fever, and consider that two quarts a day should be the minimum quantity; a large quantity of fluid is essential to perfect metabolism. In *chronic rheumatism* I frequently commence the treatment with an almost exclusive meat diet, and the relief to pain experienced by patients often tempts them to continue it longer than I consider wise. Such changes of diet are of great practical use for a short course, as it obliges the system to use up waste products which have accumulated as a result of previous errors, but I have never seen good results follow strict dietary carried on for an *indefinite* time. I am obliged to feed a good many of my gouty patients on beef and port wine, not because I consider this an ideal diet for gout, but because the diet designed for the disease has disabled the patient from coping with it. Under the methods I adopt there is no necessity for cutting off the supply of coal because the chimney smokes; the aim is to facilitate combustion, and combustion will take place more rapidly when the fire has coal enough to burn brightly.