Paralysis and other affections of the nerves: their cure by transmitted energy and special movements / by Geo. H. Taylor.

PARALYSIS

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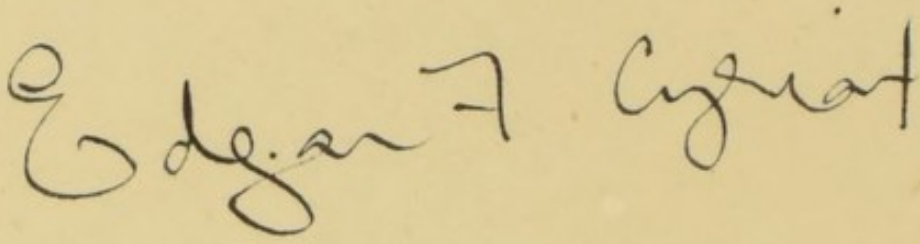

PARALYSIS,

AND OTHER

AFFECTIONS OF THE NERVES:

THEIR CURE BY

TRANSMITTED ENERGY

AND

SPECIAL MOVEMENTS.

By GEO. H. TAYLOR, M.D.,

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PREFACE.

DISEASES causing aberration and restriction of nervous power are apparently increasing in number and severity, while recoveries are not proportionally increasing. The inference is either that the effects of ordinary remedies are too transient, that the capacity of the system to respond to remedial impressions is too limited, that the most efficacious remedies are still waiting to be used, or that these causes combine to furnish obstacles to restoration.

The vital powers often suffer fatal exhaustion from misdirected and abortive efforts for recovery. The aim of treatment should be, not to produce a high degree of nerve stimulation, ending in wasted nervous energy, but to secure direct and permanent restorative effects, without cost to vitality.

In pursuing investigations to this end I have thoroughly tested and demonstrated the remarkable curative power of a hitherto neglected agency—Transmitted Energy, or FORCE. I have aimed in this little

work to exhibit the fundamental and searching nature of this agency and its positive merits as a curative means.

I have not desired to make an exhaustive treatise on the nervous system more curious than useful to the anxious invalid; but to commend to his intelligence a thoroughly practical as well as philosophical method of recovering his waning or lost powers.

GEO. H. TAYLOR.

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PARALYSIS, ETC.

INTRODUCTORY.

THOUGH paralysis and other results of diseased nerves, whether characterized by deficiency or irregularity of power, are affections of common occurrence, yet their treatment by methods currently employed is far from satisfactory. The most astute medical minds have employed their talents in investigating the pathology of this class of diseases, and many interesting and curious facts have been developed. But no remedial methods of acknowledged reliability have been brought into use to ameliorate the suffering of the neuralgic and nervous; while to temporize with the paralytic generally fills the measure of the physician's expectation. Radical cures are comparatively infrequent and hardly expected.

It therefore becomes a duty to investigate rational methods of remedial treatment for diseases so intractable, and which involve more

than any other the noblest part of our nature. Principles perfectly intelligible to the common understanding, of easily demonstrated practical value, should be extensively known, in order that their availability may be commensurate with their merits.

Our purpose is :

To show the uses and importance of *motion* in the living body, as contributing to its evolution of power ;

To explain the methods and rationale of the direct application of energy or force, as in varied forms of *vibratory motion* for curative purposes ;

To point out the uses and limitations of other exercises in diseases of the nervous system ;

To represent the success of the remedial method based on the direct use of mechanical energy in cases of paralysis and other forms of disease of the nerves, that have been prolonged and proved intractable to other means.

PATHOLOGY OF NERVOUS DISEASES.

DISEASE of the nerves differs from that of other portions of the body in certain particu-

lars, rendering its investigation more difficult, and remedial indications more obscure. The seat of such disease is generally understood to be in the nerve-centers of the brain and spinal cord, organs which are situated beneath and protected by bony coverings, and therefore removed from direct observation. The symptoms of nervous affections are manifested in aberration of sensation and restriction of power at points often quite remote from the diseased centers. Our conclusions regarding the nature and extent of the disease are necessarily founded on rational considerations in connection with light derived from experience.

The case is quite different with affections of other portions of the body. We can *see* the changed color, and the increased size of the affected part; we know that the acute anguish actually pertains to the part to which it is referred, and to no other; we can determine, by direct observation, the physical changes that are transpiring, and the curative indications are plain and direct, even though differently constituted minds may judge differently in regard to therapeutic measures.

In making the following statements and con-

clusions, I am not unmindful of the fullness of modern medical literature on the pathology of the nervous system, especially that portion relating to post-mortem appearances. These inquiries, however, are not valuable for therapeutic suggestions, since they can never be made until after the last act of the diseased process is concluded; they exhibit the *effects* of morbid processes, but show nothing of the condition of the nerves while these processes are transpiring; they disclose certain materials of disease which might have served equally as materials of health, but cast scarcely a glimmer of light upon the morbid action, and afford but the faintest intimation, if any, as to means appropriate to correct the diseased process and remove its effects.

The physician is still guided by his own and by recorded experience in the selection of curative means But it is all important that this experience should be directed in accordance with the laws of normal action of the constituents of the body, and not by what he guesses has taken place in developing diseased products, or may take place through the effect of drugs. He sees pathological action, and rightly

infers pathological products;—his direct object should be to introduce physiological action as the surest and only means of abating pathological processes.

The purpose of the present writing is therefore limited to the introduction of the reader (who, it is expected, is also an interested inquirer) to methods of cure at once practical and philosophical, avoiding the discussion of disputed and equivocal points of pathology. This topic will be referred to only so far as is necessary to gain an intelligible understanding of the curative principles and means which may be brought to notice.

HOW TREATMENT BECOMES REMEDIAL.

LET us now briefly inquire into the way treatment is expected or designed to remedy nervous disease. Since all such disease is manifested as altered, restricted, or excited action of portions of the nervous system, it follows that remedies must consist of means appropriate to increase, or repress and regulate *action* of nerve-centres which originate nervous power, whether the nervous function be that of sensation or motion.

Ordinary remedies are not introduced into the system on account of any supposed adaptedness to form an integral part of the vital instrument, from which proceeds vital energy; if that were their purpose, they would constitute food, and not medicine. Their purpose is rather to influence nutritive changes in the nerve-centers, and thereby alter the quality of vital action. They can only influence the *motions* of the incipient vital organs, and the disposal, that is, direct the motions, of substance which has yielded its vitality and become effete. In any case, whether we regard the effects of the drug as dynamic, chemical, or any other order of action, it is clear that the therapeutic effects are quite dependent on their control of the motions of the nutritive elements, while the drug itself passes on with other rejected material, and soon finds exit from the system.

The most generally accepted and modern views of the first principles of pathology of the nervous system may be stated as follows:

Nervous diseases of all varieties depend on obstacles to healthful nutrition of the brain and spinal cord, (cerebro-spinal axis). This defect

may also include the central or organic nerves. Nutritive aberration may take either of the following preliminary forms (probably more than one of these conditions coexist):

The nerve-centres may contain too much blood—hyperæmia;

They may contain too little blood—anæmia;

The nutrition of the cerebro-spinal axis may suffer such change (preceded by hyperæmia) as to allow of morbid deposits or degeneration.

The corresponding purposes of remedial treatment are therefore:

Te relieve nerve-centres of superfluous blood by removing it to other parts, which in this case are suffering from deficiency;

To convey to these centers the nutrition for which they have suffered, a result and reaction from the previous condition;

To perfect the transformation of non-vital nutrient matter to organized structure capable of evolving force which assumes the forms of sensorial and dynamic power;

To secure absorption of the abnormal matters which may invade the power-evolving tissue, and retard or prevent its power-evolving function. The possession by these matters of a low

form of organization, though a serious impediment, is not an effectual barrier to their removal.

OFFICE OF MOTION.

It will be observed that each and all of the purposes above indicated imply MOTION. Vitality is the manifestation of force or action by organized substance; pathology and disease imply wrong action, and consequently defective *motion* of constituent parts of the organized structure; while therapeutics consists in the correction and restoration of these *motions* to the normal standard, prescribed by the organized structure itself.

In health, these various series of interior motions are maintained by the activities induced in the ordinary duties of life; for the living being, as has been intimated, furnishes the arena for incessant atomic and molecular activity of various kinds and orders. Change of place of fluids, of cells, of organized and semi-organized substance; gliding of membranes, fibres, and various other anatomical parts, are constantly going forward. These actions must have support. Doubtless there

are influences at work to maintain these activities that we do not understand, but there are others which we do. Let volitional activity cease, and the system soon stagnates; it imperfectly vegetates, affording but a minimum of power available for the ends of existence. It is the activities of life, having their origin in the purposes of the will directed to securing real or fancied good, which maintain bodily health.

The purposes of life are constantly varied, giving rise to varied interior actions, extending to all the innermost as well as remote parts of the system. These varieties of action are essential to the *equipoise* of the system, upon which health intimately depends. The great danger to health, which civilized life has to encounter, is *lack of variety* in these voluntary motions. Persons pursuing mental occupations or monotonous employments are liable to engender comparatively too much motion in a restricted portion of the system, while other portions of equal, perhaps of greater importance to its physical welfare, are compelled to suffer from the need of motion. Unbalanced interior nutritive activity is the direct result;

soon thereupon occur fixed morbid products; these are the evidences and effects of disease rather than disease itself.

In our endeavors to overcome diseases originating in imperfect action, were we to be guided by common sense and reason, rather than by precedent, we should scarcely be at a loss for means to accomplish this purpose. The very evident need is, to afford more vigorous nutritive action—that is, *motion* of the elements participating in vital acts from which are evolved the different forms of vital power. This should give rise to healthy products, whether these be muscular tissue, nerve substance, or the force of which these are the instruments. It is, moreover, plain that if healthful vigor be energetically maintained in organized parts, not only will factitious and diseased products be superseded by healthy, but those previously existing, which are the result of preceding imperfect vital action, will be displaced.

The feasibility of removing disease by motion is but the corollary of the fact that health is thus maintained. A less degree of motion of elements than obtains in health, is preliminary to, if it does not constitute disease. It is only

needful that the energy of motion which health gives be afforded to the chronic invalid.

ABSENCE OF POWER OF MOTION—PARALYSIS.

But in paralysis, and indeed, in other forms of disease of nerves, the interior nutritive motions so indispensable to the generation of power are not maintained. The ability to sustain the conditions for making power is absent. This fact is the principal evidence, and in the beginning may be, and probably is, the essence of the disease of central nerves. The will either may not act, or its mandates do not reach the muscles whose action is desired. The purposes of the will in the organism fall short of their aim. The capacity for the evolution of nerve-force by spontaneous action of nerve-centers is, as regards the function of some portion of the nervous system, partly or wholly suspended. The health of this function is not maintained, and cannot easily or often be regained through power originating within.

Ordinary medical practice, recognizing the facts stated, endeavors to overcome the inertia of nerve-centers and conductors by exciting

through specific irritants the power-producing function—compelling the weakened and disabled centers to evolve more power. It is inclined to place a burden on the weakest part. The result is everywhere seen. Only in cases having excellent original capacity, where disease has made no, or but slight, progress, is the endeavor successful. There is, in fact, much to fear from treatment dictated by this principle of stimulation and forcing, whatever may be its distinctive methods. The compulsory and ineffectual endeavor of weak parts to act in response to extraordinary stimulation is liable to make undue drafts upon the capacity to act, ending in exhaustion of the little remaining power instead of its reinforcement. Cases previously curable by direct and appropriate means are thus placed forever beyond the reach of remedies. Rare cases possessing an exceptional abundance of vitality may respond to efforts of this kind; but these are few, and the large majority do not and cannot thus respond.

Treatment based upon the principles now presented pursues the opposite course. It husbands the weakened capacity; it economizes the expenditure, so as to correspond with the

generation of vital power; it refrains from tasking the disabled physiological instruments previous to the reparative action; it tries to preserve those delicate elements which constitute the source of power, from the destruction that is imminent; it affords the *motion* required for nutrition and repair, but makes no demand on the will; it elicits the evolution of that power peculiar to each function, and reserves that usually yielded by effort; and it supplies those conditions which are essential to further development.

FORCE AND MOTION, MECHANICAL AND VITAL.

THE foregoing statements are merely those of physiology. They are so nearly self-evident as to receive a ready assent. But the special proposition I desire to elucidate is that *motion*, proceeding from an external source, is competent to impart the degree and kind of motion requisite for the functions of physiology in the evolution of corporeal power; that such motion becomes a direct auxiliary to normal internal processes.

A little reflection will show the extreme

probability of this proposition ; for the process referred to does not essentially differ from that which ordinarily obtains in the system. No new element is introduced to cause derangement. Furthermore, the force which the system in health is capable of evolving is referable to an ultimate exterior source, and does not absolutely originate within. The organism is an instrument, rather than a generator, of power. The nutritive and organizing processes are merely the means whereby force introduced with food, and involved in the constitution of food, is liberated. That is now manifested, in forms called vital, which before had some other mode of existence. But the nutritive and organizing processes can not proceed, and the force associated with food and air can never be so liberated in the absence of one essential condition. This condition is the motion both of minute masses and of separate atoms, which constitute interior physiological processes. This motion, which in health is abundantly supplied by the organism, is not necessarily confined to that source of supply. In default of that source, it may be contributed from exterior sources.

The universe is replete with force ready and waiting to do human bidding and confer human benefits. Examples of the application of ordinary force or motion are seen in the marvels of mechanics. Heat is the essential condition of the existence of the arts of civilization as well as the comforts of life. Electricity in modern times has rivaled heat and motion in the interest with which it engages attention, while the wonders wrought by sunlight, as exhibited both in nature and in art, transcend all these in vastness of effects. Science has proved that these, and perhaps others, are but different forms—correlations—of force rather than different forces, by causing their transformation and mutual replacement of each other. Of these, heat and electricity are in almost universal use as remedial agents. It therefore appears not only that the body is an agent for generating force within itself—the force which is manifested in the powers exhibited by vitality—but it may also be shown to be receptive of force derived from exterior sources, and that the application of force is capable of working changes, and, if properly

employed, great benefits to its interior condition and health.

HOW EXTERIOR FORCE AFFECTS INTERIOR BODILY ORGANS.

The effects of actions communicated from without, all are familiar with, at least in some degree. For every one is aware of the peculiarly grateful sensations the invalid experiences when the surface of the body is gently *rubbed* by the hand of an attendant; in fact, this act is really not the least important duty of the nurse. It is often found that a great deal of energetic friction is of excellent service, and such advantages are insisted on by the medical adviser in a great variety of ailments, differing radically in their external manifestations or symptoms. Indeed, this very thing has been a common remedial recourse in all ages and among all nations.

Suppose the attendant varies the operation and, instead of a rubbing motion, imparts very light, rapid strokes, directed perpendicularly upon some portion of the body. The force of the action is expended chiefly beneath the

surface in this case, and another class of grateful sensations is evoked, especially if the part were previously suffering from pain. Effects similar to these might be multiplied, affecting various and differently related portions of the organism, according to the direction, degree, and rapidity of the impulse. It is evident that this would afford, through the feelings, a vague clue to possible important benefits.

A little consideration will show that the idea of therapeutic advantages through the channel here indicated is not so far-fetched or illusory as might at first be supposed. We may at least comprehend some of the processes whereby such efforts come.

The motion and pressure of the hand may be regarded as expressing force in pounds and ounces. This force is the collected energy of organized substance from minutest parts. Its origin, so far as we can trace, is in the ultimate physiological and chemical activities of certain elements of the body. The anatomical hand, being the medium or channel for the expression of the aggregate power of an infinitude of distinct molecular elements and chemical substances, is applied to oppose and overcome

the resistance of external and wholly disconnected objects. The internal forces are transformed to external power.

When, now, this force is applied to a solid body, it overcomes the inertia of the body *en masse*. The integral portions do not change their mutual relationship.

But if the same force be applied to another living being, which is constituted of soft or movable parts, it is evident that the force thus employed overcomes, not the inertia of the whole, but that of its minutest and invisible parts; is, in fact, distributed among these primary elements and causes of animal power.

But motion of the incipiently vital elements is necessary in order that they may fulfill their destiny; that the *becoming* muscle and nerve may really *become* those instruments of power; that primary organization may occur. Each and every atom thus destined is by motion urged onward in its career to the consummation of its organic purpose.

Without such motion, organizing elements could never be brought into due place, but must remain unendowed with vital privileges. Chemical changes, too, so necessary in the re-

arrangement of molecules that they may conform to the uses of vitality, and quite as important to effect their destruction and dismissal from service, can never take place unless the materials concerned are moved into contact, and within the sphere of new chemical influences.

It hence appears that, when force exterior to the living body is expended upon such body, it is not lost, but is distributed among the minutest elements, where it becomes directly serviceable to vital needs. Though not transformed to vital force, it supplies the *very conditions* in which this force originates, and thus becomes a direct aid to its manifestations. This fact is especially apparent in cases where vital duties are poorly performed, and where vital power is evidently defective, as is the case in most forms of chronic disease.

The principles now brought into prominence are not of limited scope and application. They form a part of the domain of philosophy and universal science, and do not belong especially to physiology and therapeutics. It may, therefore, serve to increase the reader's interest in the special application of these principles, to

state them in more general and comprehensive terms.

If a moving body come in contact with one at rest, its motion is arrested; but the force by which it is projected is not obliterated; it is not even diminished. A great variety of experiments has demonstrated that no portion of such force is lost; it is only caused to assume new forms. At the moment of impact the moving force is transformed to its equivalent of *heat*, *electrical disturbance*, in some cases *light*, and perhaps other forms of force. The arts supply abundant illustrations of this principle; their pursuit consists in its practical application, wherein our wants are subserved. Scrutiny of various conditions under which these transformations appear, demonstrates the uniformity of this law of nature.

It is apparent that if the body receiving the force were composed of particles destitute of cohesion, that is, fluid, the law would hold equally good, but the result would be distributed among the separate atoms. The friction of the moving atoms of liquids, it was shown by RUMFORD, produced a large amount of heat, and both MEYER and JOULE demonstrated the

uniformity of the transformation of motion to heat, as well as their units of equivalence.

If the particles of the fluid be of complex composition instead of being uniform, the diverse nature of the chemical elements is favorable to the transformation of such impinging force to its chemical equivalent. Chemical action will be determined among these matters of diverse constitution, and new products will be formed. The kind of product will, of course, depend on the nature of the elements thus engaged. The energy of motion now results in new arrangements of elemental matter. The test tube of the chemist affords an infinite variety of illustrations of this principle.

The human body evidently embodies all the conditions above presented, and is a constant illustration of the principle. In health and in disease it presents a broad arena for the combat of atoms, with varying results, depending on the extent of the control of outside influences. It is hence amenable in a wonderful degree to the wholesome control of pure force supplied from without.

NECESSITY OF APPARATUS.

PRACTICALLY, it is quite impossible to carry forward experiments like the above to satisfactory results. The effects are produced in too limited a degree to be conspicuous. Besides, these effects are exactly in the direction of physiology, and are inevitably merged with the ordinary and unnoticed interior acts, as they should be. Pathological facts arrest our attention in proportion to their gravity; physiological facts are unnoticed in proportion to their perfection.

No really curative plan, or reliance based on effects producible by the hand of an operator, has ever been established, because the power of the operator fails too soon. Indeed, more abundant power than the hand can afford was necessary to demonstrate a *principle* of action. Without further recourse, curative effects from this source must ever prove fragmentary and unreliable.

It hence became necessary to contrive apparatus dependent for its work upon a more prolific source of power than the hand of an operator can supply; and in the course of ex-

periment it was fully proved that more power is usually required to maintain the interior molecular and chemical motions which sustain physiological actions, than is generated in the system of another person. This conclusion will not appear incredible when we reflect that many persons, including most invalids, evolve little or no surplus force for expenditure on exterior objects, it all being employed to maintain the even, sluggish, physiological processes.

It becomes evident, not only that apparatus must be employed, but also that this apparatus must be capable of infinite degrees as well as various kinds of action. It should be prompt in obedience to the will of the operator as well as to the feelings of the patient.

Force supplied to the living body must be in the form of *Vibratory Motion*. In this way waves of force are made to pervade the system, as light does a transparent body. Supplied in any other form it would affect the mass rather than the constituent elements of which the mass is composed. Were the mass moved, the relations of the component parts would remain undisturbed. This corresponds, also,

with the methods of force in other potential and acting forms. Heat, light, and perhaps electricity, affect bodies to which they are communicated by means of vibratory motion ; they thereby unfold energetic chemical aptitudes which result in new chemical relationships.

DESCRIPTION OF APPARATUS.

After much diligent inquiry regarding the principles now commended to attention, and experiment to determine their practical availability, the ends sought in the application of vibratory operations for therapeutic purposes were fully realized. A series of machines has been constructed capable of applying vibratory motion in agreeable forms, to every part of the body, and successfully carrying out these principles. These applications comprise several methods.

The *first* method of applying vibratory motion is confined to the extremeties. It consists in giving the limb, whether arm or leg, an oscillation — a rapid succession of short, quick turns or twists upon its axis — the direction of the motion being at right angles to the longi-

tudinal axis of the extremity. The motion is reciprocating or alternating in opposite directions; it may be continued uninterruptedly for several minutes, or till the desired effect is produced, which depends on the condition of the system. The patient may be either in a sitting or reclining position, with one leg or arm extended for the action of the apparatus.

This motion, or method of expending force, produces mechanical attrition between the ultimate anatomical elements of which the extremity is composed; it also produces alternate slight pressure and relaxation of these constituent parts in rapid succession.

In the *second* method of vibrating, the person subjected to the operation rests in a lying position upon the apparatus, which has the general appearance of a couch, and some selected point of the under portion of the body is subjected to the rapid but very light strokes of the instrument operating from beneath, the patient being situated so as to adjust the impinging force and to render it perfectly agreeable to his feelings.

The immediate mechanical effect consists of a rapid series of vibratory waves, whose de-

grees of intensity shade off in every direction from the impinging and radiating point. As the physiological and therapeutic effects will be revulsive, stimulant, etc., according to the degree of intensity of the motion, it is plain that the desired effect may be secured by adjusting the position according to the diagnosis or medical ideas of the case as related to means employed. Every portion of the body may be subjected to various kinds and degrees of action, and the particular effect desired can easily be secured.

The *third* method of applying the action consists in the short, quick, *reciprocating* motion of an instrument applied to some selected portion of the body. Various effects are obtained through this action, according to the degree of pressure. If the pressure be slight, the action is expended chiefly on the surface of the body; if the pressure be increased, a similar action is produced among the deep-seated structures of the interior, and effects will be varied accordingly.

When the contact of the impinging instrument is so slight as to allow it to glide upon the skin, this action is tolerably understood

by the term *rubbing*. With more pressure, the skin is comparatively unaffected, while the frictional action is expended in deeper parts.

In this operation, also, the apparatus is so contrived that the degree of force and motion employed may be wholly governed by the person receiving the action.

An analysis and comparison of these vibratory motions show their mechanical forms to be similar, and that the choice in their use will depend more on local convenience than the peculiar specific effects distinguishing them.

The *degree of rapidity* with which these curative motions may be applied, generally ranges between one and two thousand vibratory acts per minute. Here, again, is opportunity to secure a variety of effects, such as experience may prove to be most desirable in different cases. The more rapid rate produces effects somewhat allied to a diffusive stimulant, but more permanent and not followed by any sign of depression. The slower rates secure reactive effects of various grades quite as valuable in a therapeutic point of view. The specific effects, to be described, diminish with the rate of motion till this ceases to be vibratory

and glides into that of *kneading*, giving it quite another character, whether judged of by the sensations or the control of nutritive functions. Very slow motions of this kind, if accompanied with due pressure, have still a therapeutic value, but of another class.

The *time* during which any portion of the body may be subjected to the vibratory action will depend on the pathology of the case, and the therapeutic end desired. Especial reference is had to the condition of the nervous system. In paralysis, these different forms of motion may be used almost without stint, if applied at the proper points and in prescribed order. In other forms of nervous affection vibration is, when well directed and not used in excess, a valuable as well as a powerful remedy. Everything depends on the purpose and design of the application, and the demeanor of the patient under its use. In short, the *degree* of success, in persons of great sensitiveness, depends on the tact of the operator.

Having thus explained what is meant by vibratory motion as applied to the different regions of the body, we are prepared to examine how the physical, chemical, physiological,

and vital operations of the organism are influenced by applications of this kind, and how the effects so produced are turned to therapeutic advantage.

EFFECTS OF VIBRATORY MOTION ON BODILY TEMPERATURE.

The most immediate and conspicuous of the effects of either of the forms of the vibratory process is an increase of the temperature of the part subjected to the action. No matter how prolonged and obstinate the previous feeling of cold in the extremities, a few minutes' employment of this agency invariably restores the normal temperature. The same is equally true of other regions of the body besides the extremities. The feeling of warmth thus induced gradually diffuses itself from the point to which the action is applied, over the whole body. A softening of the skin by increase of insensible perspiration is a constant result of the process, and an active perspiration sometimes succeeds the access of heat. The temperature has not been observed to rise above the natural standard, except in case of too pro-

longed application of the process, on several successive days.

The vibratory processes have been demonstrated to be prompt and reliable as a means of permanently restoring the natural temperature to any portion, or to the whole of the body, whenever it is deficient. Indeed, there has been found no condition of disease which effectually resists this heat-producing cause. It is consequently a means of depriving chronic disease of its most constant and troublesome characteristic.

This increase of heat may doubtless be referred to two sources. The *friction of fluids*, and of fluids and solids under agitation, has long been demonstrated to be a cause of heat. The source of heat is the motion which becomes by this means transformed to heat, and furnishes an illustration of the correlation of forces.

But the chief source of heat in this case is probably the increased *chemical action* that is superinduced, particularly that occurring through the agency of oxygen. This form of action is hastened by vibration, and the elimination of heat is but an illustration of the

nearly universal law, that heat is evolved whenever complex chemical combinations, like those constituting the organism, are reduced to more simple forms.

This heat actually appears interiorly, and differs from all other therapeutic applications of heat, which are made only to the surface. In one case the heat finds its way to the surface along with the normal products of waste, while in the other, it must be transferred inward from the surface, only through the circulation of the blood.

The maintenance of the normal temperature has always been regarded of the utmost importance. The well have great facility for resupplying the waste of heat as fast as it occurs, while in the chronic invalid its waste is resupplied tardily and with difficulty. Hence, remedies which contribute to the heat of the body, if only transiently, have ever been in favor in the treatment of chronic invalids, even though they simply supply the element of heat without aiding its normal production. We may perhaps attain some idea of the uses of temperature by reflecting that it appears to facilitate the development and perfection of

elemental vital forms. This suggestion is supported by the well-known importance of heat for the germination of seeds, and for the development of eggs of oviparous animals. In both of these cases the development of vital activity is entirely dependent on the supply of heat. Physiology affords no distinction between the elementary vital forms that are to serve in the animal structure as the instruments of its power and those that are destined for further development into separate and distinct organisms ; and it is reasonable to suppose that in either case similar conditions are equally favorable to development.

Vibratory motion not only immediately supplies heat to the body by the oxidation which it secures, and by the transformation of motion to heat through the friction and concussion of its elements, but experience has fully proved that this increased supply of heat directly becomes spontaneous and permanent. The natural production of heat is first imitated, and finally goes forward as in health. The vital force-evolving elements of the nerve-centers are enabled to perform their functions more naturally and perfectly, and the indispensable

condition for the manifestation of nerve-power is restored.

Heat has always been a favorite, perhaps because a ready, form for the application of force remedially, and its recent revival is due more to the devising of unique methods for its application by means of baths than to the discovery of new curative virtues. Applied to the extremities, it expands the capillaries, and is therefore revulsive in its effects. It aids the conveyance of effete saline compounds from the body through transpiration. Its effects, however, whenever externally applied, are transient and superficial.

INCREASE OF OXIDATION.

THE increase of heat produced by vibration is an evidence of the increased use by the system of oxygen. There are still other evidences quite as satisfactory, among which is : The products of oxidation passing from the body are increased, as proved by the following :

The skin becomes softer and moister, showing that more insensible perspiration is elimi nated.

The amount of urine is increased, often to the extent of fifty per cent., signifying that more water is produced by the oxidizing process.

Urine, previously of deep color, becomes lighter and of natural color, indicating that the extractives are destroyed by reduction through oxygen.

The amount of urea is increased, and that of uric acid is diminished, which effects are produced by the same cause.

The disappearance of rheumatism and scrofulous enlargements also affords evidence of increased energy of oxidation, reducing morbid material to the form in which it can be eliminated.

Further evidence in the same direction is afforded by the marked expansion of the chest and the involuntary effort to perform deeper respiratory acts—evident attempts to respond to the increased demand for oxygen produced by vibration. No exact experiments have demonstrated the amount of increase of carbonic acid exhaled, but we are justified in presuming that this corresponds with the other effects noticed.

ELIMINATION INCREASED BY VIBRATION.

THE effect of the increase of chemical action, secured by vibration, is expended chiefly on the retrogressive, wasting elements of the system—a consequence of the utmost importance in chronic illness. For it is at just this point in these cases that the failure which constitutes ill-health exists. According to Lehmann, the products of oxidation are always diminished in disease. This statement is corroborated by other investigators in physiological chemistry. To the comprehension of all thoughtful observers, the furred tongue, the local congestions, the evidences of "biliousness," the dryness of the skin, coldness of surface and extremities, with a retinue of similar symptoms, are evidences of the presence of incompletely oxidized and therefore retained matters. Elimination is the immediate and inevitable consequence of carrying the oxidizing act forward to completion, because the products of oxidation, secured by this means, become aëriform and fluid, and at once find exit through skin, lungs, and kidneys.

The practical importance of this point it is

impossible to exaggerate. Indeed, it is the indirect effect of all remedies, whatever be their aim, to restore the proper relation between supply and waste, by causing a more perfect use and disposal of food. Whatever else be the purpose of the body, it is, *first*, an oxidizing apparatus. The other purposes of bodily existence are fulfilled in about the ratio of perfection attained by this function.

It follows that the kind of remedial assistance most needed is that which aids in perfecting this physiological process, because such assistance supplies at once the ordinary means of destroying morbific principles, and furnishes an antidote for their effects.

The process of vibration is simply that of bringing these mobile elements of the system, which are seeking alliance, into contact. This secures the completion of those atomic changes which it is the endeavor of physiology to secure. The test-tube in the hands of the chemist, which on agitation instantly indicates the expected reaction, illustrates the effect of motion within the body in fulfilling the chemico-physiological tendencies of its constituent elements.

The oxygen held in solution by the blood becomes most potent and efficacious when brought into *vigorous* contact with oxidizable materials. The blood, on the other hand, can not attract this element from the air of respiration in greater proportion than it is yielded to the system. The effect of motion is to render active the latent chemical tendencies of atoms and molecules, and their attraction for oxygen throughout the system becomes energetic. In short, it is increased energy of chemico-vital affinities that needs to be vigorously asserted in order to meet the requirements of the chronic invalid.

This view is in perfect harmony with ordinary medical practice. It only presents means more direct, and fulfills indications more completely. For *all* remedies do something either directly or indirectly toward the end here in view, or they fail to satisfy expectation.

Practically, these views are fully justified by our experience of the effects of vibration. For as the products of waste rise to the normal standard, both in quality and amount, the countenance brightens, the appetite and strength return, and all those evidences of

disease which constitute physical symptoms coincidently disappear.

The effects now described as attainable through the application of vibratory action are desirable in all chronic disease, because they pertain to the quality of the blood, and the degree of perfection attained by the nutritive function. Many nervous symptoms are doubtless attributable to the occurrence of some toxic element, interfering with the proper nutrition of the nerve-centers and conductors, which has its origin in an aberration of the retrogressive or denutritive processes. These symptoms find their natural and perfect remedy in the effects secured through the application of vibratory action.

Another series of defects arises in chronic disease, which especially impedes the restoration of diseased nerves. This consists of the impediments to the transfer of matters which have already entered the vital arena from the digestive organs. These impediments appear in the forms of congestion of capillaries, deficient osmotic action, imperfect regional and imperfect general circulation of the blood. Each of these morbid conditions is specially

related to the health of the nerves, and is particularly amenable to the influence of vibratory operations.

REMOVAL OF CONGESTION.

In congestion, the minute vessels are distended with blood, and the current is sluggish. The capillary walls do not contract effectively, so as to move forward their contents. Most diseases are characterized by congestion at some points. When this condition has long existed, the contained blood is deteriorated, and we are informed by pathologists that gelatinous corpuscles occur. These, together with the adherent blood-corpuscles, become attached to the capillary walls and to each other, causing partial occlusion or stoppage in the vessels. The power of vibration to remove this condition of things can be easily understood. The mechanical impulse, instantly narrowing the walls of the dilated vessels, drives their contents forward. The same act also stimulates the vital contraction of these walls, adding this to the causes of motion acting upon the current. These causes conspire to force onward

and remove the mechanical impediment in the minute vessels, and a fresh supply of blood from the heart is consequently admitted.

The effect of vibration is to stimulate and nourish the capillary walls, and cause them to become permanently more contractile, and able to transmit duly their currents, instead of injuriously retaining them.

To produce these effects in a satisfactory manner requires something more than a haphazard and blundering way of applying the remedy. The *mode* of application, it has before been intimated, depends on the nature of the case, and a full knowledge of the peculiarities and powers of the remedy; otherwise injury will be inflicted. It is necessary to say here, that a full use of the revulsive means above described is an indispensable preliminary in the production of these effects. The vibratory action should be gradually carried nearer the diseased point, sending at first the lighter waves of vibration into the diseased region, being always careful to be guided by the sensations of the patient. The physician may in this way have the satisfaction, as from time to time he examines his patient, of wit-

nessing the removal of swelling (when this has been indolent) as well as pain and soreness from regions that have long suffered and proved intractable to the most approved and potent remedies before used.

INTERCHANGE OF FLUIDS PRODUCED BY VIBRATION—ABSORPTION.

THE motion of fluids caused by vibration is not confined to those contained by vessels. The effect is coextensive with the action, and includes interstitial as well as circulatory fluids.

The agitating effect of vibration superinduces an exchange of fluids. Those outside the vessels, in which the tissues in general are bathed, are transferred to the venous vessels through their membranous walls, while those contained by the nutritive or arterial vessels pass in the opposite direction. This is exactly the way in which these respective fluids naturally tend, by reason of their qualities, functions, and destinies. But these motions are aided and rendered perfect by mechanical assistance from an exterior source,—by vibration.

This effect, it will be noticed, is on the principle amplified in works on physical science under the designation of *Osmosis*. The conditions for this action consist in the differing fluids being separated by membranous walls. Motion being imparted to *one* of these fluids (that within the vessels in this case), the *other* is drawn through the membrane and joins that in the vessels. The physical conditions are amply fulfilled and the expected results attained in the case before us. The *evidence* of the action consists in the diminution of swelling, in disappearance of fat, and in certain cases, at will of the operator, the sudden appearance of what are usually called "bilious" symptoms.

It hence appears that vibratory action becomes a reliable and radical means of securing interstitial absorption, and is of excellent remedial service in case of swollen parts. Practically, it is an effective means of reducing hypertrophies of organs whether internal or external, glandular swellings, and dropsical effusions whether areolar or in cavities. In the latter case the action of the skin, always increased by the motion described, often be-

comes for a short time excessive, while the effusion in the mean time disappears.

The diminution of scrofulous swellings and hypertrophies is probably produced by the joint result of two effects of vibration. First, the reducing effect of the additional oxygen caused to be attracted to and absorbed in the region; second, the absorption, through the agency of the same cause, of the liquefied materials into the general currents of the circulation, submitting them, in common with the rest, to purifying and eliminating causes incessantly operative throughout the organism. These effects of vibration in scrofulous and other enlargements have often been practically demonstrated.

The therapeutic influence of the effects of vibratory action in disease of the nerve-centers is easily made intelligible. It matters not what pathological appearances may be revealed by post-mortem examinations; it is the beginnings and early progress rather than the products of such disease with which we are called upon to deal. The beginnings of disease of nerve-centers must be allied to the initial stages of other forms of disease. There cer-

tainly must be some dyscrasy of the blood capable of sustaining the disease before it can exist. There must also be perversion of local nutrition, here as elsewhere connected with the office of capillary nutrition, consisting in part, at least, of imperfect interchange of fluids. The wasting matters resulting from disintegrating nerve-tissue are probably imperfectly reduced, and consequently retained in some noxious form. These imperfectly elaborated matters are capable of either furnishing mechanical obstructions in the capillary circulation of the cerebro-spinal centers; or they may react as toxic agents, and hinder or pervert the generation of power at this important seat of vitality. In either case vibratory action is wonderfully effective in removing the impediments to health which exist in capillaries. It will therefore exert a valuable, indeed indispensable, restorative power in diseases of the nerves.

REVULSIVE EFFECT OF VIBRATION.

THE remedial method which consists in causing activity and even irritation in some

tissue, or at some point, for the purpose of diminishing the evidences of disease in a distant part, has always been employed in medical practice. Surface irritants, such as blisters, plasters, ointments, vesicants, liniments, embracing a host of different articles, belong to this class. Cuppings, leechings, bleedings, issues, setons, and cauterizings belong to the same. The application of heat and cold to parts of the body, as well as the use of the Russian, Turkish, and other baths, are in part for the same purpose. Though revulsive remedies may not always be employed with good judgment, yet experience has fully shown the correctness of the principle which dictates their use.

Doubtless the good effects of many internal remedies, as cathartics, stimulants, alteratives, etc., may be attributed to the same principle. Such is the obscurity of medicinal action, and such is our ignorance regarding the way medical effects are produced, that it is often impossible to determine whether, for instance, the cerebro-spinal substance is directly affected, or some other tissue is made by the action of the drug to call nutritive supply from the

previously excited nerve-centers. There are proofs that the latter hypothesis is the correct one in many cases. Whether the one supposition regarding the mode of operation of remedies, or the other be correct, it is quite certain that the disease is mitigated, not by making a physiological, but pathological impression. This impression may or it may not be transient. If we could fully *know* the causes of nervous maladies, we might often trace their origin to remedies whose immediate consequence may be relief and seeming benefit, but whose ultimate effect on nerve-centers is disastrous. The facts in this case must be left to the further development of medical science.

There are two kinds of revulsion. One consists in producing an afflux of blood to some region of the body, as the skin and extremities, whereby the quantity contained in a suffering part may be diminished. This is regional revulsion. The other kind relates to the physiological uses made of the materials the blood contains, whereby nutrition is changed from the support of one to that of another function. This is physiological revulsion.

The mode of securing regional revulsion is readily understood. The vibratory applications are applied to a limited portion of the body; its nerves are aroused, and its nutritive activities excited. This, more than any other cause, increases the measure of blood which flows to the designated region. The vessels become distended, their capacity increases, and the part gains color.

The local increase is attended by a corresponding diminution of blood in contiguous and even in remote regions of the body. This revulsive consequence of vibratory motion may be increased to any desired extent, simply by extending the area of the action and multiplying the applications. When new and vigorous action is assured in any chosen part, such part is made to assume new relations to the remainder of the body as regards the distribution of the nervous power, as well as that of the circulation—effect closely following cause. Nervous action is clearly dependent on blood supply, and increases or diminishes in any region or organ with the increase or diminution of nutritive activity. This activity is completely under the control of vibratory motion.

The facility and thoroughness with which vibratory motion may be supplied, renders it a ready and reliable means for determining the real value of this therapeutic principle. It is found to be as valuable in mitigating and subduing affections of extended regions of the body as in controlling the lesser ailments of invalids. Thus, various disabilities relating to the head, chest, digestive organs, pelvis, etc., find relief from the derivative use of vibratory action. But nowhere is the effect more satisfactory than in diseases of the cerebro-spinal axis, whether characterized by diminution of power or by neuralgic pain. Any portion of these centers of nervous power suffering from congestion will find direct relief in vibratory motion, if applied with a strictly revulsive design. This is probably because of the excitement produced in the skin and extremities, and the transfer of blood to them. The salutary effect is rendered permanent by cautious repetitions of the operations at suitable intervals. There are no coincident pathological conditions superinduced to compromise the purity and permanency of the effect, as is the case when other revulsive means are employed.

But the physiological revulsion produced by vibration is distinct from any effect produced by other means, inasmuch as it relates to bodily functions as well as regions.

The principle forming the basis of this curative process will be readily understood. Normal action of the *muscles* is preceded and accompanied by *nerve* action.

This nerve action may either have its origin in the *will* which communicates its incentive through the nerve to the muscle, or in the irritation produced by some cause affecting the sensory extremity of the nerve connected with the muscle. Now, the vibratory action, however energetic it may be, takes place without the intervention of either of these causes. The nerve receives no incentive and does not act, and is entirely relieved of the necessity for acting. Hence, the nutritive effects which action always incites fall upon other than nerve-tissue; revulsive effect specially related to nerves is secured; the pre-existing excessive activity of nerves is counterbalanced; their congestion is relieved; excited action of the cerebro-spinal centers is subdued. Indeed, it not unfrequently happens that persons of

habitually excited nerves lapse into a quiet sleep while being subjected to the vibratory operations. These facts afford evidence that the most prominent cause of nervous disease, when this consists of congestion, is removed by vibratory movements.

CONGESTION, THE PRIMARY CONDITION IN NERVOUS CASES.

It is well understood that a diversity of symptoms greatly differing in character may arise from the same cause in different individuals. There is much reason to believe that the first stages of diseases of the cerebro-spinal axis are characterized by the presence of too much blood in the nerve-centers. In the progress of the disease, the change of habits which is caused by enforced inactivity may, and probably often does, produce subsequently an opposite condition. This conclusion is supported by the popular observation, that persons whose habits of life subject the nerves to undue activity and wear for a long period, incur a far greater liability to nervous disease than others; indeed, they are always

verging on some form of such disease. Constitutional predisposition has also its place among influences conducing to such diseases; but unequal use produces unequal nutrition, the essential and ultimate cause of this class of affections.

Although the brain of man is but one-thirtieth the weight of the body, physiologists have shown that it receives from one-tenth to one-eighth of the blood sent from the heart to sustain the body. If the afflux be too much increased by use, or if it be not counterpoised by muscular action, the nerve-centers will be under perpetual pressure. If, now, the general health be from any cause impaired through the ordinary channels of derangement, it is clear that the deterioration must be more decided and grave at the point of greatest nutritive action, and disease of nerve-centers is the inevitable consequence.

The remedial requirements of such conditions are perfectly obvious. The nutritive afflux to nerve-centers must be turned in the opposite direction. To increase the healthy action of the muscles and other physiological elements is to relieve the embarrassed nerves. This

design there is no other proper way to fulfill. But the requirement is not met by ordinary exercise, because this implies *effort*. Such exercises commence in volition, which has its origin in cerebral-centers. In health, the co-equal use of nerve and muscle preserves their equipoise; but in disease of the nerves, there is inaptitude for any considerable degree of voluntary action. Besides, such exercise is damaging, because instead of restoring the equipoise, it increases the disparity of action, which already exists, between the two great channels of bodily power, the nerves and muscles. Exercise, to be beneficial in these cases, must be quite passive, and vibratory applications are the only methods yet devised whereby passive motion can be successfully applied for curative purposes.

But there are also cases of nerve-disease in the progress of which the spinal cord becomes anæmic; it requires more blood to supply its nutritive wants. The vibratory operations are equally efficacious in transferring the circulation in the one direction as the other, and the need now indicated may be complied with readily. It is only necessary to reverse the

order in which the applications are made. This change reverses the direction of the impulse afforded by the operation—sends the blood as easily *to* as *from* the spinal cord.

In these cases, however, the essential need, when thoroughly understood, will be found to be not so much an increased supply of blood in the cerebro-spinal centers, as increased facility for initiating and perfecting those normal changes of matter whereby nervous power is generated. This principle has been sufficiently discussed in another section.

EVOLUTION OF FORCE INCREASED BY VIBRATION.

PHYSIOLOGISTS agree that it is through chemical changes in the instruments of power that vital force is generated. In all disease the chemical changes are imperfect and insufficient, as is proved, not only by the deficient force set free for the uses of the will, but also by the altered character of the waste passing from the body and deficient amount of normal products of waste. It has already been shown that exercises in general are designed by nature to maintain these changes and thereby to

maintain health; and it has also been shown that vibratory motion is capable of supplying the same conditions, resulting in the evolution of the needed nervous power. These facts are equally applicable in maintaining and restoring the health of the nerves, the instruments of the will and sensation, as of the muscles, the instruments of dynamic power.

But the power liberated in health, by the chemical changes,—"metamorphosis of tissue"—it is calculated, is in excess of that expended on objects outside the body. There is, hence, a residual force, which is appropriated by the organizing elements, and employed for constructive purposes. This subject is fully elaborated in Dr. Carpenter's work entitled "Correlation of Vital and Physical Force."

The bearing of this principle of physiology will be seen when it is understood that molecular and chemical change is largely superinduced by vibratory motion, and that force is in this way liberated without the usual expenditure. The exertion of the will, the usual cause of expenditure of nerve-power, is entirely suspended. This allows the *constructive* force

generated in the manner above described, to be employed wholly for the reparation and benefit of the instruments of nerve-power. It thus appears to be a demonstrated fact, that vibratory motion aids the power, sustains and restores the health of the nerves, and is in strict accordance with theoretic considerations emanating from leading authorities.

EXTERIOR FORCE AUXILIARY TO ITS INTERIOR DEVELOPMENT.

That a large amount of force is required for the daily expenditures of the system is quite apparent, and the fact becomes the more obvious when the amount generated is diminished by disease. But the system does not absolutely originate this force — it only eliminates that which is presented to it in the food and air it receives. The vegetable world organizes matter by combining it with force; the two are subsequently separated by the animal organism. The system is an instrumentality for giving form and direction to this elimination, and affords a predestined career to whatever it receives. The transpositions of material, which

constitute the basis of physiology, have the purpose of evolving through physical and chemical changes the actions and powers of the living creature. To this end, the vital molecule influences contiguous matters, and subjugates them to the vital form; but mobility is the inexorable condition. The succession of atomic changes becomes in some way, at present unexplained, the bearer of vital power, and serves the purposes of the will. It follows that the amount and quality of power manifested by the organism are entirely dependent on the motions of these minute factors. The most useful remedies must consequently be those which act in the direction of the organic tendencies at every point in the career of matter in the system. Exterior force is a direct agency for this purpose, and can be legitimately and profitably employed.

It will be observed that the supply of motion to the constituent elements of the body, if in suitable degree, introduces no new form of action. It only exalts to the desired point that which previously existed, rendering it more pronounced and effective. In other words, force, supplied from without, is, by physical,

chemical, and physiological transformations, made to subserve and perfect vital uses. Every atom is assisted to consummate its tendencies. "We everywhere discover," says Claude Bernard, "a rigorous correlation between the intensity of physical and chemical phenomena, and the phenomena of life; therefore we are able, by acting on the first, to modify the second, and regulate them at will."

From this it will be noticed that the consequence of only a single impact of force upon the organism is distinctly traceable in inevitable physical, chemical, and physiological effects in the inmost recesses of the body wherever vital power is evolved. That such a cause influences and controls the evolution of power, is a logical necessity. Though the energy expended among vital molecules by a single impact may be too inconsiderable, when transformed to physiological action, to be of much therapeutic value, yet it must be remembered that this act may be repeated without limit, and until the desired curative efficacy becomes conspicuous. The form of the application admits of wide variations, adapting it to the needs of the system under

varied circumstances, thus further complying with the needs of different invalids.

ELECTRICITY, A PRODUCT OF VIBRATORY MOTION.

THE use of electricity, long employed as a curative force, has of late experienced a revival. That an agency so long known should not have achieved more rapid popularity, is evidence either that its curative virtues have not been fully brought out, or that it has often been indiscreetly applied. There are many facts which justify the latter inference, and show, also, that injurious effects are not only possible, but frequently actual. The employment of this agency attests readiness on the part of the scientific public to examine and test the merits of force for curative purposes. Progress is achieved even by experiments which do not as well as those which do result according to expectation.

Vibratory motion most conclusively disturbs the static electricity of living bodies. This disturbance is probably attributable to the friction of the multitudes of particles, and to

the transformation of the motor to electrical force. There does not arise an uncontrolled amount of this agency to compromise the vital welfare; nor does its presence cease directly on the discontinuance of the cause, as is the case with the galvanic stream. By exciting a rubber ruler by friction, and observing that electrical attraction lingers for a while after the exciting cause is withdrawn, one can be satisfied that the static is less evanescent than the galvanic form of the electrical force. Experiments are now in progress to determine the tension of the electrical force thus developed, its degree of permanency, and its physiological effects, with the view of discovering what portion, if any, of the curative efficacy of vibration, may be attributable to electrical disturbance.

CONFIRMATIONS OF THE FOREGOING PRINCIPLES DERIVED FROM NATURE.

ALL motion returns to its starting point and is in some manner reciprocal, having a diversity of rates of pulsation. The many millions per second of the vibrations of light, and the

motion of the planets in their eccentric orbits, are examples of the law. Mechanics change the rate but not the fact of reciprocity of motion. The many motions per minute of the piston of the locomotive are converted into and exactly measure the length of the journey both in time and space; the locomotive as well as the piston constantly returns to the same point.

Nature is replete with examples both of the communication of vibratory motion from one object to another, and of the conversion of one form of vibration to other forms. The power of heat, light, and electricity to affect bodies within the sphere of their influence, and their mutual transformation into each other, need only to be referred to. Each of these forms of force, it is well known, may result from pure motion producing attrition of the particles of matter.

In the animal body, everything is palpitating, reciprocal, vibratory, in different degrees. Its vitality is supported and manifested through modifications of such action. The air and food employed are alternately taken and given. The force which accompanies these

supplies does not remain, but is immediately expended. The physiological acts of eating and assimilating, sleeping and waking, activity and rest, labor and recreation, are necessarily alternating.

Now, note the dependence of vitality upon these reciprocating actions. Respiration is alternate motion, without which the oxygen required by the interior operations of the system could not be supplied. This reciprocating motion is transmitted to the stomach and lower digestive organs, and is an absolutely necessary condition of their health. The heart pulsates against the walls of the chest, and stimulates respiration. The arteries ramify and pulsate throughout the system, stimulating the nutritive actions they are designed to support.

But the system is so contrived as to insure in health an abundant supply from without, of reciprocating and vibratory motions. All the voluntary motions of the members of the body are necessarily reciprocating, and react generally upon its interior mass with vibratory motion. In sitting and standing, the sustaining muscles work alternately, and so affect the interstitial and circulatory fluids. In walking, every foot-

fall affords a wholesome vibratory motion, extending throughout the system and reaching its minutest particle. Riding, whether in a carriage or on horseback, simply exalts this kind of action and its effects. Each exercise increases the action of some portions of the body more than other portions. From each may therefore be derived a specific therapeutic value, according as it is desirable relatively to increase or diminish action in different regions of the body.

Now, in all cases of chronic disease there are presented conditions to which these facts pertaining to motion correspond. There is deficiency of physiological motion, as well as of the conditions for its spontaneous supply. The property of motion to become converted into other forms of force whose presence is needed to perfect vital operations, is one of the utmost importance in therapeutics. Exterior aid can, through this property, be employed to perfect physiological endeavor, therefore, to restore health. It need not be said that the application of vibratory motion to delicate and sensitive parts might prove injurious. The contrary assertion would deny the possession of curative

power. The advantage of all power resides only in its discreet use. The value of a drug is closely connected with the fact that it becomes poisonous in some doses and under some circumstances. It is exactly so with force in vibratory as in other forms. Injurious effects only proclaim a wrong use of any agency, and the unfitness of the prescriber.

The adaptation of remedies demands most thorough acquaintance with disease; its special form and nature, its degree of progress, the constitution of the patient, the capacity of the system, and the relation of the parts to each other; it also demands a thorough knowledge of the nature and powers of the remedy. Deficiency in any particular is sure to render treatment either useless or positively injurious; the remedial use of motion is by no means an exception.

ACTIVE AND SEMI-ACTIVE MOVEMENTS.

OTHER movements than the vibratory are of indispensable service in most cases for the treatment of loss of muscular and nervous power. For while, as a general rule, it is of

the utmost importance to husband the limited nerve-power by restricting its expenditure, yet it is sometimes necessary to direct this power into the extremities. By vibration the organic activities are so aroused that more power seems to be generated; and it has been found that the volition can be put forth with greater ease and effect. Actions of this kind serve to extend the influence of the will to the extremities, and so to aid in regaining lost control over the muscles.

The utmost caution is necessary in the use of voluntary exercises that they be not too vigorous or too frequently repeated. Errors in this respect are often committed by persons who have failed to master the principles of the treatment by motion and force, and who, therefore, can only imitate the methods I have devised. Understanding that *motion* is the form of the remedy employed, they proceed to make large and exhaustive demands on the will of their patients. They can only sadly fail in cases of *real* disease and of delicate constitutions, much to the detriment of correct practice. When the power of the nerve-centers is quickly exhausted, it is tolerably

certain that this power is only slowly and with difficulty replenished, and that it is the replenishing rather than the exhausting process which demands assistance. Even slight indiscretions in the use of voluntary action will sometimes re-excite the morbid process which was the original disease. Why this effect may ensue is easily understood. For while, in health, the nerves and muscles act equally, they are supplied with nutrition to sustain their action in corresponding, that is, equal ratio. But in disease the nerve-action is disproportionate to muscular action, causing also disproportionate distribution of blood-supply, and congestion of the nerve-centers is produced or continued, as the case may be.

It should be said, however, that in practice there are circumstances which modify the occurrence of results so grave. Among them are the coincident restriction of the power of the will, denying action to the nerve-centers, also the subsidence of the hyperæmia of the nerve-centers, and the substitution therefor of some of the morbid products disclosed by post-mortem examinations.

The undesired effects of voluntary exercise

in these cases of restricted power, may be avoided by using appropriate means to control expenditure. A sure method of exercising control is to move the affected extremity by the hands of assistants in such a way as to allow the invalid only a limited participation in the action. While this is safe and useful for the patient, it is too fatiguing to the assistants to be of very much account.

PARALYSIS AND NEURALGIA DUE TO A VARIETY OF DISEASED CONDITIONS.

THE curative effect of vibratory and special movements in paralysis, neuralgia, and other affections of the nervous system, is manifestly due to the extraordinary control attained by these operations over all the primary actions, and especially the nutritive. Were this not the case, the remedy would be circumscribed in its curative effects to a very limited sphere, as is that of a drug.

The different degrees and forms of paralysis and other nervous affections are in themselves only symptoms and effects; they are referable to a multitude of causes, but not to any uniform and specific cause.

Nerve-function consists of two branches—the evolution of nerve-power, and the conduction of nerve-power. All causes, however diverse, which restrain or prevent the *evolution* of nerve-power at its central source; and all causes which restrain or prevent the *conduction* of nerve-power along its prescribed channels, whether the function be motor or sensory, will be attended by paralysis as the necessary consequence.

So, also, all derangement in the manifestation of sensory power will be accompanied by sensations of an abnormal, and generally of a painful kind, and this constitutes neuralgia.

It hence appears that paralysis and nervous affections in general have not that specific character that is assignable to many forms of disease, and that while the ultimate cause must lie in perverted nutrition, their intermediate and direct causes are multiform. Among these, physicians are cognizant of the following:

Inflammations, abscesses, and tumors, arising in the immediate proximity of a nerve-conductor, may afford such pressure upon it as to interrupt its function and destroy or mod-

ify its conducting power. The parts to which a nerve so affected leads will become paralyzed, or will suffer pain, according to the degree of pressure. There also are cases in which the conducting nerve does not readily resume its function even after the original obstruction is removed. This is peripheral paralysis.

Compression of Spinal Cord or Brain, from Effused Fluid.—Serous or watery fluids may be too abundantly secreted by the arachnoid membrane which incloses the central nerves. The pressure thus produced will wholly or partly suspend the functions of these nerves. Loss of power—paralysis—and deranged sensations will be the consequence.

Degeneration of the Central Nerves by Softening.—The power-evolving tissue looses its texture, becomes soft, and ceases to be of proper consistency or to be normally renewed, and nerve-force is consequently no longer generated. This form of degeneration is one of the consequences of imperfect nutrition. Paralysis is coextensive with this morbid change.

Change of Structure.—The nerve-tissue or substance is displaced at points by another formation—a hard whitish substance—called

sclerosis. By this change the generation and conduction of nerve-power, both motor and sensory, are precluded.

Embolus.—Coagula of blood sometimes obstruct branches of the nutritive vessels of the central nerves, and thus deprive the power-generating tissue of its nutrition. These coagula doubtless begin as minute points and increase by accretion. Paralysis of the parts connected by nerves with the centers thus impoverished is the consequence. The function of the brain may also be deranged by a somewhat allied affection consisting of an expansion of some vessel.

Congestion.—In many cases of neuralgia, congestion of some portion of the nerve-centers or conductors undoubtedly exists. There is also abundant evidence that congestion is precedent to, and coexists with, those special morbid conditions of the nerve-centers from which paralysis results. Effectually to prevent and remove congestion is therefore equivalent to removing paralysis.

Local Adventitious Matters.—There doubtless occur various products of waste and of imperfect nutrition which have never been

isolated and named. The conditions for the existence of such products consist of deficient activity in the processes of oxidation and venous absorption. The pressure of such matters upon, and their contact with, the power-generating nerve-substances must obstruct vital function and cause paralysis and neuralgia.

Toxic Elements.—Nearly allied to the above is the spontaneous occurrence of blood-poisons. That the peculiar characteristics of many chronic diseases are due to this cause is extremely probable; and there is no obvious reason for making chronic nervous disease an exception. That other forms of spontaneous blood-poisoning exist besides the universally recognized one of *uræmia*, is matter of legitimate inference. Those toxic principles which are conceded to be the basis of the acute eruptive diseases, should have their analogues in the slowly developing or chronic affections. That the effects of these causes would be most conspicuous in the nerve-centers is naturally inferred from the sensitiveness of this portion of the organism. This suggestion accords with our experience in producing transient blood-

poisoning by certain drugs. In a deranged and morbid condition of the nutritive system there is a continuous supply of morbid products, capable of deranging the action of nerve-centers in various ways, according to the composition and quality of these unnamed products.

HOW PARALYSIS OCCURS, AND HOW REMOVED.

We are now enabled to understand the mode of origin of paralysis and other nervous affections. Such affections are the consequences of certain proximate causes, a part of which are above enumerated; these, again, are the products of radical causes, related in some way to the development, sustenance, and destruction of the elemental vital form, which serves as the instrument of nervous power. It is plain that the real and radical remedy for nervous disease must reach both the proximate and the ultimate causes, or only imperfect relief is found.

It is not enough that the extremity or other paralyzed part be stimulated to act by medicinal or even mechanical stimulants. Such action can be maintained only by power ema-

nating from a source back of the point where it is exhibited. Action is of no account unless it has its origin in the centers designated for its evolution. The power stimulating the muscles must be *vital*, and can arise from no other conditions than those which support vitality.

THE CONNECTION OF VIBRATORY AND OTHER MOVEMENTS WITH THE RESTORATION OF NERVOUS POWER.

THE conditions for recovery consist in the removal of impediments to normal action, and the supply of power in the direction of physiological activity. The physiological channels and mechanical methods through which these purposes are accomplished by motion have already been detailed. The application of these principles to special classes of paralytic and other nervous diseases is readily made. For example:

In spontaneous blood-poisoning, and in case of adventitious substance in contact with nerve-tissue, the influence on the generation of nerve-power can only be annulled by the removal of the painful matters by oxidation.

They occur only because of the incompleteness of the oxidizing function, and remedies afford no complete substitute. The oxidizing function is readily exalted simply by securing more energetic contact of oxidizable matters with this element. Such contact is rapidly and thoroughly secured by vibratory motion. This purpose is further assisted by cultivating the power of the respiratory organs through increased action of the muscles of the chest. That the effect sought is secured soon becomes evident upon the application of the appropriate movements.

Congestion, whether of the head or spine, is removed by leading the blood away from the congested region, in connection with stimulating and strengthening the contractility of the weakened vessels. The revulsive effects of vibration and special movements are particularly efficacious in diverting and correcting the course of the circulation in the larger vessels; while the direct effect of the same causes in refreshing the blood in the capillary vessels furnishes a new and important addition to therapeutic resources.

The pressure of effused fluids upon the nerve-

centers is removed only by promoting their absorption. By causing the blood to flow more freely in its vessels, the physical condition for transfer of fluids is supplied. Effusion can take place only when the circulating fluids are stagnant. Every physical impulse received from without by the capillaries urges their contents forward. This aids the removal of impediments in the circulation, and therefore aids absorption. This impulse and action are fully supplied by vibratory motion.

Even if the effused material be blood, the chance for its complete removal by absorption is greatly increased by the vigor afforded that act through the influence of vibratory motion.

In cases of degeneration and of hardening of sections of the central nerve-substance, the same agency induces effective restorative action. Remedial indications call for the correction of the process whereby morbid change was produced in order to correct the effect. This remedy, however, will produce local as well as general effects. It has been repeatedly proved that scrofulous enlargements and glandular swellings disappear under the judicious use of vibratory and other movements; and it will be

seen that cases of paralysis which are rationally referable to altered structure are restored under the influence of the same curative means.

Coagula in vessels are possible only because the general conditions for the support of vitality fail. The motion which fructifies and supports the vital endeavor at other points would be the most rational means of preventing the occurrence of this kind of mechanical impediment in the circulation. Besides, the tendency of vigorous motion would necessarily be to break up and reduce to its elements such mechanical impediments after they have formed, and thus serve as the most promising of all remedies for this cause of paralysis.

Paralysis and neuralgia produced by chronic inflammation of contiguous tissues of course subside on the removal of the cause. The *rationale* of the cure of chronic inflammation has already been explained. The effect of the treatment by vibratory and special movements in nervous disease arising from this cause is more open to observations than in the other cases named, and is therefore more immediately satisfactory to both physician and patient.

APPLICATION OF THE FOREGOING

THERAPEUTIC PRINCIPLES.

HAVING examined the modes of action, the effects and curative power of vibratory and special movements, we are now prepared to inquire into the results of their practical application in cases of nerve-disease.

CEREBRAL CONGESTION.

FULLNESS of the head, when habitual, is of itself a serious affection, and ordinarily difficult to remove. When considered as the necessary preliminary of a series of diseased conditions which ultimate in paralysis, it becomes a matter of the utmost significance.

There can be no disagreement regarding the needs of cases belonging to this class. The first and most imperative one is the withdrawal of the surplus blood from the head, and its distribution to parts evidently suffering defi-

ciency. Even if there be suspected disease of the arterial walls, which of course implies the worst consequences, the indications are not changed; nothing can be proposed of more promise than the removal of the undue arterial pressure, as the condition for the restoration of the integrity and contractile power of the arterial walls, upon which everything depends.

Two things are required to secure the ends proposed: the kind and degree of action which shall cause the blood to flow freely to the extremities, and to become permanently employed in supplying nutrition to the tissues; and the kind and degree of action which fructifies arterial nutrition, and strengthens these minute but all-important vessels. The remarkable influence attainable by vibratory and special movements over the circulation in the larger as well as in the minute vessels when freely brought into requisition is easily tested, and their power to afford renewed energy to defective parts may be implicitly relied on, as the following case will show:

Mrs. B., aged forty-three, of full habit, with short neck, large head, and much color of face, bordering on purple, had been for several years

engaged in business which required severe tension of the calculating faculties. She became affected with cerebral symptoms of increasing severity. These consisted of a feeling of pressure in the head, accompanied with intolerable headache. These symptoms had irregular periods of aggravation, when she would be confined to her bed, dizzy at the least movement, eyes injected and intolerant of light, and voluntary power diminished and often temporarily lost. Her feet were always cold; no means had sufficed to maintain even a comfortable temperature.

For more than a year she had been under the watchful and interested care of an eminent physician. But, unfortunately, medicine supplies no adequate, certainly no *permanent*, remedy for mal-distribution of the circulation. Ordinary revulsives and derivatives are limited to local and temporary effects, and the insidious changes going forward in the cerebral structures proceed to their fatal termination, with scarcely any interruption from medical effects. Atheroma, thrombus, and effusion, affections leading to fatal consequences, must have their commencement in local defect in

the power of the vessels, and in sluggish local circulation. This local condition depends as much on the use other parts make of the circulation as the parts specially suffering. The blood must be transferred to vital regions far beyond, in order that the threatened region may heal. In the present case, the frequent transient loss of power and consciousness constantly threatened to assume a fatal form.

In this condition she came under my charge. Appropriate movements were applied to the extremities first, and to other portions of the body in due order. These operations from the first afforded her relief, and very soon she felt an assurance that the cause of her suffering was passing away. After four weeks, having had none of the former exacerbations, and being quite free of all unpleasant symptoms, the treatment was suspended.

A few weeks later, on the recurrence of a slight premonition of her old malady, she returned for a short period, and the result of treatment was complete success, since which she has remained well.

It will, perhaps, be said that there was no lesion in this case to prevent recovery. To

this it may be replied that similar cases are often hopeless from the beginning; that it can not be certainly known just what degree of change in the substance of an organ is required to constitute lesion. Besides, we are justified, from the proved efficacy of the means employed where the parts are open to observation, in the inference that reparation of serious injury may and often does transpire under the favorable circumstances presented.

SCIATICA.

THIS form of nervous disease, usually only ameliorated by medication, and by the external application of stimulants and irritants, is entirely amenable to the treatment by vibratory with other movements. It is probable that the two effects of revulsion are brought into use in these cases. The powerful agitation of the extremity calls blood into it, and simultaneously diminishes the fullness of the capillaries of the lower segment of the spinal cord and of the plexus, in which the sciatic nerve originates, and from which it derives its power, thus restoring the nerve-centers.

At the same time the *muscular* action and nutrition of the affected limb is increased by the same cause, which also inevitably restores the balance between the muscle and nerve; congestion of the nerve and its pain are simultaneously removed.

This statement of the principles of cure is fully corroborated by facts. An organ or extremity suffering neuralgic pain diminishes in size. This indicates that the morbid and intense nerve-action, which constitutes pain, is supported at the expense of muscular nutrition. When the latter is restored by any *adequate* means, the muscular growth and action are restored, while the pain no longer continues.

The same principle of restoration is found equally effective in practice, when applied in case of neuralgia of the arms, or indeed any portion of the body. The following is an average case illustrating the access, progress, and cure of sciatica:

Mr. N., of this city, aged about forty-five, had suffered more than a year with sciatic pain of the left leg. He attributed its origin to harassing business perplexities, being a mer-

chant engaged at that time in an unsettled branch of trade. Though the pain was nearly constant, it fluctuated greatly in degree. The greatest suffering was at night. He was compelled to rise from his bed, rub his limb with his hands, and walk the room for relief, several times during the night. He had been treated by the usual methods, including *electricity* and *rubbing* applied by well-known physicians, but only temporary relief was attained. He placed himself under my care in the fall of 1869. The afflicted leg was shrunken in size, the flesh soft and flabby, exhibiting a very strong contrast with its fellow. The treatment, as usual, was adjusted with reference to increasing the muscular nutrition of the limb, while it should diminish the hyperæmia of the lower segment of the spinal cord. The patient was required to *do* nothing, while energetic molecular activity was aroused in the extremities, the unaffected as well as the affected one. Experience has shown that to secure the first described effect of revulsion, it is much better to produce excitement in both limbs than in one. At the same time the limbs were extensively stimulated by appropriate mechanical

processes. In doing all this, care was taken not to engage the action of the will power in the affected leg beyond a very moderate degree.

The whole body was included in similar operations, both because the whole system labored under some defect, which, precipitated upon a particular nerve, caused the manifestation of the disease, and also because, in applying treatment, it is important to success that the circulatory, nervous, and nutritive activities should be thoroughly equalized. A single application of these processes caused decided amelioration of pain. This effect increased with each subsequent operation. After three weeks, the habit of wakefulness with which he had been so long afflicted was broken up, and he could rely upon good rest through the night. He continued the treatment two months, when the need for it disappeared altogether, being quite restored to health.

PARALYSIS.

ALL forms of paralysis afford the severest test of the efficacy of remedies. The reason of the difficulty of conferring any benefit in these

cases often arises from mistaken endeavors of the physician. He is inclined to dally with effects, the products of disease, instead of strengthening the vital power in every tissue, and perfecting the blood-making process, upon which all power so much depends. Even if the latter be the physician's purpose, he is generally not sufficiently cautious in choosing his remedies; for, in case of paralysis, the nature of the affection is such as to require their prolonged use. If such remedies be employed as would prove injurious to the healthy, they must be much more so in case the vital power is insufficient to protect against their pathogenetic effects. However flattering their first effects may be, their prolonged employment will serve but to weaken and destroy the little remaining chance for recovery. The continued use of medical stimulants for the spinal cord is, therefore, to be deprecated.

Many physicians, though perhaps not fully agreeing with the statements above made, yet practically adopt the principle. This is proved by their having recourse to the remedial use of force in the form of *electricity*, thus acknowledging the insufficiency of ordinary remedies,

and the probability of finding in some form or application of force the adequate aid for the vital endeavors. Even in the use of this agent the same practical error is not unfrequently committed. Paralytics often entertain singular ideas as to the nature of their disease. They seem to regard disease and pain as something synonymous. They declare themselves to be *perfectly well, except* some extremity which is useless, and assume that that part only requires treatment. It is often difficult for them to understand that the grand purpose of the body is to yield power, and that all deficiency of this product indicates defect in the process, which is quite the same thing as ill health. Nearly all cases of paralysis are benefited by the treatment of vibratory and other movements. The following is a good illustration of the result attained in this disease:

Miss Y. was twenty-four years old when brought to me from a neighboring city. Her disease began five years before with typhoid fever, accompanied with spinal meningitis, which lasted several weeks. She only partially recovered from the effects of this illness; for though she acquired the ability to walk, her

power to do so diminished instead of increased, and in less than a year she lost all control of her lower extremities. She suffered no pain, except occasionally in the loins, which was accompanied with a sensation of heat. Her disability was such that her only mode of locomotion was the wheel-chair often used by this class of invalids. Crutches were of no use to her; she could stand only by being held in the upright position by assistants. Sensation was entirely absent from the knees to the feet; upward there was a gradual increase of sensibility to the loins, above which it was perfect; the control of the sphincters was incomplete.

The vibratory action was applied freely to the feet and legs first, afterward in succession to all other parts of the body. This operation was continued, with suitable intervals of rest, two or three hours daily. Little fatigue was experienced from these applications, but rather a tendency to quietude and sleep. Increase of temperature of the extremities is always produced; in the present case it was sadly needed, though she was not sensible of the constant coldness of her feet and legs. Symptoms of increase of power soon followed the restoration

of natural heat. Occasionally, the sensation of heat in the loins was subdued by the application of the *ice-bag* for an hour over this particular region of the back. Encouraged by slow but constant improvement, the treatment was kept up four months. At the end of this time she was able to walk about the house, assisted by a cane, and the presence of an attendant. In this condition she went to her home for the summer. In October she returned, having made some progress in the interval. Resuming the treatment as before, with such additions as her increased strength allowed, her progress was more rapid; she was soon able to make short excursions on the street, assisted by her cane and attendant. At the end of another four months the sensation and motion of her limbs had so far recovered as to afford to ordinary observers no intimation of any defects, except that her steps were slow and measured. In the course of the succeeding year she returned again, and received treatment three months. At the end of this time there was nothing wanting in sensation, motion, or health. She was soon married, and has continued well, not only able to engage in the

ordinary occupations, exercises, and enjoyments of life, but thinks nothing of walking two miles upon the street at one time. In fact, she is able to walk farther and endure more, with less fatigue and no disagreeable consequences, than the average of ladies who consider themselves well.

This lady's case affords an excellent test of the value of other medical resources for paralytics, compared with force, as vibratory motion. For five years she was undergoing different kinds of medical treatment. During the first portion of this period she did not stray beyond the ordinary range of the physician's resources; afterwards she resorted to such special means as electricity, then Turkish baths, etc. These different methods gave her some encouragement, but none had made a real impression on her disease; and she remained as helpless as before, and came to me with no hope of a radical and permanent cure.

The favorable result attained in her case, and attainable in multitudes of similar cases, is plainly due to the greater relevancy and amplitude of the curative means. Neither unaided nature, nor the usual resources, could secure

so thorough and constant revulsion from the spinal cord; none could impart to the nutritive forces, which form the basis of all power, the requisite nutritive energy. These indications are, however, liberally met by the judicious application of movements.

It is important to remark, for the encouragement of paralytic invalids, that less perseverance would have attained less, perhaps no reward. If she had become discouraged at the end of two or three or four months, as many afflicted in this way are inclined to be, the result would have been entirely negative.

PARAPLEGIA, AFTER EXCESSIVE MENTAL WORK.

It is probable that in sudden attacks of paralysis, a precedent condition conducive to it, existed. The nutritive vessels of the brain or spinal cord are in such condition of disease as to render a full attack inevitable. The circumstance to which the attack is referred is the occasion for developing, rather than initiating, the disease. Sooner or later an attack would be inevitable, unless those habits of life which insidiously but certainly undermine the general

and local health are radically changed. There are always causes for disease of the nerves, traceable far back of the symptoms, and it is to these causes that the physician's as well as patient's attention is most earnestly invited.

An instance now in mind is that of Mr. M., aged sixty, who was, at the time of his attack, a clerk of a State legislative body. His duties in this position were and had been extremely arduous, even requiring his attention so much at night as seriously to interfere with his time for sleeping. After some months of this excessive strain on his mental and bodily powers, he was suddenly struck down speechless and nearly motionless with a paralytic attack affecting the whole body, but the lower extremities in greater degree, which remained for several weeks quite useless. He improved very slowly, and at the end of about a year his general health was apparently good, the arms were only weak, and by the aid of a cane he could walk about after being lifted by an assistant from his chair. The flexors of the feet, however, had but feeble contractile power, and sensation in the lower portion of his legs was nearly absent; his countenance was dull and

appearance dejected. In this condition he came to me, having required in his journey hither the aid of two men to effect his transfer to and from the different conveyances.

The treatment was exclusively by vibratory and special movements, and was rapidly beneficial. Sensation returned to his legs, and his control over them increased daily. Vivacity returned to his countenance, and his whole appearance improved. In three weeks he could easily rise unaided from his chair; in five weeks there was full return of power and feeling to his legs, but the flexors of his feet still acted tardily, causing the toes slightly to droop, but not enough to be conspicuous in his gait. He was fond of surprising those who had known his helplessness, by exhibitions of his agility. Circumstances at this time compelled him to return home, being now able to engage in business pursuits.

We can never be so sure of the exact nature of the spinal affection from which paralysis proceeds, before the patient has received treatment as afterward. There appeared nothing in the history of this case, or in its symptoms, to indicate that it would not, under ordinary

circumstances, pursue the same course of gradual diminution of power that is ordinarily witnessed in similar cases. The rapid improvement which immediately followed the application of means adapted to remove local congestion and to produce absorption, proves that the obstructions to the manifestation of nervous power did not consist of deposits of a low form of organization, or of a material degree of degeneration of the spinal centers. More time is requisite to effect the changes preliminary to recovery after morbid deposits or actual degeneration has occurred.

We do know, however, from daily experience, that pathological states form a progressive series—one gliding into another for which it is the preliminary, with unerring certainty. An easily removable congestion becomes duly transformed to fixed products, perhaps of low organization, most difficult to liquefy and remove. We may infer the nature and extent of such transformation from the greater or less facility with which the case yields to appropriate treatment. If the treatment has been inappropriate—that is, does not most powerfully antagonize congestion, and produce the

other effects desired — our judgment is not aided by the result.

GENERAL PARALYSIS.

Even elderly persons afflicted with paralysis are amenable to treatment, and the lives of such may be rendered not merely comfortable, but useful for a prolonged period. Mrs. E., aged sixty-two, came to me for medical care and treatment four months after a stroke of paralysis, affecting the whole system in nearly equal degree. At this time she was unable either to turn in bed, rise from a seat, articulate distinctly, use her hands to feed herself, or her feet to walk. Every change of position required assistance. At times there was great difficulty of swallowing, with spasm of the throat and diaphragm. Her symptoms were scarcely any better than immediately after the attack.

Added to this were other long-standing difficulties. One lateral half of her body was defective in size and power, the result of infantile paralysis, and had, through life, been the seat of much neuralgic pain. The bodily weak-

ness, or perhaps the consciousness of restricted power, reacted on the mind; she was subject to frequent fits of involuntary sobbing and great depression of spirits, and was quite as hopeless of recovery as were her friends. The caprices of fortune had borne heavily upon her, and as a necessary recourse she had devoted herself to intellectual and literary labor with more energy and tenacity than could be healthfully borne, which was regarded as the probable cause of the precipitation of her attack.

After four or five weeks of careful application of the varied forms of this treatment, acting upon the extremities and afterwards other parts of the body, she began to show the desired evidences of improvement. Her voice returned, and she could use her hands to feed and wait upon herself. At the end of three months she had acquired natural and complete, though not vigorous, control of every muscle of her body. Her mind became clear, her hands resumed their cunning, she could feed and wait upon herself; she cut, prepared, and made her apparel; her feet obeyed her wishes, and not only bore her large, heavy body over level surface, but up long flights of

stairs without assistance. It was inconvenient for her to pursue longer the regular application of the treatment, but at irregular intervals she resorted to my rooms for this purpose, coming from her home; thus she for a while continued the improvement so well begun. After two or three months more her strength was so far restored as to enable her to engage in usual female avocations, and to resume to some extent the exercise of her pen.

Her age is against her ever regaining the full vigor of middle life, even had circumstances allowed her to continue the treatment which she greatly desired. But at this date, nearly four years since she came to me, she still enjoys comfortable health, having lost nothing that she had acquired while under treatment.

In this case it is probable that the process of restoration was simply that of absorption; or at least that absorption of effused fluids was the foremost of the processes of curative action. Vibratory motion is a most powerful agency for causing capillary action and the return of interstitial fluids to the circulation. To cause this action is, in such a case, to remove the

surplus fluids in the sub-arachnoid spaces and the consequent pressure, from the brain and spinal cord.

The well-proved oxidizing effect of vibration, and its aid in sustaining and reproducing the wasting organic instruments of power, are also to be kept in mind in accounting for the restoration of these cases.

HEMIPLEGIA.

PARALYSIS of one side is regarded as proceeding from disease or injury of the spinal nerve at one side above the parts where defective power is manifested. Paralysis of this form may be progressive, or it may occur suddenly. On account of the concealed position of the seat of the affection in the cerebro-spinal axis, the exact nature of the morbid change can not be precisely known during the patient's life. While this fact may render a prognosis impossible, it does not in the least absolve the physician from his duty to the invalid with paralytic disease.

The treatment by force through the instrumentality of motion affords peculiar advan-

tages. While in no degree hazardous, differing in this respect from many spinal remedies, this remedy acts only in the direction of health. It almost without exception produces beneficial effects, even in those cases which are not destined to complete recovery.

The following case illustrates the beneficial effects of the use of vibratory and other motions in a case of hemiplegia, referable to an affection within the cranium:

Mr. S. was a gentleman well known in public life, of an extremely active, sanguine, irrepressible temperament, with fine intellectual and superior oratorical powers, and at the time he applied to me for medical counsel was aged fifty-nine. He had been the subject of great extremes of excitement in the arena of politics as well as business, a thoroughly "used-up" man, whose general appearance indicated twenty more years than he had seen; in short, one of that class of cases for whom the physician expects least benefit from his remedies.

The accession of his disease was sudden, and affected the whole of the *right* side. Percussion revealed a dull tenderness near the

base of the head, at the *left* side. He could walk a few rods with great difficulty, by giving the affected leg a lateral swing, having no control of the flexors of the foot, and those of the leg being nearly in the same condition. He was unable to raise his right arm, and it swung uselessly at his side. He could not move his hand or fingers, except, perhaps, in the slightest degree; they were numb and rigid, and could not be straightened; they were much swollen from debility of the vessels. The mental evidences of the affection were prominent. He had often an uncontrollable disposition to weep, great fear of being left alone, great depression of spirits, all of which were sources of intense misery. His judgment, however, was correct, and his interest in affairs as active as ever.

He came under my care about ten months after his attack. All treatment was suspended but that derived from various forms of motion. Special pains was taken to reawaken powers of motion and sensation in the affected arm and hand. This patient was satisfied with a small amount of treatment, which is contrary to the usual desires of this class of invalids, but it

was daily and regularly applied, according to the variations in his nervous condition.

In three weeks he could for the first time use his knife and cut his food, and also began to employ the affected hand to open doors, etc. In six weeks he went home greatly improved in body and mind. During several succeeding months he came for a few weeks' treatment at different times, as suited his convenience and fancy. He became able to walk long distances in the streets, though not without a degree of awkwardness in his control of the right foot. He acquired control of *all* the muscles of his right arm, though not the wonted celerity of motion. He had not, since his attack, been able to write his name; now, he wrote letters covering several sheets of paper, in a beautiful round, clear hand. This result certainly exceeded all expectation founded on ordinary experience.

LOCOMOTOR ATAXY—PROGRESSIVE PARALYSIS.

THIS form of paralysis is characterized by deficiency or absence of control of the motions of the lower extremities. It is accompanied

by loss of sensation, while the strength of the muscles remains. The motions are irregular, the invalid staggers in walking. These peculiar symptoms arise from degeneration of the posterior columns or portion of the spinal cord, while the anterior portion is less affected. The affection comes on very slowly, and progresses till all power is lost.

The control exercised over nutrition by vibratory motion affords a new prospect for recovery, in this confessedly intractable class of cases. Not only is the degeneration of the cord arrested, but the renewed vivacity of all the nutritive operations results in restoration of power, and probably also in the reproduction of power giving tissue.

Mr. N. had been for years engaged in extensive manufacturing as well as mercantile business involving many cares and much anxiety, but from all of these he was now laid aside. When he came to me he had been a great sufferer for three years. The symptoms of his disease had developed very gradually, but with decided and uninterrupted increase from the beginning. On examination I found complete absence of sensation in his feet and

legs. A pin passed its whole length into his leg, in different places, elicited no sensation whatever. He did not feel the touch of his feet on the ground. He had full muscular power in the legs, but was obliged to maintain his balance in walking by placing his feet wider apart, and constantly looking at them.

Notwithstanding the numbness, he suffered much torture from morbid sensations. The chafing of his pants was annoying, while the casual brushing of ladies' skirts against his legs in walking often gave great suffering. In addition, and in seeming inconsistency with numbness, he had occasional attacks of stinging, burning pains, generally confined to a very small area. He compared this sensation to that which might be caused by the impinging of a jet of steam against the leg. This form of pain frequently shifted its location. Common sensibility remained entirely absent during these paroxysms of excited and morbid sensation.

He was quite disqualified for business, receiving meanwhile the advice and care of the most esteemed in the medical profession. His adviser for several months before consulting

me was Dr. Brown-Sequard; nothing, however, had served in the least to arrest the progress of his disease, or even to mitigate his peculiar suffering. The medical reader will doubtless form an hypothesis from the narration of symptoms given, that there was progressive degeneration of the posterior columns of the cord, and that this diseased condition was attended by, and probably produced, a congested condition, perhaps sub-inflammation at various points of the anterior columns.

Considerable difficulty was experienced in adjusting the treatment to the seemingly mixed and contradictory symptoms. Should the blood in the spinal cord be increased or diminished? and in what portions of it are these different effects required? were questions which could not be satisfactorily answered. Even if they could be, it is impossible to treat differently nervous elements in immediate contiguity as are the anterior and posterior columns of the spinal cord. No benefit appeared at first to be derived from the treatment; the absence of feeling, the difficulty of locomotion, and the attacks of acute suffering continued, but as he

did not grow worse—his previous constant experience—he persevered. I had demonstrated in a sufficient number of instances to be satisfied of the certainty of the power of vibratory motions to remove congestion, and to invigorate the nutritive tone of any part for whose benefit these motions were used; and the treatment of the case was accordingly continued. In eight or nine weeks the tactile sense—sensation—began to appear, and the paroxysms of pain to diminish in severity and frequency. At the end of four months, though not restored, he felt able to take some active part in his business, consequently suspended treatment and went to his home. The sensations were now normal, except a little remaining numbness in his feet, and the paroxysms of pain were infrequent and comparatively slight.

The next winter he returned, having lost nothing in power or health during the eight months he had been absent; on the contrary, he had continued in some respects to improve, notwithstanding he habitually devoted several hours each day to active business. He could now walk with a firmer step, and the act demanded less of his attention. I found him

decidedly more amenable to treatment. He remained with me three months more. At the end of this time the sensations and motions of his feet and legs had become perfectly natural, and the strengt has full and vigorous as ever. He has for the last two years filled his place at the head of a large business, where he has heavy responsibilities, but not a symptom of his old illness has returned.

This case also confirms the supposition that the curative process goes forward in the seat of the disease for a considerable time before the fact is manifested in the sensations and strength of the patient. The nature of these intermediate processes of restoration is a matter of rational inference based on what we know of the means employed and the condition precedent to their use. In the spinal cord there must be diseased substance and probably dead adventitious matters, consequently material foreign to the composition of vital, power-evolving tissue. To oxidize and remove these is the primary object. The acting vital elements of the spinal cord need to be reinforced with fresh power. Nothing can do this so well as to aid the nutritive endeavors. That the

atomic and molecular motions which are induced by vibratory movements are capable of effectually securing these ends, is apparent from the wholesome changes they work in other forms of disease. The favorable results, easily demonstrated, prove that the means employed are far more powerful, and better adapted to the end desired, than ordinary remedies, since such remedies are of only temporary service, or entirely useless.

Other conditions being equal, recent cases of paralytic disease are far more tractable than those which have existed for several years. The latter class need not, however, despair of help. The following case proves that the impediments to the manifestation of nerve-power may be removed after they have apparently become fixed. This case is that of a Southern gentleman, forty-eight years of age. Until five years ago he had enjoyed excellent health, and then his illness came upon him without a premonitory symptom. On awaking in the morning, he found himself unable to move any of his limbs; his head was the only part of the body that would obey his will. The sphincters were utterly powerless, and so remained for a

long time. He, however, improved slowly, and in six months had regained the use of his arms, and was able to stand upon his feet, if supported. His efforts were thereafter directed to full recovery. To this end he availed himself of the counsel of the ablest physicians, and submitted to the usual variety of medical treatment. During his illness he resided for a period at each of the several Virginia Springs, the Arkansas Hot Springs, the Kentucky, and St. Catherine's, Canada. He had also availed himself of the skill of the eminent leaders of medical practice in nervous diseases in this city. During the last year he had relinquished all treatment and hopes of further improvement.

At this time a former patient, a well-known gentleman, observing his helplessness, urged him to try once again. So faithless was he, however, that he could be persuaded to come for an examination only by being accompanied by his philanthropic acquaintance. His symptoms were those of an ataxic invalid. It was impossible for him to walk straight or erect. He would make excessive strides, and his legs would be thrown out in a very irregular and

even ludicrous manner at either side. His thighs were a good deal emaciated, and he had little power to retain urine. His feet were so numb that it was possible to inflict serious injury without his knowledge. At the end of one month after beginning treatment his main symptoms appeared unchanged; but in two weeks more he had made great improvement. He could now walk perfectly erect, scarcely any singularity could be detected in his gait, and sensation had in good degree returned to his feet. His control of urine had also much improved, and there was every prospect of continued improvement and ultimate recovery.

Paralysis is sometimes helped by vibratory and special movements in a very short time, when still from some cause full restoration is not attained. The power of the treatment and the harmfulness of impatience are well illustrated in the case of Mr. E., aged forty-eight—a gentleman of remarkable energy and business capacity. His was a case of progressive paralysis, beginning at the lower extremities with numbness and loss of motion. He resorted to medical treatment at once and continually, but nothing checked the progress of his disease;

and at the end of eighteen months he had not the power to rise from his chair, or even stand when lifted to his feet. The numbness had extended to his waist, and he could neither control the lower bowel or evacuate the bladder. His urine was ammoniacal and contained much mucus.

In this condition he came under my charge, not having relieved his bladder during his journey of twenty-four hours. The treatment was prescribed, and applied with great care, and he improved from the first. In three or four weeks the power over the bladder was completely restored, the urine was of normal quality, and he was able not only to stand, but to walk with the aid of a cane and one attendant. In eight weeks his control of his legs had so increased that he made frequent, but unadvised, walks about the house with the aid only of his cane. Having gained confidence in this increased power and control over his extremities, he now walked the distance of thirty feet without cane, attendant, or any assistance whatever. This effort was contrary to advice, and proved injurious; his mind became unduly excited; he grew impatient at what he regarded

the slowness of his recovery, and consequently concluded that the virtues of the treatment had become exhausted. In this frame of mind and critical physical condition he went from my care and resorted to electricity. I however did not lose sight of this interesting case. He lost health and power directly, so that he returned to his home in less than six weeks after leaving me, in a much worse condition than he came.

This case affords also confirmation of a principle of therapeutics previously expressed, that it is fatal to success to make undue attempts to exercise. The results of his efforts were not transmitted to the muscles of his extremities, but reacted upon the cerebro-spinal centers and promoted the congestion of those sensitive parts from which all nerve influence emanates. The consequences must be disastrous, and often irremediably so. The desired changes in the diseased nerve-centers can only be attained by affording preponderating activity to the muscles. This can only be done by withholding the exercise of the will, while the other tissues receive energetic exercise.

FACIAL PARALYSIS.

In a few cases, paralysis arises from some affection in the course of the nerve, the centers remaining sound. In these cases the nerve becomes diseased by contact with diseased structure through which it traverses. Health is more speedily and certainly restored in such cases than when the affection has a deeper seat. The case of Capt. S., of one of the ocean steamers, is in point. In this instance, an injury inflicted on the head, which confined him to his house and room for several months, resulted in paralysis of the facial nerve. There was complete loss both of action and feeling in the left side of the face. The mouth and cheek were consequently drawn to one side, and the left eye was drawn wide open, even in sleeping. He had no power to close the eye, not even to wink. The constant exposure of the membrane produced conjunctivitis, with incessant and profuse lachrymation. His appearance was of course unsightly. He came to me immediately on leaving his long confinement. The application of the treatment was extremely agreeable to him, and his lost powers were

rapidly developed. In one month sensation fully returned to the affected side of his face, he could control his eyelid, and was perfectly restored.

In this case no improvement had taken place in these several months, notwithstanding the care and skill that had been bestowed on a widely known and valuable man. It is possible that time would have wrought favorable changes, but no indications of it had appeared. Reparation of the nerve was doubtless attributable to absorption, always produced by the treatment. The rapidity of restoration attests the vigor and appropriateness of the remedy.

NEURALGIA AND HYPERÆSTHESIA.

THE subject of *pain*,* though old as life itself, has not been enough studied from rational data. It has been regarded and treated as useless, and having no compensating quality. The sensation, rather than its cause, is the dreaded thing, and consequently in the

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*For a more complete account of pain and its relations to health, the reader is referred to my work entitled DISEASES OF WOMEN, THEIR CAUSES, PREVENTION, AND RADICAL CURE.

more anxious than intelligent endeavors to be relieved, the effect instead of its cause receives medical attention.

Accordingly, when experiment develops medicaments whose employment mitigates or annuls pain,—or, rather, the consciousness of it,—such medicaments are forthwith regarded as an unqualified boon, and are adopted without further inquiry. It is not to be inferred from this that I condemn *all* use of remedies of this class; and that a temporary annihilation of the consciousness, so far as relates to pain under easily conceived and frequently occurring circumstances, may not be best. What is to be deprecated is the abuse of vitality arising from their frequent, especially their habitual, use; and also the influence of such remedies to discourage adequate investigation into the nature and relations of pain.

Pain undoubtedly is a mode of expressing vital power. In case of disease its absence indicates inaction of the instruments which should express it, but not, necessarily, an abatement of the morbid process. This view is supported by the fact that sedative medicaments diminish the waste of the system, con-

sequently, the organic changes whereby nerve-power is evolved; and also by the return of the pain as soon as the system is relieved of the presence of the drug. The prevention and the reduction of pain by medicaments consist, therefore, in the transient and local repression of nutritive action.

The *cure* for pain is a different thing from its suppression. The one corrects the process whereby pain is evolved, generally by causing a more appropriate use by the system of nutrition; the other conceals the results of misuse of nutrition, while the disordered relations continue. There is, I am justified by facts in stating, a radical remedy for chronic pain and excited sensibility—a cure that courts every test of efficacy. It consists in exciting activity in other tissues bearing a relation to the nerve-centers from which pain proceeds. Empirical practice, even when employed in a very crude manner, and to an inadequate extent, as when relief is found from rubbing near painful parts, confirms the correctness of the statement. But when processes are applied in a systematic and intelligent manner, the results leave nothing further to be desired.

There are probably several reasons for these effects, among which may be stated the following:

The two kinds of revulsion previously described are made distinctly and thoroughly available. The blood, bearing nutritive supplies, is energetically transferred *to* the skin and extremities, and, therefore, *from* the congested nerve-centers.

The demand of the muscles and other tissues for nutritive support is made by this action paramount to that of the nerves—thus reversing the previously existing relation.

The oxidizing effect which is the inevitable and direct consequence of vibration, works a change in the quality of the blood, destroys the toxic principles which may have arisen therein, and thus enables it more perfectly to supply nerve-support. The following is a good illustration of the radical effect of vibratory and other movements in extreme and prolonged neuralgia and hyperæsthesia of one leg. The case was that of an unmarried lady, sixty-three years of age when she placed herself under my care. She was of a strong constitution originally, and possesses a vigorous,

active intellect which she continued at times to task, but had early broken down in health of nerve by extreme labor in teaching and devotion to educational enterprises. She had neuralgic pain of the limb, accompanied constantly by extreme morbid sensibility—tenderness and soreness—so acute at times as not only to render the touch of another person exceedingly disagreeable, but this sensation would be prolonged for many hours. This sensibility prevailed throughout the whole leg, but was greatest along the sciatic nerve and its ramifications, and extended to the foot. She always required the aid of two crutches for locomotion, and was unable to mount stairs even with their aid. The soreness was aggravated if the foot was allowed to rest on the floor while sitting. The whole limb was much shrunken, soft, and flabby, and considerably smaller than the other.

A notable characteristic in this case was that these disagreeable symptoms were always aggravated by mental activity. Even five minutes' close attention to any subject would cause an increase of pain and soreness. To participate in conversation of unusual interest would

arouse these symptoms to greater intensity, soon compelling her to desist. For more than twenty years this condition had been perpetuated without any important variations.

This affection was not thus prolonged through lack of medical attention. After having conformed to the advice of different physicians of eminence in general practice without advantage, she had freely availed herself of all sorts of special remedial treatment that happened to be presented to her. She had been an inmate and patient at nearly every health establishment in the States, but all were equally ineffectual in even mitigating her symptoms. Indeed, the intolerable sensitiveness of the limb was rather aggravated than otherwise by these frequent applications of nerve-exciting remedies. Having in several instances demonstrated the peculiar efficacy of vibratory and other movements in reducing nervous excitement, I saw in this case an opportunity for putting the principle to the severest test. The treatment was so applied as to secure its revulsive effects, both as respects regions and functions. At first, and for some time, the affected limb was left untouched, while the various

forms of vibratory action were applied to the unaffected limb as well as to the whole body. In a few weeks we were gratified to find a diminution of the painful tenderness, and she began to tolerate the application of the treatment to the suffering extremity. She continued the treatment through the winter, at the end of which time her crutches ceased to be of further service, except on occasions of fatigue, when some degree of the old sensitiveness and soreness was apt to return. After an interval of several months the treatment was resumed. The weak limb acquired hardness, strength, and size till it finally became equal in every respect to the other. She has not used or needed her crutches for six years. She walks upon the street wherever she chooses; mounts stairs with perfect ease; does a great amount of intellectual labor; writes and publishes books; works from five in the morning until night habitually; travels about the country from Maine to Florida; is out in all kinds of weather; sometimes overworks, takes cold, and is temporarily ill, but *never* feels any return of her old suffering or weakness, and is now, at seventy, more energetic and healthy than since

her early womanhood. This case shows conclusively that complete restoration can be secured in spite of age and long-standing illness.

SUPERSENSITIVENESS OF SPINE.

Excess of sensibility is generally accompanied by excess of blood in the part from which it proceeds, and in proportion as such part is relieved of excess of blood, sensibility diminishes. In exterior parts we have ocular demonstrations of both the excess and diminution. In interior parts we have the evidence of the same conditions in the relieved sensibility which invariably follow the use of processes that draw the blood from the interior parts. Hence, morbid sensibility finds relief in those measures which operate to withdraw surplus blood from the spinal centers. This view is substantially supported by all medical practice, and is carried out by the use of counter-irritants to the spine, and by remedies which produce the effect of diminishing the caliber of the spinal capillaries.

It must be said, however, that sufficient distinction is not made between the transient and

the permanent benefits which may accrue from the use of remedies. Furthermore, the very important fact is too often ignored, that the remote effect of a remedy is frequently quite the reverse of the immediate effect. These statements are sustained by the experience of invalids affected with too great manifestation of sensory power. For, in the case last narrated, in which supersensitiveness was added to pain, there was neither lack of means or time employed to secure the desired result. But the effects proved to be simply a series of tantalizing disappointments, without permanent benefit to those interior conditions on which the symptoms depended. Remedies which affect sensory nerve-centers produce perturbations of the sensory power, without essentially diminishing the aggregate of morbid action. To indefinitely continue this kind of experience is to render more and more impressible the nerve thus acted upon, and render restoration either spontaneously or by any means quite impossible. The following case illustrates these principles:

Miss S., aged forty, when I was called to see her, had been for several months confined

to her bed in consequence of the gradual increase of a spinal affection which commenced a dozen years before. Her principal symptoms were those of exquisite sensibility of the back, mostly in its upper portion, extending at times to the head, accompanied with periods of special aggravation and severe hysterical attacks, in which the extremities and whole system would be convulsed and rigid. Her invalid history hardly deviated from the ordinary course of this class of cases. She had been for years uselessly treated for uterine affection, mistaking the subsidiary for the primary element of disease. Counter-irritation to the spine, as the scarred appearance of her back amply testified, had been freely employed without once attempting to obviate the *need* of counter-irritation. The relevancy of sedative and narcotic drugs had been fully tested, and she was now in the constant use of various opiate preparations.

The supposition that the use of the so-called sedative remedies suffices to diminish the aggregate of pain in chronic disease, is a very pernicious error. The effect assigned is only the primary; the secondary and opposite effect

is overlooked. The reaction from temporary annihilation of pain, or rather from the obliviousness to its existence, is severe; the sensations are greater, are less endurable, and call loudly for repetition of the drug. These statements are proved by reference to cases that have for a long period been in the habitual use of narcotics. The feelings become greatly exaggerated and the system so far subverted that it has but little power for any other purpose than to respond to sensorial impressions. This was the condition in which I found Miss S. Her sufferings were excessive, and the very means habitually employed to mitigate them had the effect of making her more sensitive, of actually increasing her suffering, and of rendering her more and more hopeless. As, however, she appeared to have a good constitution, I considered her case hopeful, and she was accordingly brought to my Institute in the fall of 1867.

The first thing to be done was to break from the use of opium, and, indeed, from all sedative and nerve remedies. This is always a serious matter, but becomes comparatively easy with the aid of movements. The stimulus these

operations afford the nerves appears to act somewhat in substitution for the drug, and the system glides nearly unperceived from its morbid exaltation into a state approaching health. This, however, did not occur without one or two hysterical spasms. She continued to gain in strength through all the variations of feeling. In two months she was entirely emancipated from the need of quieting remedies, and the sensitiveness of the spine was permanently relieved. She continued the treatment a month or two longer, at the end of which time she returned to her home perfectly well. At this writing she remains in good health.

INFANTILE PARALYSIS.

THE grave and permanent consequences growing out of paralysis occurring in infancy and childhood, invest it with extraordinary interest. The physical capacities for life depend on what seems the accident of a moment, and the intelligence with which the accident is met.

This affection usually occurs, without warn-

ing, during the progress of some of the temporary illnesses to which children are liable. Neither the causes of the disease, nor the actual condition of the spinal centers involved, are clearly understood. That hereditary influences have much to do with its occurrence is inferable from the fact that it sometimes appears at birth. That it is removable and its consequences obviated, if treated by such means as are calculated to remove spinal congestion, I have had opportunity for demonstrating. Timely and correct treatment is often followed by complete recovery.

But the great mass of instances of infantile paralysis are practically neglected in the early stage; the consequences are serious and permanent. The peripheral nerves remain paralyzed, although the centers may recover so far as is possible in the absence of the stimulus derived from sensation. The child grows, but the paralyzed parts, not being stimulated by influences extending to them from the will and being deprived of action, are but feebly nourished, and fall far behind in development. Extremities thus affected are therefore deficient in growth, withered in appearance, cold to the

touch, and greatly wanting in sensation and power.

Another serious complication sooner or later follows, the extent depending on the degree of the paralysis. A portion of the nerve-fibers supplied to the limb retain a degree of natural power. The muscles to which these healthy nerves are distributed are consequently not impaired, they continue to grow and to increase in contractile power. But the action of these muscles is not properly antagonized in consequence of the paralysis of the opposing muscles. This unequal action of these two sets of muscles draws the limb out of place, usually deforming the ankle or wrist, and sometimes other joints.

The deformity increases in proportion to the disparity in the nutrition of the well and the paralyzed parts. Examinations of the tissue of unused muscles have in some cases demonstrated that it becomes degenerated, the muscular material being displaced by fat, and the possibility of muscular contraction under any stimulus is therefore out of the question.

The means usually employed for the relief of these cases have been galvanism and braces.

Galvanism has proved of service only in the milder cases, and satisfactory in but few. Braces are not used so much for the disease as to mitigate its inconveniences. Their employment is an intimation that nothing better or more radical can be done. Such a conclusion is, however, without warrant. While appliances may, in some instances, be better than nothing, they are far from being the only or the best aids to develop the lacking power and substance of the limb. I have shown the power of vibratory and special movements —

To excite nutritive activity in feeble parts, even though paralyzed;

To conduct the blood to enfeebled regions;

To restore temperature to any region where it is deficient;

To arouse sensation;

To produce absorption of deposited matters, whether they be adventitious material in the spinal cord or fatty matter in the muscles;

To relieve congestion of the spine;

To increase growth and action of muscles;

To harmonize the relations between the action of muscle and nerve.

All these effects are imperatively demanded to their fullest extent in infantile paralysis; and the patient recovers only in proportion as they are produced. Much time is necessarily required to gain a complete demonstration of these effects. It happens, however, that my experience covers sufficient time to afford the needed evidences; I therefore select the following example:

Jane B. became paralyzed in the right leg when three years of age. When between six and seven years old she came to me for treatment. The affected limb was at this time three inches shorter than the other, the disparity in growth having been occasioned by the paralysis. The limb was cold and shrunken; the ankle had insufficient power to support the body, and was liable to turn whenever her weight rested upon it. She could not walk, but hobbled about in a painful manner. The shortening of the leg had caused at the lumbar region a permanent curvature of the spine.

She was a bright, active child, and entered with much interest into the treatment, which was continued with satisfactory evidences of progress about five months. At this time,

nutrition having become permanently directed toward the affected limb, she was able to stand upon the foot without the ankle yielding to her weight. The curvature of the spine was entirely corrected, and she now went home, but continued for many months to receive some of the exercises that had been applied to her while under my care. This was ten years ago. I have occasionally seen this patient during her growth into the womanhood she has now attained. The difference between the size and strength of the legs has continued to diminish, till now her style of walking and appearance give no evidence of her former defect, and many of her present acquaintances and friends are quite unaware that she was ever deformed, either in spine or limb.

REMOVAL OF DEFORMITIES WITHOUT OPERATIONS—INSUFFICIENCY OF SURGERY.

In many cases of paralysis non-paralyzed parts do not act healthfully, but are in a state of either frequent or constant spasm. It is probable that the central disease, which suspends the action of certain nerve-elements, extends its influence to contiguous nerve-centers,

and that the inferior degree of disease produced in this manner causes the abnormal and uncontrollable form of action which is denominated spasm. Thus, we have utter relaxation of a portion of the muscles of an extremity, and uncontrolled and excessive action of another portion. When this condition occurs in infancy, or, indeed, during the period of active growth, the constant drawing of the member to one side causes those fixed deformities and flexions which never recover spontaneously, and which it is the purpose of orthopædic surgery to relieve.

The method usually adopted to redress these deformities consists of *tenotomy*, or severing the tendon of the contracted muscles, combined with extension of the limb by means of apparatus. Sometimes stretching the contracted parts by continuous application of force is employed alone.

The advantages supposed to arise from cutting the tendon may be stated as follows:

The opposite sides of the deformed limb are made alike in action. The contracted muscles have no longer power to act upon the extremity, and it can be fully straightened.

The interspace between the separated ends of the cut tendon is soon filled in with tendon; the muscle thus lengthened is restored to service, and ceases to cause deformity.

An instrument adapted to maintain the limb in place enables the child to use it, and thus increase its development and power.

The weight of the instrument, added to that of the limb, is supposed to increase the exercise of its muscles, and thus further to aid the development of the wasted extremity.

This method of treating deformed limbs has doubtless been of good service in some of the above-mentioned particulars, and is justifiable in the absence of knowledge of superior methods for remedying these defects. The results expected of treatment when it is confined to the means described are, however, seldom fully realized; and whatever result is attained requires a very long time. The difficulties in the way of success may be summarized as follows:

The operation of severing tendons does nothing either toward removing the cause of muscular contraction, or the contraction itself. It only releases the limb from its effect. Even the contraction is itself but an effect; the im-

pulse to contract is derived from central nerve-irritation, which is not abated by disconnecting the tendon from the point to which it is attached. The operation is only palliative, and in no sense a radical or curative measure. Hence the recoveries which follow these operations do not proceed from this, but from other causes.

By severing tendons, the antagonizing muscles are rendered alike, not by increasing the power of the weak, but by annihilating that of the strong muscles. The aggregate power dispersed to the extremity is therefore not increased, but diminished, by cutting off that which was represented in the contracted muscles; the control of the will over the extremity remains as imperfect as ever, and its nutritive supply as feeble.

The deformity often returns after the restoration of the continuity of the severed tendon in consequence of the continued action of the original cause. Only when the cause of contraction has spontaneously abated can the instrumental process become helpful.

After the adjustment of instruments, the weight of the extremity, together with that of

the instrument, is often borne by muscles situated higher up, and not by those of the affected parts—not by the muscles which ought to perform that office. These latter are the muscles which every endeavor should be made to stimulate, but the means in question have little influence to do this, and far from as much as is desirable and attainable. The child provided with supports walks as with a wooden limb. The effect of this mode of locomotion is to employ in the parts which really act, the nerve-power and the nutritive support which should flow to the extremities. The consequence is to maintain an unequal nutrition in the parts already suffering from that cause.

It is evident that when the means for correcting this class of deformities is confined to the orthopædic methods, the attention of the physician is concentrated on effects, while the causes producing them are neglected; that nothing adequate or radical is attempted to restore power to paralyzed parts, or to abate the irritability and spasm of the contracted parts; that the disparity between the extremities must continue; and that the necessity for artificial support must exist for an indefinite

period. The only compensation to these drawbacks and difficulties is that of enabling the child to stand upon its feet.

It hence appears that the views of the nature and needs of this class of deformities which are adopted by orthopædists, are partial and inadequate to supply the treatment required by these cases; and that the mechanical devices which they furnish are useful only in a limited number of cases.

The resources of orthopædists will remain incomplete till they adopt adequate means for relieving spasm; for restoring health and power to diseased nerve-centers; for restoring normal action to nerve-conductors; for increasing the nutrition and power of the muscles to which the nerves are distributed, and which from long inaction have lost not only their function, but normal substance. This want is supplied, and without surgical operation or processes, as is shown in the following case:

Master G., aged twelve years, suffered an attack of paralysis affecting the right leg, when six years of age. On examination, the leg was found of nearly equal length with the other, but weak, flabby, and cold. Sensation was so

dull that he did not suffer from the constant low temperature of the limb. The muscles were poorly developed, and of feeble contractile power, and there was but little action below the knee. He, however, had managed to hobble about, with a very awkward limp, without support. The great toe of the affected limb was permanently bent under, in consequence of severe contraction of its muscles, and could be straightened only by using positive force. This deformity greatly increased his difficulty in walking.

He was treated by vibratory and special movements applied to the weak side and leg, particular reference being had to the affected toe, and also to the chest, which had become contracted in consequence of the bowed and unseemly position his defective limb obliged him to assume in walking. In six weeks his paralyzed limb maintained its temperature equal to that of its fellow, and very good sensation had returned. At the end of three months the deformed toe had become straightened, and no longer troubled him in walking or in wearing his shoes, though the control of the extensors was still weak. Whenever he

gave attention to his gait, it was not defective; the habit of limping was not, however, entirely overcome. There is every probability that by continuing even moderate attention to the principles inculcated by the treatment, the defective limb will become as large and perfect as the other before the young man attains his growth.

This case is selected for record here, not only because it is a good illustration of the adequacy of this treatment to restore power and to correct deformities, but because of the obvious futility of any attempt to accomplish these objects in his case by the orthopædic method.

It is interesting to note in these cases that difference in power of the two limbs diminishes much more rapidly than difference in size. The unaffected limb, which for years has done nearly all the work of standing and even of walking, becomes exaggerated in size. When the action and the habit of use of the two limbs are reversed by the treatment, the difference of power is changed with the difference of nutritive support, till these become finally equalized; but restoration of size falls behind that of power.

CONTRACTED LIMBS—IMPROVEMENT AFTER FAILURE OF TENOTOMY AND INSTRUMENTS.

THE principle that the restoration of power and the removal of spasm entirely depend on the restoring of health to the nerve-centers from which these symptoms proceed, does not admit of question. And since deformities occur as another consequence of these same causes, it follows that the same treatment is required in the one case as in the other. It is also legitimately inferable that forcible extension is not only inappropriate, but that it may prove a source of additional irritation to the already diseased nerve-centers, and that the deformity may be increased and perpetuated, rather than ameliorated, by such treatment. These results actually occur, as will be seen in the following cases:

A young lady in a neighboring city had been afflicted with a nervous disease from the age of fifteen. Her spine was highly irritable; the least touch would at times cause intense spasm of the whole body. One leg had become permanently contracted, the foot being drawn up nearly as high as the knee, and was crossed

over the other leg. The contraction of the leg had destroyed all power of locomotion, and she had remained in this helpless condition for nine years. In addition to the usual resources of medicine, she had during this period employed those of orthopædic surgery. The contracted tendons had been severed, and an apparatus capable of maintaining extension and flexibility of the limb had been fitted to her. This treatment was of no service, she was still unable to walk, and the leg soon returned to its previous contracted condition in spite of all efforts to maintain extension. It was three years after this experience that I first saw her. I found in addition to contraction and spasm that she was afflicted with chorea, the jerkings of which were easily excited and of great intensity. The inference was direct that the cerebro-spinal affection caused and maintained the deformity; that special attention to the deformity was futile while the cause remained; and that there could be no permanent help without restoring health to the nerves.

On account of the exquisite sensitiveness of this invalid, and consequent tendency of all impressions to produce reflex action, the treat-

ment was very slow and cautious. In six months the deformed limb was completely straightened, she became able to walk, and has since retained this power, a period of seven years, except when prostrated by acute disease.

The following case has been reported in the medical journals, and regarded as beyond the resources of medical and surgical treatment. The extreme severity of the contractions, their prolonged existence, the continued action of the cause, the extent to which the muscular system is implicated, the potential nature both of the medical and surgical treatment which have been employed for relief, and the negative results flowing therefrom, combine to render it a case of peculiar interest, and also to demonstrate the extraordinary control vibratory and special movements exert in diseases of the nerves. The case referred to is that of a gentleman who, ten years since, was stricken with paralysis accompanied by convulsions followed by extreme contractions. Two years ago he was brought to New York for medical treatment, and secured advice from eminent professors. The right arm was the only limb that was of the least service to him. The left arm

and even the fingers were so contracted that he had very little control of their motions, the elbow and most of the finger-joints being quite fixed.

The right leg and foot had slight sensation; the left was quite devoid of all sensation. The legs were crossed and so strongly flexed at both the knee and thigh joints, that the calves of the legs pressed upon the thighs, and one knee was nearly in contact with the abdomen; the legs being crossed prevented the other knee from coming up as far. He was absolutely constipated, his urine was ammoniacal, and he had very little control over its passage.

He received electrical treatment, in all the various ways dictated by modern use of that agent. He is also reported as having taken 180 grains of iodide of potassium daily, besides bichloride of mercury and other medicines. He was submitted to surgical operations; his tendons severed, and forcible stretchings applied till the contracted skin under his knees separated three inches. This, as might be expected, threw him into a fever, from which it was with great difficulty he recovered. He was then brought to me. He bore large scars

of bed sores just healed. These sores occurred during the sickness produced by the surgical operations. There had been great loss of the muscular substance of the thighs where the sores occurred. His legs and thighs were still flexed, and legs crossed in the manner above described - the remedies had aggravated the deformity, because, instead of soothing and restoring, they increased the irritability of the spine.

In this state I began his treatment without the least expectation of relieving the deformities of his limbs, but with some faint hope of diminishing his terrible neuralgic condition, and thus rendering life more tolerable.

His supersensitiveness and especially the excitability of his reflex power precluded any but the mildest treatment, but even this made him more comfortable, and lessened the tendency in his limbs to spasmodic action. In the spring, after six months' treatment, he went to the country and spent the most comfortable season since he became paralyzed. He returned late in the fall, resumed the treatment, and continued it five months longer. The result has been that he has acquired tolerable use of

his nearly useless arm; all but one of the contracted fingers are restored; the legs no longer cross each other or are pressed upon the abdomen; sensation has returned to his feet; he has acquired the power of moving them as well as his legs to a limited extent. He now sits in his chair, and in sitting appears like a well person. His improvement has been slow, but beyond all expectation of his friends, and indeed any one who knew his medical history.

I am not prepared to reverse the medical sentence which has long been passed upon him; he is still a sick man; but I am glad to present his case again to the public, to disprove the tacit as well as the often direct allegation that orthopædic surgery furnishes the best aid for the restoration of deformed limbs, and that the use of drugs supplies the most reliable and direct means for restoring health to the cerebro-spinal axis.

DISABILITIES CAUSED BY RHEUMATIC AFFECTIONS.

PERMANENT stiffening of the joints and contraction of the muscles and tendons, depriving the invalid of the power of locomotion, fre-

quently follow attacks of rheumatism. Even unsightly deformities and complete helplessness are the occasional legacies of this disease, while the lesser degrees of restricted power are its peculiar characteristics. The loss of power of motion is not, in acute rheumatism, due to disease of the nerves, but is occasioned by the pain produced by attempting to move the inflamed parts. After the subsidence of the first acute symptoms, the sufferer finds his joints stiffened, swollen, rigid, and sore, the tendons shortened, and the muscles reduced in length, size, and power, and the control of the locomotive power diminished in corresponding degree. Experience proves that this condition is but slowly ameliorated by time, and that ordinary remedies are unreliable and inefficacious.

A brief discussion of this form of restricted power, though not strictly justified by our title-page, is introduced here because paralytic and rheumatic forms of helplessness are often to a degree confounded in the popular mind, and because, also, essentially the same form of remedial treatment proves efficacious in both classes of cases.

The rationale of the effect of the application

of vigorous motion to muscular tissues can not fail to be apparent on the least reflection. The nutrition of muscular tissue becomes thereby fructified; its substance and contractile power increase and become predominant. Muscular power is a controlling power in the system; its wholesome influence is readily transmitted to tendons, joints, and the whole framework. Elasticity, suppleness, and strength of every tissue are the inevitable consequences of natural motions and habitual use of parts. The contracted tendon is lengthened, the shrunken muscle-cell is filled out, the flexed extremity is spontaneously straightened, and the parts assume their natural functions under this wholesome influence.

But though effects like these might naturally be inferred as the consequences of applied motion to weakened and stiffened parts, yet the proposition that such applications remove the *cause* of the weakness and stiffness —the rheumatic poison—requires further elucidation. That the essential principle of rheumatism is removed by vibratory and other similar processes admits of ready demonstration; but to render an adequate reason there-

for, it is necessary to recur to the accepted doctrines of modern science regarding the nature of rheumatic disease.

Coincident with rheumatic fever and swelling there occurs a great deficiency of the water of the urine, and of its characteristic healthy constituent, urea; there is a corresponding increase of extractives and of uric acid. The latter products appear to displace the former to a considerable extent, and to be due to defective conversion of materials. Urea includes most of the nitrogen of the wasting tissues, and represents the ultimate product of oxidation derived therefrom.

The preponderance of uric acid and extractives, on the other hand, indicates a less vigorously oxidizing activity. These products are imperfectly soluble bodies, foreign in their relations to the tissues which they pervade.

The system in this condition resembles a fire which, when there is imperfect draft, produces smoke instead of the perfected invisible products of combustion. Urea is a perfectly soluble substance, and readily passes from the system with the escaping fluids; while uric acid is practically insoluble and occurs in mi-

nute crystalline form, quite capable of interrupting the flow of the blood in the minuter capillaries. This interruption actually occurs in the vicinity of the joints, in tendonous parts, and others of similar composition. Hence the origin of rheumatic inflammations; the swellings, stiffenings, and contractions which characterize the disease, and are apt to follow as its permanent legacy.

If the nature of the remedies which have achieved a reputation for usefulness in rheumatism be duly scrutinized, it will be found that they are such as either directly or indirectly serve to increase oxidation, or supply to some extent a temporary substitute for this element in the physiological operations. The iodides probably fulfill the latter purpose.

The above statement of the cause and nature of rheumatic affections and the origin of the disabilities and deformities resulting therefrom, leads directly and unequivocally to this inference, that the system now *demands increased efficacy in its oxidizing function, so as to carry forward the oxidizing product to the healthy standard.*

No cause of oxidation in the living body has

proved equal in degree or in permanency to vibratory motion. In rheumatism, the rapid restoration of the urine to its natural and healthy standard, both in quantity and quality, the improved condition of the skin, and the simultaneous abatement of the swelling and soreness of the joints and other local seats of disease, afford new and incontestable evidences of the power of this remedy.

It hence appears that the curative power of motion is not limited to the fact of increasing local nutrition and the suppleness of joints. The processes of vibratory motion are capable of correcting the quality of the blood by so perfecting its oxidation as to remove its effete and noxious matters. These effects are not confined to non-inflammatory conditions, but extend back to the *cause* of the inflammatory process, especially when this consists of the rheumatic poison. But in these cases success depends entirely on the mode and order of the application.

The characteristic tendency of rheumatic affections to become localized in selected regions or about the joints, is a beautiful provision of the disease, and supplies the key for its proper

treatment, even in the worst cases. The non-affected parts or interspaces afford ample opportunity for the direct frictional play of the motion and its effects upon the muscular tissue. The same local actions also affect the fluids of the whole system, which are conveyed through the part and subjected to the action; and a profound degree of constitutional effect is thus secured. These non-affected spaces can be rendered vigorously active without in the least disturbing the inflamed parts, even though in close proximity. By these means the following consequences are easily secured:

The oxidizing effect which follows and is insured by the rapid percussion and frictional contact of minutest organic parts is rendered progressively more complete. The temperature of the system is increased, not through exterior heat, but by its interior development. It is difficult to estimate the assistance thus lent to the vital endeavors. The amount of fluid in the urine is increased, sometimes fifty per cent., and the peculiar sediment which characterizes the disease soon disappears. The moisture of the skin is increased. These facts afford the best evidence that those eliminatory acts

are restored which maintain the quality of the blood at its healthy standard.

But the effect which affords the most immediate satisfaction appears to be due to *revulsion.* The frictional action applied to the interspaces between the inflamed parts causes a large increase of blood in the region to which such action is applied, as is evidenced by redness, increase of temperature, and moisture of skin. This afflux is absolutely required for increased nutrition of the muscles. At the same time the distention of the capillaries in the swollen parts is diminished, together with the heat and pain. Those parts which previously would not tolerate the touch of another, can now be handled, not only with impunity but positive comfort. This shows that the fluids have become transferred from the region where their presence afforded pain, to tissues in which they are likely to subserve their normal nutritive purpose.

The toleration, by the inflamed joint or other part, of mechanical interference is the signal that it may be directly employed to advantage. By discreet manipulation, especially by vibratory waves sent through the affected region,

capillary contractility is still further stimulated, till the caliber of the vessels approaches the normal standard, and the effused fluids forming a portion of the swelling are still further removed. The curative process thus goes on till it is perfected. The following case of aggravated articular rheumatism, treated by "movements," affords a fair example of the usual progress of restoration:

Miss N., by occupation a teacher, was prostrated in the winter of 1870 with severe rheumatic fever, which, in spite of the most approved medical attention, in a few weeks lapsed into the chronic form. Nearly all the joints were affected; the ankles, knees, wrists, and fingers were much swollen, painful, and stiffened, rendering them entirely useless. One of her medical advisers, who probably had some vague notion that there is remedial efficacy in motion, without, however, understanding as to the what, when, where, and how of the operations, proceeded to apply a variety of twistings and flexions to the affected parts. The consequence, as might have been predicted, was greatly to aggravate the inflammation and superinduce permanent morbid changes.

Indiscriminate movements are more likely to injure than to benefit. The distended vessels are strained and weakened by rough handling; the morbid process is renewed or increased, the recuperative power diminished, and permanent injury is almost inevitable. In case of local swelling, the first remedial endeavor should be to attract from the affected part the surplus fluids, and distribute them to the other and deficient parts, after which the gentlest means are adequate to restore the contractile power of the capillaries, and cause absorption of effused fluids. The attrition of tissues imparted by discreetly applied vibritile and frictional motion is the reliable means of securing this end.

After three-quarters of a year of confinement to her bed, and after her attending physician had pronounced her case hopeless, Miss N. was brought to me. At this time she had lost all control over the left hand, both ankles, and one knee; the other knee was in nearly as bad condition. She could neither walk nor stand. The feet were extended and rigid, and if she were placed upright, the toes only could touch the floor. All the joints were swollen and sore. The power of the muscles to execute voluntary

motion was nearly absent from every part of the body, and there was very little muscular substance. She was swathed in flannels, requiring them through the hottest weather, and was sensitive to every trifling motion of air.

Notwithstanding the extreme soreness of the inflamed parts, and her utter helplessness as regards voluntary action, she was laid upon the proper apparatus, and vibratory and frictional motions were applied to the intervals between all the joints. She was surprised to find the treatment agreeable to her feelings, and that her disability was no impediment to its use. The applications were succeeded, as usual, by a delightful glow throughout the whole system, and by no fatigue. The sore parts, which previously would tolerate no action, could now be manipulated without disagreeable sensations. She now exchanged flannels for linen, and caused the window to be constantly open. The operations were continued daily, and she daily increased in strength and flexibility of the rigid joints. In two weeks she had acquired such facility of motion and strength as to allow her to stand, make her own toilet, and discharge her nurse. In four

weeks she adopted crutches, and was able to walk about with ease. In three months she had acquired an abundance of flesh, the muscles had become rounded out and hard, and she could make excursions in the streets. There only remained a degree of stiffness in one ankle, which she attributed to the injury inflicted upon it by the indiscreet "movements" to which reference has been made.

From experience afforded in the application of the principles above stated, we are justified in the following conclusions:

The blood is renovated, and nutritive action is favorably influenced, by the application of force in the form of vibratory and frictional motion. Imperfectly elaborated wasting matters are disposed of under the influence of this cause.

Swellings are reduced, and stiffened joints are rendered flexible.

Muscular power, which has been lost or suspended by disease, is restored, and the muscles, which have become attenuated and shortened, recover both their length and size.

The *will* not being called into requisition, these applications are suited to the most feeble.

THE TREATMENT OF NERVOUS INVALIDS CONSISTS IN MEANS FOR DEVELOPMENT AND TRANSFORMATION OF ENERGY.

It is due the seeker for health that the proper channel for the direction of his efforts be pointed out as clearly as the results of experience and the present condition of science will allow. In the preceding pages we have set before him the salient facts from both these sources, so far as relates to the therapeutics of motion, or as may be better expressed, *Transmitted Energy.*

We now desire to add such further statements in recapitulation as may seem to give unity and congruity to the whole subject.

HEALTH A QUESTION OF ENERGY.

All questions of health relate to the development and uses of the energy of living beings, however manifested. The value of life to its possessor is evidently in proportion to his control of energy — to the application of the surplus over strictly organic requirements to beneficent ends. This would secure absence of pain and the enjoyment of a maximum of

power. Medical science and practice exist for the purpose of aiding such development and control of energy, through the proper vital instruments for its expression, the muscles and nerves. Remedies are the means found useful by experience for general and local control of energy, but are in no sense in themselves sources of power. The true hope of the physician, therefore, lies in modifying the circumstances, internal and external, under which energy is developed. A rigid examination of the conditions favorable to vital power shows these to be largely of a *physical* nature, so largely, indeed, as to render physical sources of energy both indispensable and controlling in the vital economy.

Such considerations lead to inquiries as to the effects on the vital organism of the *direct application of energy in the form of motion;* whether functional activity may be reinforced and perfected thereby; under what circumstances, and to what extent; also, how far the *consequences* of functional failure, past and present, usually described as disease, may be corrected by this means alone. It will be observed that the proposed therapeutic recourse

differs from ordinary remedies in its essential independence of vitality as the initial source of help, on which other remedies of all kinds so very much depend.

The statements following are chiefly those of mechanical physiology, and are generally accepted in modern science. With these I may join facts derived from experience, arising from peculiar opportunities; facts hardly accessible to those whose experience is limited by the ordinary practice of medicine.

WHAT TRANSMITTED MOTION IS.

TRANSMITTED motion is that communicated to the body or its parts through contact with some object in motion; this may be some instrument or machine, or the hand of another person—in either case designed and adapted to produce certain effects by motion transmitted.

On account of the rapid exhaustion of the energy which any individual, however strong, is capable of exerting, those effects, producible by the hand of an operator, will not, for the present, be considered; attention being called only to those proceeding from more abundant

and unfailing physical sources, as machines and instruments specially adapted by their construction to transmit power to the living organism.

The form of motion, capable of remedial effects, is that which in some way influences the ultimate constituent elements of matter, so as to change their destiny at will in some chosen direction. This motion is necessarily vibrating or reciprocating; no other is really communicable to the organism. This kind of motion is propagated in rapidly succeeding waves (1,000 or more per minute) through the substance of the body—its fluid, semi-fluid, and solid constituents; the force, as *motion*, gradually diminishing as the distance from the point of its introduction increases.

In the manner of transmission there may be considerable variety. The waves may be sent perpendicularly from the surface, or parallel with it; transversely or diagonally, with or without compression of the parts submitted to the action; the locality, direction, order, etc., securing variety of effects, from which the prescribing physician may select, according to the special indications of the case.

WHAT BECOMES OF THE ENERGY IMPARTED TO THE BODY IN THE FORM OF MOTION.

THE amount of energy thus transmissible to the living body is evidently measurable, that is, it may be stated in some better known equivalents to facilitate comprehension of its amount; as we speak of steam engines as equivalent to certain horse power, and of horse power as foot pounds.

This illustrates the positive nature of what is transmitted. A man may exert the whole power of his muscles in moving a weight; he may do the same, and in place of antagonizing gravitation, may cause transposition, in a variety of ways, of the interior, invisible constituents of the organism of another person. An instrument conveying energy from some unlimited source may evidently do the same thing. In each case there is an equivalence of cause and effect; the latter, in the aggregate, is absolutely equal to the former. In the process, the causal energy has come to assume other forms—has taken new affiliations with matter. Thus, motion, introduced in the reciprocating form, will, in part, assume the direct form, as a pump

sends a stream; in part, it appears as heat, as friction may produce ignition; while still another portion is spent in causing transposition of constituent atoms, or chemical effects, as sudden impact may produce explosion of some mixtures, while stirring will cause precipitation in others — evidences of chemical effects of motion, that is, motion transformed to chemical affinity.

That force or energy, under the circumstances stated, is not lost, or in any degree diminished, is the dictate of modern science. Force is never lost; it only changes its form by change of circumstances; its elusiveness is evidence of change, not loss. We may still trace energy imparted, as above stated, through numerous phases and fields of action; we may even detect it in the performance of most necessary physiological work, without which the powers manifested by the vital system are utterly impossible. In so far as we shall find energy, force, or power, thus transmitted, to supplement those deficiences of organized energy which we characterize as disease, it falls into the category of remedies, and we are compelled to regard it as remedial. Beginning

with effects purely physical, we may easily trace a portion of these equivalents of motion up to the very threshold of vitality.

DISPLACEMENT.

THE bulk of the vital system consists of fluid: blood inside the circulatory vessels, and interstitial fluid exterior to the vessels. This mass of watery fluid, though pervading and pervaded by vitality, is non-vital, at least so far as to be strictly amenable to physical control. The blood transports nutrition; the interstitial fluids carry nutritive matter, and participate in nutritive actions and changes.

An impinging force displaces fluids; those contained in canals or conduits, as bloodvessels, are urged forward in the direction allowed by their valves. Every repetition of the impinging force increases the effect. Mechanical obstacles, if such exist in the bloodvessels, are necessarily removed, broken up, or urged out of the way; the outflow of blood, both to and from the nutritive capillaries, is perfected. This effect is soon indicated in the quality of the organic effort directed to the same end; the

pulse becomes slower and fuller. The motions of the nutritive fluid are entirely obedient to the same control. Increased nutrition of tissues, superinduced by the fresh supplies of blood, laden with oxygen, causes motion of the fluids in the direction of the scene of activity; while the onflowing venous currents recall mechanically, within the walls of the veins, such spent matters as are destined to be excluded. Hence, the mechanism of the circulation of the blood and interstitial fluids is, by exterior motion, set and kept in action in all the minute details necessary to nutrition and the support of vitality, but without the least vital expenditure; and, although entirely in harmony with the ordinary causes, yet quite independent of them. An auxiliary cause has practically come in to carry forward defective action to the perfected stage.

It will be apparent that the effects just described are no other, in kind and degree, than those occurring in health, when the ordinary and spontaneous action of the muscles secūres the same effects. The contracting muscles press upon both the blood in its channels and the interstitial nutritive fluids, and produce the same

effect as may be produced by mechanical impingement of exterior force, contributed by some instrument adapted to this purpose. The fluids which enter into the composition of the body have not the least power of self-motion, but depend on impulses generated within or received from without the system for whatever change of place they suffer. The physiological consequences are quite the same, from whatever source the power which produces them may be derived.

FRICTION—HEAT—CHEMICAL CHANGE.

Fluids in motion, especially those whose fluidity is imperfect, and motion of fluids in contact with solids, cause heat; or, to speak in the language of science, convert motion into heat. Rumford experimentally caused water to boil in boring submerged cannon, and thus were obtained data for finding the equivalents of the two forms of energy. The facility of the change of motion to heat appears to be in the ratio of adhesiveness or friction.

The physical nature of the components of the human body, soft, semi-fluid, adhesive, and

moderate pressure, conjoin to favor the transformation of motion to heat. When, therefore, reciprocating or vibrating motion is transmitted through sections of the living body, the temperature of the whole, beginning with the part submitted to action, quickly rises. The circulation of the blood appears to diffuse the increased temperature throughout the body, and increased transpiration soon gives evidence that a surplus is being produced, and is disposed of through the whole surface.

All organized beings are developed only at fixed temperatures, and the progressive development depends on the maintenance of such temperature. The fact that heat-promoting remedies are favorites with physicians of all classes, is strong evidence of the importance attached by them to the heat-making function.

The heat of living beings comes from two sources. One source is the *motion* pervading all living parts, which, whether derived from vital or extra vital sources, is in part transformed to heat. Another is the heat set at liberty by the abundant chemical change that is the concomitant of all life. These two causes of the bodily temperature are intimately con-

nected; for motion is not only changed to heat, but incites oxidation also. Heat is, therefore, a most important remedy.

One of the first indications of disease is irregularity of the heat-making functions. Although there may be actual excess of temperature, its production is really, in every case, diminished; the excess is owing to its retention with the imperfectly oxidized matters, associated with which heat should be eliminated.

Chemical changes in the vital system depend on conditions quite similar to heat. Composition and decomposition of the ever changing constituents of the body, vital and non-vital, are possible only by contact of the atoms among which such changes occur; and contact is the necessary result of *motion*. Motion is, therefore, absolutely essential for all chemical actions. Friction, or contact with some degree of force, naturally affords a higher and more perfected result than feeble contact; the constituents of the body following the same law as matters exterior to it. Sluggish chemical action and imperfect vital results are, therefore, by the assistance of motion, carried forward to those perfect results that are compati-

ble with vitality and health. And, in the same way as before indicated, exterior sources of motion bring about effects physiologically indistinguishable from those generated from the usual interior sources of motion. In other words, motion is a remedy, so far as relates to organic vital chemistry.

This principle is specially exemplified in that indispensable accompaniment of all animal life —the oxidizing process. Imperfect health betokens, in the same degree, imperfect oxidation and imperfect removal of the waste products of vital action and expenditure. The oxidizing process within the vital system is peculiar in being always progressive, or proceeding in stages, instead of being a single process, as is usual in the inorganic world.

The difference between health and disease is probably commensurate with these stages of oxidation. Not that any actual form of disease is predicable on such data; for interminable secondary effects, in which vitality plays a more or less prominent part—in which, also, inherent constitutional tendencies and considerations largely enter—conflict with the possibility of definite conclusions in so obscure and

complex a state of things. This, however, is a subject for practical demonstration. Oxidation is largely promoted by transmitting vibratory motion to the living system, and the excretions, particularly of highly oxidized matters, are very largely increased thereby, and return to health is proportionately aided.

Motion (to recapitulate) transmitted to the living system from exterior sources, is capable of producing the following effects, without in the least tasking the vital sources of power:

It urges forward the blood in the circulatory vessels, removes mechanical impediments and obstructions therein, and therefore diminishes the frequency of the pulse and action of the heart.

It secures the necessary interchange of nutritive fluids between the bloodvessels and the acting organs, upon which tissue change directly depends.

It is, in part, transformed to vital heat. It supports those physiological actions which result in heat production both local and general.

It carries forward to perfection those chemical changes through which waste of material

is eliminated, and those whereby organic development and vital power are supported.

It, in short, goes to the root of certain physiological insufficiencies, which result in the pathological condition. It supplies the energy needed to elevate this pathological condition to the physiological.

HOW NERVOUS AND MUSCULAR POWER ARE NORMALLY SUPPORTED.

The remarkable efficacy of transmitted energy in restoring defective and irregular nervous power has its foundation in the nature and relations of the different classes of vital energy to each other.

This will be understood on reviewing the physiological processes whereby the different forms of vital power are evolved, especially those forms manifested by the muscles and the nerves.

The development of dynamic, or muscular, energy involves nutritive support of the muscular tissue, as the condition for its further development; or the incorporation of supplies of outside material, which include that which is destined to appear as energy. The vital

molecule, in parting with energy, is reduced to common dead matter, which in health, is instantly removed and replaced by like material similarly endowed; and thus the physical and dynamic power of muscles are maintained.

The energies of the nervous system are maintained by a similar process, being that of constant importation from outside sources. The nervous system represents a variety of forms of power; as sensation, emotion, reflex action, intellection, and those combinations and modifications of them which constitute the *will*. The gray matter of the nerve centres are the vital organs which have the power to eliminate nervous energy, as the muscles do the dynamic variety.

As all vital parts and tissues are practically bathed in a solution of food and oxygen constantly renewed (the blood and its circulation), it is plain that the support for vital action is ever present and ready to yield to acting organs that which is demanded by them to sustain each special form of action, whether it be that of muscular or nervous energy. Such support, in any case, is conditioned upon *use*, and upon nothing else. It is quite impossible

to *force* nutrition upon unwilling organs. Physicians often attempt this method, but the consequences, in the long run, are disastrous. The nutritive organs become clogged, and some form of local disease follows.

The instruments of energy—the vital tissues of muscles and nerves—draw upon the common fund, the blood, only in proportion to use, and abstract from this fund the special combinations of elements that are adapted to serve the demand.

If possible, still greater injury arises from the endeavor to extort nervous and muscular energy by medicaments, and by other means than is provided by nature, in the *natural use* of the instruments of power. In no other way is their capability for use reinforced and maintained.

The blood contributes of its multiform components to whatever tissue presents its demand by *action*, that which through the organizing process is capable of sustaining such action. Every functional act is a local demand on the whole resources of the system. The organ is local, the supply is general and mobile. The parts of the vital system are so connected and

so responsive to local nutritive calls, that they unite in urging the general supplies forward to the point of need. The blood evidently comprises ample resources to sustain alike the muscular and nervous energies, and these are yielded to the support of either, in the ratio of the demand produced by use.

Healthy persons, therefore, find no difficulty in supporting *either* class of functions from the same food. This shows that ordinary food contains ample diversity for all needs; if for those in good health, therefore for the ill, whose requirements are the same in quality, but greatly diminished in quantity, by reason of inactivity of function. Hence it appears that special aliments for the support of weakened powers are of slight utility; the plan does not recognize that the essential difficulty is not in aliment as such, but in its imperfect application to use.

COUNTERPOISE OF MUSCLES AND NERVES.

The physiological process of deriving vital energy from aliment is a double process. Muscular energy is naturally evoked by the incitation of nervous energy. The senses, the emo-

tions, the intellect, and that resultant from the combination of these, designated the will, are the usual and natural provocation to muscular action. This mode of action of the two varieties of power involves nutritive changes in the respective instruments located at the utmost distance from each other. The two classes of function, while acting nearly simultaneously, are, in fact, *the natural counterpoise of each other*—at least, as regards the distribution of nutritive support derivable from the blood.

This law is essential; otherwise there can be no surety of a proper distribution of the blood, laden with energy-bearing material. It is in the contravention of this law that we shall find a profound cause of derangement in the product of energy yielded by the system, and of the organs which give rise to it. This law is, in fact, the key to the etiology of widely prevailing forms of nervous disease, and equally a guide to prophylaxsis and cure.

HOW NERVE CENTERS BECOME DISEASED.

One approach to a final consummation of nervous disease proceeds something in this

wise: Exercise of the nervous function in some one or more of its departments is prolonged. Constitution, habit, circumstances control this. The continuous evolution of nervous energy compels, to a corresponding degree, the adjustment of the physiological mechanism to support the energies being so liberally and unremittingly set free, by conveying the blood in increased amount to the region of action—that is, to nerve-centers sending forth energy. But corresponding muscular action being wanting, it is plain that the condition absolutely essential for redistribution of the circulating fluid in this way concentrated, is inoperative. The consequence is, the local vessels of the brain and spinal cord become surcharged, dilated with stagnant blood. Hyperæmia is the inevitable consequence. From this there is no prospect or hope of permanent relief, except by the operation of the natural law, which makes a counterpoise of the muscles by muscular action. In this downward progress, the first stage is apt to produce temporary local excitation (neuralgia), soon followed by diminished power of sensation, or motion, or both. This may be succeeded by alterations of tissue and well

known pathological changes of different orders, which, however, are not so much the real disease as its last products.

These residual products and effects of aberration of function are less amenable to physiological destruction than are the normal tissues, but do not necessarily require remedies additional to physiological action. But this action must be *intensified*, in order to become remedially effective, by introducing exterior energy through mechanical methods.

Defective counterpoise causes the pathological state only in case of the nerves. Excess of muscular action can only *diminish* nervous manifestation. That intellectual strength, emotional power, and even sensation are distinctly diminished, by prolonged excess of muscular action, is matter of common observation. Injury occurs only when the muscles, failing for want of rest, are further stimulated to still greater nervous exertion by the will, when temporary nervous exhaustion occurs, which is restored by judicious rest.

We may now present some of the various kinds of evidence of the correctness of the proposition, that the principal instruments of nerv-

ous energy are seriously injured, often destroyed, by prolonged deficient muscular counterpoise.

Physiological Evidences.—These have mainly been presented in the statements showing the facility with which the development of energy may normally be diverted from one portion of the system to another, and from one tissue to another, and so be made to assume at will the form of dynamic, or of nervous energy, according as it may be caused to be evolved by the muscles or by the nerve centers.

Pathological Evidences. — Certain morbid irritations of the spinal centers produce muscular spasm. The violent muscular contraction and liberation of muscular energy calls for nutritive support, producing thereby such counterpoise as to diminish the morbid nerve excitation. Spasm, temporarily, at least, removes its own cause. Epilepsy is an extreme illustration of this principle. The whole muscular system is thrown into violent contortions. The revulsive effect of extreme muscular activity reduces the local nerve irritation, (which may consist of temporary local hyperæmia), and the system very soon returns to its normal equi-

poise. Hysteria presents similar marked illustrations of the principle, as does also instances of local spasmodic action of the muscles.

Therapeutic Evidences. — It is within the writer's experience and knowledge that each of the above forms of spasmodic action is radically cured by means of *energetic muscular action*, or rather, by such action *imparted to* the muscular system. For, according to the hypothesis as well as the facts of experience, it is necessary that *nerve centers* should *not* act; that the motion should be not only very energetic, but entirely passive.

Evidences from the Consequences of Pain.— It is well known to physicians, that in prolonged sciatica the affected limb is soon found to be diminished in size; the difference of circumference between the affected and the sound limb often amounts to one or two inches at the thigh. Indeed, the muscles of any painful part will diminish in size and power. The reason for this is evidently because the excitement, and consequent increased demand for the support of the morbid energy of the nerve centers diverts nutrition from the muscles. The muscles are starved by pain—pain being doubtless

a form of energy, and a product of increased nerve nutrition. It is often observed that even a painful rheumatic member soon diminishes in size, affording evidence of morbid diversion of the energy bearing nutritive support. On the other hand, excited muscular action, or continuous spasm, sometimes occurring in partial paralysis, causes *increase* in size of the affected muscles, showing conclusively which form of morbid excitation demanded the larger amount of support.

Evidences from the Effects of Drugs.—The class of drugs included under the head narcotics, or quiet and sleep producing remedies, have the ultimate effect of increasing, relatively, at least, the functions of the cerebro-spinal centers. It is not necessary to theorize on this point. Appeals to facts soon convince us that the habitual opium and morphine user sleeps far less than if he never used the drug; that he is wild with sensorial and emotional excitement, and that his muscles become shriveled to the last degree. These are conclusive evidences that the drug has diverted nutrition from the muscles to the nerve-centers, which are made by the drug to evolve an excessive

amount of uncontrollable energy, So, too, the bromides produce a staggering gait, betokening weakness of nerve; and chloral has produced many cases of insanity. The sedative, in the long run, diverts nutrition to cerebro-spinal centers by the local irritation it superinduces.

Evidences afforded by the Therapeutics of Motion, or Transmitted Energy. — Whenever passive motion is transmitted to a muscular part, the pain which may previously have pervaded the region, ceases. If desirable, complete local anæsthesia is procurable in this way. It would seem as though surgical operations were possible under the local influence of motion. The readiest explanation of this fact is, that the nutritive excitation of the muscles temporarily reduces that of the nerve to a minimum. The muscular mass being immensely greater than the nervous mass, this effect would necessarily result.

It is the constant experience of patients receiving passive motion, as transmitted energy or otherwise, that *sleep* is produced; in fact, sleep becomes, after a little, quite irresistible with some patients. This fact is probably due to the same cause.