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MEDICINA MECHANICA.

MEDICINA MECHANICA,

OR THE

THEORY AND PRACTICE OF ACTIVE AND PASSIVE

EXERCISES AND MANIPULATIONS;

CONSIDERED AS

A BRANCH OF THERAPEUTICS, AND AS ADAPTED BOTH TO THE TREATMENT AND CURE OF MANY FORMS

OF

CHRONIC DISEASE.

BY

JOHN W. F. BLUNDELL, M.D.

LONDON:
JOHN CHURCHILL, PRINCES STREET, SOHO.
MDCCCLII.

"*Non arctandus est mundus ad angustias intellectús, sed expandendus est intellectus ad mundi imaginem recipiendam qualis invenitur.*"—BACON.

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PREFACE.

It is not in disparagement of that which has long been appropriately termed the "Spiritual Life of Man," that we consider the agency of his active existence as impressed and guided for the most part by *Mechanical Laws;* nor would it perhaps be foreign to our natural conceptions of the wondrous structure inhabited by this "Spiritual Life," were we to class the relations of our organism to the great Universe in which it moves under the highest of all Sciences — that of Mathematics. Indeed, so far as our own share in the work of supporting and maintaining health is concerned we have the authority of the renowned Boerhaave for the application of Mechanics to Medicine, who himself recommended a rational and mathematical inquiry into the causes of diseases and the structure of bodies. But let Time determine this as

it may, we need be no longer troubled with those doubts which once obtained among us, and led many to conclude that, in the words of Bentley, "all must be performed by mechanism or accident;" rather may we consider that evidence as accessory to medical knowledge which defines mechanics to be "the geometry of motion, exhibiting the effects of powers or moving forces," and that the harmony of those powers or forces, both in the organic and inorganic worlds, may be mirrored to our senses even in the hourly operations of Human Existence. Still it is upon the "Spiritual Life," which alone comprehends the *unity* of the system, that we must depend either for its duration or its integrity. It is because Medicine has all along been viewed of necessity as an experimental science, that we probably are often prone to regard the human system as a thing much of the same character, guided and governed by accident or chance, and alternately moderated, retarded, or accelerated in its action by the exhibition of materials for assimilation to it, of the effects of which, or the processes involved, we are as ignorant now as men were in the very earliest days of the Healing Art.

At a time also when new systems of various claims are contending both for the meed of medical

approval and that of public favour, some apology might be deemed necessary for the present work. But when it is found that the writer seeks alone to re-establish an ancient though neglected Branch of Therapeutics, and without aiming at too high a goal, or seeking to assume even the symbol of universality, as too many essay to do, some degree of general attention, apart from its intrinsic merits, might reasonably be expected in its behalf. That there existed a gap in medical science which the resources of the Materia Medica have failed to fill, has long been felt, and when the author's attention was first directed to the effects of this Treatment, he felt convinced—a conviction which experience has more than confirmed,—that through the same channel this want would be ultimately supplied.

If we go back to the history of the matter we find unequivocal testimony of its ancient practice. Herodicus, himself the master and teacher of the great Father of Medicine, is the reputed founder of this art, whilst a portion of its methods are clearly indicated in those pursued by certain physicians of the Greek School, denominated "Iatraleiptes." Since that time its general principles, so far as we know, have slumbered or have been lost, and

now appear only recognisable in many forms yet followed in various conditions of surgical manipulation. The merit, however, both of restoring and establishing on a firm scientific basis this useful and important adjunct to the treatment of disease, is due to the genius of the late Professor Ling of Sweden, who, after a trying period of many years, succeeded both in attracting the attention and gaining the assistance of his Government, and in founding the Royal Central Institution of Stockholm. To enlarge upon the value of his partly unaided labours—it may not be hyperbolical to affirm—is for a future age, and not for the present; nevertheless, it must be admitted that a country which has given to Science and the World a Linnæus and a Berzelius, and has long been famed for the philosophical acquirements of its children, ought to be at least permitted, on a point of paramount and increasing importance to the perfection of medical art, to present to us one more authority. The System has already been adopted in Russia, Germany, Austria, and Prussia, under the patronage and with the aid of several of the reigning Sovereigns of those countries; and within the past few months the author had the pleasure to converse on the subject with Dr. Neumann of Graudentz,

a most earnest disciple of this Branch, who had been deputed by his Government to visit several countries, there personally to inspect its progress.

This country owes its introduction to the enterprise and skill of Mr. I. G. In De Betou, a Swedish practitioner of high attainments, who, about twelve years ago, endeavoured unaided to engraft a system which, as another writer aptly observed, "was worthy of a better fate than to be buried in a distant corner of Europe." The perseverance and success of this gentleman the author more than perhaps any other individual has reason to attest, while it is a worthy record of this introduction that the treatment has been working its way to fame and appreciation without those means of publicity which are ordinarily put into force. It is but just to state, however, that the unpretending attempts of this practitioner to establish it in the opinion of the medical body *as a branch of their Art*, in which light it can be alone considered, has been attended with the approval of some and the tacit opposition of others. Still the fault rests not entirely on one side. The Swedish School has been so chary in its elucidation of this branch of science, that the medical profession and the public hitherto have had little

or no opportunity of judging fairly the facts or the groundwork of the art. In the current medical literature of the present day it is painful also to reflect, that the aim of very many appears to be to shelve the opinions of predecessors, and upon the supposed ruins of former labours to raise a superstructure of their own. The words of the great Johnson will apply now as they may in any subsequent period of our history, wherein he declares that "the most zealous enemy of innovation must admit the gradual progress of experience, however he may oppose hypothetical temerity." These writers should remember that in denouncing others they forget their own short-comings,—that in thus acting they only lessen the degree of their own usefulness to Society and curtail their professional triumphs; and that, even in spite of the exclusive character of their attainments, the Public is after all the supreme Judge. That a doctrine founded upon the instinctive laws of Nature in the Human subject should require more for its free acceptation than the approval of Reason, is an anomaly in that faculty itself; but that it should be ignored even by those who profess to follow Nature, is a fact we can only reconcile with the imperfections of our transitory being.

In the present instance there is certainly need neither of one of the above courses nor the other. For we find that *Medicina Mechanica*, the practice of which is generally known under the term "Therapeutic Manipulation," is not a new thing, neither in its discovery nor its appliance—nor could it absolutely be so. As far back as we can trace, bodily movements have been considered one of the principal means of developing the frame and promoting its healthy functions,—bodily motions are therefore some of the most important conditions for the preservation of Life and Health. Yet, that Exercise demanded a proper *physiological basis*, has been admitted both by ancient and modern physicians. The success, moreover, of the Swedish Treatment has been already such that it remains for members of the profession wisely to investigate and to endeavour still further to develop it. And it may be now said only to require that sanction here which it has already so abundantly received elsewhere.

As far as the general plan of the work is concerned, the author must crave some indulgence for the paucity of materials at his command. Until the appearance of Dr. Roth's book, there existed in our

language only the pamphlets of Messrs. De Betou, Georgii, and Ehrenhoff, whilst the first-mentioned work issued from the press at the moment the manuscript copy of this volume was about being placed in the hands of the printer. He gratefully acknowledges, however, the assistance he has derived from those pamphlets, as well as from the *disjecta membra* of a few other writers, to the common principles specified in all of which he has added the results of his own experience and study. It is obvious, therefore, that the chief clue to the Art is to be traced in the physiological elements which unavoidably occupy so large a space; and, instead of affording any speculative minutiæ of movements, which in truth might be more agreeable to the eye than practical in the pursuit, he has affixed cases illustrative of the chief forms of disease to be treated, together with the plan of treatment pursued in those cases. It is hoped that the care with which these have been drawn up, will alone render the work available by the practitioner. Nor must it be omitted that the use of medicines is not interdicted in many of these cases, though it will be seen that the majority are of such a kind that medicines already had failed, or would fail in being

of permanent service. It is, in fact, with the view of remedying, to however small an extent, the existing gap in medical science, that the present volume, with all its acknowledged imperfections, is offered to the Profession and the Public.

32, Finsbury Circus, City;
December, 1851.

CONTENTS.

INTRODUCTION.

The chief facts upon which the science of Medicina Mechanica is based are these, namely, that the Human System is a unity in itself;—that it is a perfect organism or whole made up of minor organic structures, each possessing distinct attributes, yet unitedly contributing both to the perfection and integrity of the entire vital machine; that, as a *chemical* effect can proceed from internal to external parts of our bodies in consequence of this unity, so can also a *mechanical* effect advance from the external to the internal; and lastly, that, by acting specifically, by means of the nerves and muscles, upon any of these organs and parts, when their vitality is abbreviated or their functions deranged, as in the *chronic* form of disease, both harmony and equilibrium may be restored.

From these acknowledged conditions, sanctioned as they are by physiological and pathological research, are deduced the great elements of Ling's

doctrine; and it was from the obvious conclusions to be drawn from these rules that he was led to declare, when speaking of the effects of specific movements in the body, that "although most of these effects are generally known even to the ignorant, yet professional men have taken no notice of them, the chemical agent (medicine) alone having absorbed their whole attention."

The following, therefore, is the substance of his own theory of human organisation, condensed into tangible form.

"The vital phenomena may be arranged into three principal or fundamental orders, viz.:—1, *Dynamical phenomena* (manifestations of the mind, moral and intellectual powers); 2, *Chemical phenomena* (assimilation, sanguification, secretion, nutrition, &c.); 3, *Mechanical phenomena* (voluntary and organic motion, viz., locomotion, respiration, mastication, deglutition, circulation, &c.)

"The union and harmony of these three orders of phenomena characterise a perfect organisation, and every vital act is accomplished under their combined influence.

"The different share these phenomena take in a certain vital act, gives it its peculiar character. If any derangement occur in any of these phenomena, the result is always a disturbance of the vital functions, which we call disease.

"The state of health depends accordingly on the equilibrium and harmony that ought to exist between the functions of those tissues or organs in which these three orders of phenomena occur.

"When this harmony is deranged, in order to re-establish it, we should endeavour to increase the vital activity of those organs whose functions have a relation to that order of phenomena whose manifestation is decreased or weakened.

"The physician has accordingly to regulate, not only the medicine and food requisite for the sick (chemical), but also exercise, position during rest, &c. (mechanical), and the manner in which the irritable mind is to be calmed, &c. (dynamical). Due attention to all these matters is necessary to constitute a rational treatment of disease." And hence he reckoned that there exist three kinds of natural influences on our bodies, viz.: 1, Chemical Agencies; 2, Physical and Mechanical Agencies; 3, Dynamical, Moral and Intellectual Agencies.

The first of these external as well as internal agencies referring, as it does, to the action of medicines, as well as to other physical effects, will at least exculpate him from the charge of presumption in having endeavoured to supersede many of the established methods of the schools; nor are we aware that any of his followers, limited as they unhappily are at the present hour, have professed,

or do profess, to ignore the use and application of medicines. It is fair to admit, notwithstanding, that they seldom avail themselves of these means in their own practice, and simply because they do not profess *to cure all diseases*, but to bring to bear upon such as have assumed the chronic form, certain instinctive and mechanical appliances which the laws of physiology and pathology (as they have most certainly revealed them) undoubtedly sanction. And, moreover, experience has proved that the union of the two forms of treatment, namely, medicine and the mechanical agent, have often been not only too strong of action, but frequently antagonistic in effect.

These *chemical agencies* relate, in the first place, chiefly to what he designated as the "planetary laws" which affect our bodies; in other words, to all that is experienced in the *material world* of which the human being forms a part, and in which his organism works in the clear course of an appointed duty, composed of many of the same elements, though organised and framed for higher purposes. Thus the conditions of existence have also, by some writers, been considered to depend on what is called "a forced state," the vital laws not only antagonising, but being in continual conflict with the chemical laws; the difference in the material world between organic and inorganic matter lying in this, that

the former is endowed with an active or living power over the changes and arrangements of its particles, while the latter possesses no such faculty. It is on this account, likewise, that we can only affix the phenomenon of life to the manifestations of organised matter,—though life itself, as an isolated fact, cannot be esteemed as a result of organisation; on the contrary, organisation would appear to be the result of a unity or perfection of certain distinct vital agencies or forces for a specific purpose. Again, even with reference to the laws of inorganic matter, it has been long since found that the mutual attraction of inorganic substances is not invariable, and that other agencies, like the diverse attributes of life, are here at hand to adapt and modify the subtle requirements of the material work. The latter considerations, however, would be somewhat foreign to our subject were we led into a discussion regarding the *principle of life,* or to add another to the many theories which the present condition of science is alone capable of giving forth. All that we know of "life" is that it is an immaterial principle,—a law of nature, of a higher order, though from the same source as other known laws proceeding from the Divine Founder. But although as yet we know absolutely nothing of these laws, still there is much that is almost daily revealed even by Nature herself, while the thread may, ere long, be taken up and

pursued much farther than we even now expect. At the present time we stand, with all the great accessories of science and reason, merely in the position of a material being judging that which is immaterial, and a finite being essaying to comprehend that which is infinite.

The *chemical agencies,* therefore, act upon our bodies in realising much of that we have before described as a "forced state," or in the antagonistic form. The manifest sign of death is a decomposition of the component particles of bodies in which the vital power has passed away, though not suddenly, as too often supposed, but after it has fought its ground inch by inch, and has alone yielded when all its means of defence have failed. This is the common history of a diseased body, and its struggles for existence. It is a lesson to the uninitiated in medical science in the care of their bodies, as well as to the practitioner. The *vital* principle antagonises the *chemical,* and so long as its power lasts so long is the organism perfect, and the return of its particles to the elemental form delayed. This clearly evidences how widely opposed are the forces of organic and inorganic nature, but the geometrical laws of motion may mechanically affect each in the same form though not in the same direction. Yet, to understand more perfectly how the vital force maintains its powers of resistance, and by what

means, so far as capacity permits, we must turn to the most prominent features of the nervous system.

The researches of physiology have shewn that the nervous system is pre-eminently the first in the order of organised nature; that the ultimate design of the several organs and functional structures of the body appears to be that they should minister unceasingly to the nourishment and support of that system, and receive, as it were in return, for the perfection of their own functions in accordance with the laws of unity, that vital stimulus on which depend both their activity and power. The beautiful and inductive theory of the "germ force" is one which best displays the vital capacities in their general acts, and in their persistence. A careful study of the common course of existence in human beings, their development, perfection, and ultimate decay, has led physiologists to establish three stages in the life of the "germ." The "germ force," in truth, is identical with the "nerve force;" the "germ" partakes either of the strength or weakness of the sources whence it was derived, and according to its own inherent capacity so will be its manifestations. The youth, as it were, or most active period of the "germ" is in its *evolution*, during which it develops the animal structure, and by means so subtle and various that they are by far the most astounding of all the wondrous efforts of prolific

nature. The "germ" evolves and the child develops, and that restless activity which yields its own peculiar delights and sorrows, marks its progress until the middle stage, when development ceases, and the bodily tissues grow by super-addition, remaining stationary at mature age, or in the ripeness of manhood; and then a period arrives when the *involution* is to take place, and the germinal scroll of life, written in language that never fails, rolls gradually within itself, and the elements it has collected from inorganic nature to form the organic are returned to their place in the universe, when nought remains of the work but the spiritual life which once dwelt therein, and is gone to render account of its mission.

The laws of the universe are immaterial, but the laws of organic nature are partly material, and in that part their chief duty is to maintain harmony and equilibrium; to make this their grand office, and to enlist all functions for its perfection and common purpose. So, in addition to the ordinary amount of *force* in the "germ," it has a portion for the repair of the body, and it is this quantity that, during life, mainly resists the chemical laws; for, were this not the case, that amount which is necessary to meet the "accidents of existence" would rob *development* of its proper share, and the creature-form be curtailed thereby in some of its proportions,

if not in all. These considerations are not foreign to a fair elucidation of the science or practice hereafter treated of, but deserve a long-continued and earnest attention; for it is by an acknowledgment and an adherence to these facts that we can rationally hope to assist the organism with prudence and care, when chronic derangement is found to ensue. While it is upon these checks to development that that nervous system, upon the integrity of which the functions of all organs and parts rest, is, through their errors, deprived of its own requisite nourishment, stinted in its growth, and abbreviated of its performances; it loses, in fact, its power of resisting the planetary laws, and is threatened with dissolution, unless that reaction, which is equally a law of nature, come to the rescue. The object of the medical practitioner is, therefore, to gain time, (time being the given quantity in the problem before him,) by sustaining the powers of life by artificial means, such as shall be directed in the first case to the particular seat of the disturbance, to rouse or depress the parts by means of muscular and nervous agency, (the organism's own weapons,) and, lastly, to lead forward the reactive law by improving the tone of the system generally.

In this wise the chemical laws are equally for the preservation as they are for the destruction of the human system. We find that great and im-

portant element, oxygen, both necessary to the perfection of human life and to the perfection of human death, neither of which can be consummated in its absence. Antagonism, therefore, in this as in other cases, seems to be absolute to *perfection*, though, at the same time, it fixes and defines the boundaries and limits of human existence. It is clear that as the body becomes deranged through external or internal hurts and impediments, or through constitutional weakness of its nervous system, which may spring from congenital defects or large demands upon that tissue, so do these antagonistic laws begin to operate with undue force, not only disturbing the harmony of organs, but tending to decompose their elements. Consequently, the great axiom, which holds in this science and in others, teaches us, that the life of the individual is prolonged according not to the *kind* but to the *degree* of what is called his "vital capacity." That "vital capacity" is to be maintained, if at all, by keeping in activity all organs and functional parts collectively, and by diverting any accidental disposition in one organ to consume more than its allotted share of nerve force, or to rouse them again from a morbid inactivity, equally disastrous to the economy of the whole. Antagonism being, then, in the order of nature, our practice should be to resist the force of the chemical against the vital laws. By a proper

application of therapeutic manipulations, we *react* upon the active powers resident with the nervous system, and that simply by giving a natural and normal direction to the acknowledged functions of the organism to restore harmony, and rescue it from those aberrations which are inseparable from a living machine so perfect, yet so complex.

Secondly, the *physical* and *mechanical agencies* are of a more important character still, and are perhaps more immediately connected with the operations of the *nervous system,* as controlling and regulating the human machine and preserving its existence with the self-same integrity as its own. But we must have no confusion of ideas in regard to this view of the matter, for the nervous system is itself dependent on nourishment, though it be the chief agent in assimilating those elements whereby all nourishment is provided, while it is to the "germ power" that we must reconcile all weaknesses and defects resident there—by the law of the germ, that according as the power given to last a certain time is used so will the germinal products—in fine, the human creature. Mechanical agencies, therefore, are of two kinds or orders,—internal to the body or external to it; the former are the natural functions of the organs themselves, and the latter proceed either from exercises normal to the body or from extraneous effects. The functions of the in-

ternal organs are essentially of a mechanical order, proceeding from the nervous power displayed in them; for, if their arrangement and function did not depend on nervous stimulus, it would be obviously impossible for any organ to remain long without disarrangement, and that stimulus nature has supplied in the *sympathetic* chain of ganglia, an isolated branch of the nervous system. This branch, which is treated of in another place, is styled that of "organic life,"—"on the fair presumption," as we have there said, "that all organised parts sympathise with each other, and thus balance the functional powers which they are separately or collectively called upon to evince." The *momenta* of the sanguiferous system is also treated separately, and, it is hoped, the several operations of its organs made equally clear. But we find that certain of these organs are constantly liable to local derangement, though disease itself cannot long continue to maintain a purely local character. If the dormant organ be not aroused from its lethargic state, or the pressure upon its powers of free action removed, other functions will gradually become impaired, and the whole system of organs be rendered inert until such time as the original impediment shall be removed. Hence the metastases to be observed even in idiopathic derangements, and the proofs therein afforded of the unity of the animal frame-

work. Hence, also, one of the maxims of this science, in reference to internal mechanical forces, "that a chemical effect can proceed from the internal to the external parts of our bodies," and *vice versâ*.

Again, through the *sympathetic* system of nerves, these several organs are made conscious of the necessities of each to sustain the several duties of this elaborate and wondrous machine; and so long as the nervous force is sufficient, so long will the various offices of the mass proceed in the conditions of healthy action. Acknowledging, as we must, that we can effect nothing in the absence or loss of that vital stimulus supplied by the nervous system, yet we may easily imagine, apart from the experience which has already conferred stability and truth to this branch of medical art, that in morbid conditions of parts, artificial appliances, similar in degree though not actually in *kind*, can be brought safely to bear when the nervous vitality ceases to exert its wonted influence. These appliances, it must moreover be borne in mind, arise partly from the instinctive faculties of man and a knowledge matured by actual investigation,—trammeled with and supported upon no theory which professes to search deeper into the springs and sources of human existence. This is so abundantly exemplified even in the commonest usages of medical practice, that

it is barely necessary to do more than allude to it here; and whatever power man is permitted to exercise over the functions of his organism is in this naturally and instinctively pointed out to him, or we should look in vain for the many cogent evidences we have of the efficacy of medical treatment, as well as for the correctness of classification of those morbid phenomena which have been unitedly sanctioned by members of the healing art from the most remote antiquity. Therefore, as in the healthy state of the body each organ reacts upon the functions of other organs, so in the unhealthy or diseased condition impairment is felt first in one, and thence in the whole mass. It is in this wise that the *vis medicatrix naturæ,* or the self-sustaining powers of life, are brought into active movement, and these, the most prominent of the "germ forces," are inherent in the organic constituents of the body, and separately as well as collectively vigorous in imparting tone to the system; in repairing, nourishing, guarding, as well as alleviating the hurts and pains arising from the accidents of existence or the several calls both of the natural and artificial state.

The second kind or order of *mechanical agencies* is that which relates to all extraneous effects and natural exercises; in truth to nearly all those physical results which follow upon the intimate connection of the human organism with the material world.

It bears out the force and strength of the maxim already insisted on with regard to *chemical* effects proceeding from internal to external parts, namely, that as in the former case so in this, a *mechanical* effect can go from external to internal parts—these effects resulting entirely from the *unity* of the structure. As Mr. De Betou has aptly observed, when speaking of this important law, (and we should fail in giving a better illustration of it,) that "did a blow only injure the parts on which it fell, the leg or arm for example, how could persons faint, or even die, as they sometimes do, from such a frequently recurring accident?" It is scarcely necessary here to refer a reflective mind to the clear relationship that subsists between the nervous system of man and the universe which surrounds him, an indwelling consciousness hourly present through the nerves of special sense and of the reflex-motor kind, whose characteristics are to be met with in the second branch of the great "tripod of life."[1] The examples of these agencies are endless. They lengthen out the application of this science to bounds almost indefinite, and direct the practitioner or the student not only to the obligation he holds to practical anatomy, physiology, and pathology, in the exercise of his profession, but to learn well the appliances which must

[1] See concluding "REMARKS," p. 101.

be as varied as are the numerous conditions of disease. With these acquirements, and a mind thus framed by inductive reasoning, he will not be prone to treat the human organism, as it too frequently is, as "a mere machine," or the channels of its life-giving stream (in the language of an eminent medical writer) as "a set of dead tubes;" nor will he be the plaything of rules ever liable to change, eternally shifting his ground to suit the inventions of the age, considering received truths as only truths for the time, until they be dissipated by the next which shall arrive. In the light of a practitioner, a simple follower of nature, he may justly consider himself as standing in relation to his work as a physical agent, armed alone with those assistants which both ancient and modern records abundantly furnish for him. Let him for once break down the barrier of prejudice and exclusive self-sufficiency, and believe that his own science, which like all truth is not confined to the yearnings of corporate bodies but extended as the universe, should advance as openly as all other departments of knowledge do advance; and he will know that mystery, wherever it exist, is but the veil of ignorance—prejudice but the adamantine fold shrouding unfairly dealt-with Reason.

Thirdly, the *Dynamical agencies* apply not only to the moral and intellectual, but to the very mainspring of active existence—*mechanical motion*. In

the simplest form in which so complex a phenomenon can be presented to the mind of man, we find motion to be an expression of life. Active life implies both perfection and harmony of the human frame. Man, in himself, and with reference to his appointed end, and to the *cosmos* or great world around, has been fitly styled a *microcosm,* whose movements and essays are either normal or abnormal; and thus an abnormal or wrong movement may be held to be an *expression of disease,* and cessation of movement *death.* For this end his very brain possesses a *dual* character, the spiritual and the physical; the one foreordained for the high purposes of his existence, the other for the sustaining of his material duties. How evident the moral and intellectual functions of his brain are, is a thing hourly present to him; but more remote even than the source of those powers are his relations with the laws of the universe, and the effects of those elemental changes momentarily occurring in the disposition of organic and inorganic matter. Even mechanical science, referring only to simple machines, has taken the laws of dynamics in this wise, namely, that "a machine viewed dynamically, may be considered, as a means by which certain motions of determinate quantity and direction may be made to produce other motions in other directions and quantities." Why the "geometry of motion" should not apply to the animal machine, in

a form modified alone by the spiritual part of its existence, we are utterly at a loss to conjecture, or the intellectual powers of man would have already placed him in different position, both as to knowledge and volition, than that in which we find him. A few facts also will serve to disclose something of his subjection to the physical world in which he dwells. "The smallest angle produced on a nerve, blood-vessel, or muscle, either by the position of the body, or by external application, causes a change in the parts more immediately contiguous, a less and less marked change in the more distant parts; till, like the undulations of the air, its force completely dies away." "Slight pressure on a nerve irritates it; strong pressure gives it pain. Press the same nerve with still greater force and it becomes paralytic." "The parts to which its branches are distributed are all similarly influenced by the movement." "Disease consists either in the too quick or too slow movement of the whole organism, or of one or more of its parts."[1] But we may yet go farther in our search after the common laws that apply to man in his relation to the universe, for, in him, motion is clearly not only an expression of life, but an expression of the sum of those laws of nature which sustain its active powers, and antagonise, in dual form, those

[1] De Betou.

of *inertia*. "Non fingendum aut excogitandum sed videndum quod natura ferat et faciat."

To these common laws of *motion* the vital phenomena are undoubtedly subservient; a cognisance of their demands upon the active being in its mundane capacity is made known through the mind, by its *perception*, and directed by the exercise of its *will*. The latter controls the machine by means of nerves which form the peculiar tissue immediately in subjection to it; and through the connection existing between these nerves and every the most minute portions of the body, corresponding effects are produced. The axiom in these cases being, that "whatever displaces or produces motion in one part of the body, must also produce a corresponding change in neighbouring parts capable of movement." "Every atom of the human body moves," in invisible yet appointed order. Disease, whether brought about chemically, mechanically, or dynamically, is "a too quick or too slow movement."[1] It is well known that the most minute particle or atom of a virus will affect the whole blood of a person, and we can only account for this in the belief of that almost electrical communication or vibration of the atoms of that fluid. The atoms of tissues share equally in the results of the same law.

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[1] De Betou.

It is likewise upon the law of molecular vibration, whether of the molecules themselves or the particles which compose those molecules, it matters little, that the functions of assimilation are performed. By the simple rule of contact, or otherwise, the elemental ingredients of the blood are presented in the capillary vessels to every tissue, and thence take the form of the tissue at which they arrive; and the contact, if it be by this rule, can only be with the approximate atoms, and these must communicate both the law and the material apposed from one to another, from the external to the internal. So are dynamical effects produced, corresponding in every example with the isolated and peculiar vitality of the part or tissue.

It may be held, therefore, that dynamical agents are the most powerful of all others in the human system, and that the phases of disease should mark, be the seat of the phenomena where they may, the existence of a common *cause*, and that some impediment to the free course of vital action, and of the nervous power especially. Equally with the physical and mechanical agencies, the boundary lines of the dynamical are scarcely definable, but they are, nevertheless, certain and methodical. By these external means, communicated to every atom of the frame, be it superficial or deep-seated, the physical education of man is accomplished, and this

wondrous human machine takes its appointed place, and performs its cycle in the universe.

If the tabernacle of human life be thus placed with reference to the universal laws of nature, and affected by them in many forms and conditions, it must be obviously clear to the understanding that man, from the free agency of his *will* as far as material things are concerned, can, to a certain extent, react upon his own organism, and, when guided by the hand of Science, do much in the way of maintaining harmony, and restoring something like an equilibrium when functional impairment shall have taken place. Upon these facts, and the successful proofs of their truthfulness and rationality, which Ling's doctrines and practices have unitedly exhibited, the science of MEDICINA MECHANICA proceeds onwards in its course, and it would be almost impossible to foretell either the boundary or extent of its valuable aid in Medicine, when it shall be permanently acknowledged as an essential branch of Therapeutics. We can assist the reactive law of nature by any of the three means here stated, namely, by the chemical, mechanical, or dynamical, the last proceeding mainly from the efforts of our instinctive as well as reasonable being.

In the practical language of this science, however, we have to deal with the mechanical branch of therapeutics, and shall proceed to treat of many of

the most prominent points in relation thereto. But it becomes absolute upon those who attempt this, to state, briefly and clearly, why they can, acknowledging as they must do the inseparable principles of "vitality," simply prescribe a mechanical agent to cure disease? The answer is this: that the practitioner of this treatment takes the human frame under his care, when its vitality (which controls and adjusts) is operating so weakly that the mechanical force is, as it were, in the ascendant. Were this not so, chronic disease could barely ensue in any case; or, at all events, we should fail to account for those *instinctive feelings*, and we can use no plainer term, which the organism of man sets up of its own accord, for its own remedy when out of order. It was upon a careful study of the acts which follow these instinctive feelings, that the science itself was founded. Ling himself, as a philosopher and physiologist, appears by accident to have revived the therapeutic agency of voluntary and involuntary movements, both in men and other animals, which follow, invariably, symptoms of organic disturbance. Grasping at the idea thus again brought to the light, he found, moreover, that his own body profited by attention to these conditions, and the obvious conclusion was, that if good effects could be produced by instinctive means of which the mind was hardly conscious, a still greater acquisition could be made

by the science of medicine when applied in harmony with the laws and structure of the human body. And, if medical knowledge were of any real value at all, it could undoubtedly grasp these instinctive principles of the living organism, and direct them systematically and effectually.

We are fully aware, notwithstanding, that many writers reject the notion altogether that the animal forces are regulated in their operation according to physical or mechanical laws, but they fail, consequently, in doing more than asserting the control of the vital forces, a denial of which is in no degree or manner urged by the promoters of this branch of therapeutics. Indeed, the followers of this art ignore the idea of the organism being viewed as *a mere machine*, but, at the same time, they can find no argument to disprove the position as to its being under the influence of the universal laws of motion, disposed of and arranged by an immaterial principle, —that of life; or that which distinguishes organic from inorganic or apparently dead matter. If this principle of life, whatever it be, or whence derived, does not make use of organic structures in this wise, how are we even to judge of the faculties of nerve-substance (which is the material by or through which this life is commonly manifested), when we are told that "the structure of the medullary pulp of the nervous system *is almost inorganic.*" There-

fore, this science does not seek to explain the phenomena of "vitality" by the common laws of mechanics, but simply the *motions* of those organs, tissues, and what not, which are governed for the ordained purposes of human existence by this peculiar vitality. If, too, the "mutual attraction" of inorganic particles is not invariable, there is additional reason to believe that the elements common to both are disposed of in much the same way, similarly regulated in *kind*, though not in *degree*. Nor is this opposed to a fair consideration of the functions of the human structure, physiologically as well as anatomically. It does not matter what is or is not the acknowledged vitality peculiar to each tissue of the body, when we would observe the motions or phenomena of those tissues, for the *order* of them must be *fixed*, whether it be slow or energetic; it is evident it must be so, or how are we to define what is known as the "harmony of nature?" It is the high privilege of the organised being, man, to act upon the whole material world by means of a "spiritual will;" but it is in no sense or manner granted that "will" to alter or regulate the common forces by which the subservient organism is framed, modelled, and gifted. The "will" may control *functions*, but can exercise none whatever upon the primitive laws of such forces as absorption, secretion, assimilation, and the like. These are in trust to

Nature; and when their conditions of action are perfect the *mind* has no influence over them, beyond that of withholding or retarding the vital stimulus, which can only be done partially.

Again, in the elements of organic nature we find the same combining proportions as in the inorganic. Motion, once imparted, propagates itself, and is thus spread through every atom of the mass. The vital forces may determine the character of the organism and its special duties; may use it in the appointed way; but they are limited, as we have said, to the functions of a perfect organisation, or what is familiarly known as the healthy state: when this is absent, where can we look for aid but to the mechanical forces of external and internal stimulus, both nervous and muscular? The successful results of the mechanical treatment must be referred to these conditions, or we seek in vain for a rational explanation of them. The greatest proof of its efficacy is embodied in a fact that should never be lost sight of, and it is this:—*that the effects of the movements and manipulations are not only continuous during the periods of application, but are lasting in their results upon the body;* whether by restoring its lost tone, or re-establishing its former vitality, we need not take upon ourselves to distinguish. If the vital force had any power over the chemical compounds of the body, it would, in very many cases,

repel the action of medicines and poisons, and if the *mind* possessed equal powers of control, it would undoubtedly rebel against all such as did not accord with the harmony, or taste, of its sentient impressions. The latter is a homely view, yet one which, in simple language, conveys to us the proof, that man may bring his scientific knowledge to bear when the vital forces are themselves at fault. This branch of therapeutics, then, treating as it does disease when chiefly in the chronic stage, is the ultimate restorer of vitality, or it is nothing. It looks to the inherent vital forces as the main-spring of every active movement and function of the organism, and it essays alone to remove what might be almost called inorganic impediments to the free course of those forces. Hence, the art itself owes its origin to careful observation of those *instinctive* acts which the Divine Wisdom has implanted in animal life for its preservation. And if the science of medicine be not based upon correct instincts, matured, like any other faculty, upon observation and experience, it again is nothing. Ling made these the study of his life, undeterred either by obloquy or straitened circumstances, and his memory is cherished in his native land with an ardour which we should fail adequately to express.

Experience, or instinct, tells us that when we suffer from internal disease we should adopt those

positions which are calculated in some measure to relieve our sufferings. Thus, in disease, or even in health, we sleep better in certain positions than in others; one person seems to prefer reclining against a chair or table, the asthmatic to sit up in bed, another bends his body forwards, or stretches himself in the horizontal posture. These are mere mechanical adaptations, yet they undoubtedly are effective, as we all can testify who have used them. Life, it is said, can be preserved and prolonged by life itself; hence, too, the instinctive movements of the organism. The most decided symptom of the vital forces being at fault is where disease has assumed the *chronic* form, for then the ordinary practices of medical art have been in all time baffled. The body so afflicted is certainly not resigned to its fate, but the reactive powers are looked for in other heroic means not ordinarily brought into requisition. Change of air, exercise, mental influences, and the like, and a fervent hope that some unseen agent may exert its power in the place of art, are the natural yearnings of a practice the utility and efficacy of which are too often restricted by its own followers.

The human system speaks to man in language not to be misunderstood. In the nausea and sickness of fevers the body refuses nourishment, allowing the nervous system time to recover from the

severe calls which vibrate, as it were, in all parts, and could not accord to it an increase of duty. When a sick person experiences pain, which more frequently arises from congestion of the blood-vessels than from any other cause, he seeks to touch the part, and, by an amount of pressure or friction, determined by reflex sensations from the superficial or deep-seated injury, to promote absorption, stimulate the nerves contiguous, and hasten onwards the retarded stream. The well-known complaint called sea-sickness, the results of riding in a carriage with the back towards the horses, swinging by ropes, are all the effects of movements to which the body is unaccustomed, and each exerts its influence so long as the *mind* shall not be capable of adapting the conditions of the organism in correspondence with them. So, also, the nervous system itself is found subject to those external or internal impressions which enlarge or circumscribe its activity, in one case terminating in the various forms of paralysis, in others in convulsions, epilepsy, and the numerous train of latent and obscure diseases which belong almost exclusively to this particular tissue. If, we repeat, we press upon a nerve with considerable force it becomes paralytic,—as in cases of large effusion upon the substance of the brain or spinal cord, the integrity of the nervous matter is destroyed or, as it were, broken down;

but slight pressure stimulates it, and by the angle so produced upon the nerve, either by internal application, external, or change in the position of the body, a change ensues in parts more immediately contiguous, and so on.

Thus, all-paramount as the nervous system is, it yet cannot accomplish its work, whether in the healthy or diseased state, without the aid of agencies obviously inferior to it, and mainly of a mechanical kind, of which the most important are resident both with the muscles of organic and those of animal life, whose motions are generally comprised in the involuntary and the voluntary. The ordinary instincts of animals are to be observed in the routine of the former, and the acts which result from these beneficently-ordained qualities of our organism are the products of the latter.

But to pursue the subject of instinctive acts. We find a certain chain of connection between what are commonly termed emotions, affections, passions, and propensities; for, whilst the last are considered to be "actions led on by impressions," ordinary instinct is said to imply a knowledge how to do and when to do certain things. Uncontrolled by the mind, they are essentially involuntary acts, and developed frequently with a determinate speed and direction for which the more slow reasoning faculties of the brain would barely suffice. Yet in this the

high office of the mind, both in the practitioner and patient, is rendered certain and effectual, that the results of simple instincts may be known, guarded, and directed according to intellectual experience. We cannot, therefore, urge the sufficiency of instincts; but this question has often arisen, "How far are they capable of learning or performing new actions?" Ordinary instinct is sufficient for all the *probable* acts of life, as are exemplified in the indwelling powers, those by which we are guided in the choice of food necessary to supply material for the reproductive powers; and investigation even among the lower orders of animate beings has proved how obscure are the limits of these phenomena. Animals, guided by instinct alone, have yet performed *new acts,* and are susceptible of cultivation under man's guidance or example, so that the human being has a powerful agent in these faculties to strengthen his knowledge of functions necessary to prolong and guard his existence.

Even the simple instincts both originate in and are ruled by nerve-actions, as are also the workings of the purely physical and mechanical forces, seen in the movement and formation of the blood, the movements of the heart, stomach, and intestines, the various muscles, and particularly those of respiration. But in the animal economy the instinct for repose is never excited by or through the latter, for

they go on continuously, taking of themselves an amount of rest equal to their activity; likewise do they speedily make the mind conscious of impairment or impediments to the free action of some or all of them, and so providentially forewarn of disease and even of its latent source.

Thus the instinctive movements of the animal correspond in most cases with the nature of the difficulty sustained by the organism; and the practitioner himself has no better guide. Nor in this view is he more puzzled by *sympathetic* movements and results than he is in all the numerous instances of uncertain diagnosis which beset so intricate a science as that of medicine. Equally mysterious are all the phenomena of the instincts and those occurrences which result from them; and so little knowledge have we gained of their uses hitherto, that we are more cognisant of their defects than of their sufficiency. Time may, however, remedy this gap in our knowledge. Still, if any one feature of an uneducated existence more than another made manifest the authority of *a mind,* it is undoubtedly that displayed by the instincts: the more numerous they are, likewise, as in the case of man, the more the necessity for this spiritual monitor. It is affirmed of Ling, that, being afflicted with pulmonary disease when young, and after the usual recourse to medicines had failed, he applied certain

movements to his own person, the effects of which had occupied his previous studies; and thus his life was prolonged to the advanced age at which he died. And thus, also, this system, resulting at first from instinctive forewarnings of the lapsing condition of the body, need not be considered merely as a *mechanical power*, but may exercise the greatest influence over the vegetative and the intellectual life of our frames.

Again, the instinctive voluntary and involuntary movements undoubtedly act in preventing, allaying, curing, and partly suppressing diseases, and even those of long standing, for it is then that the sufferer is more prone than otherwise to efforts of this nature. It is obvious, however, that all exertions which tend to so desirable a consummation as relief from the pains and penalties of disease, are modified by the "vital capacity" of man, dependent, as that is, not only upon the form and structure of his body in the state of health, but on congenital disproportion, as well as actual impairment arising from hurts and damages which his system may have sustained. It is upon circumstances of this nature that the movements and manipulations are themselves beset by natural difficulties, such as are alone to be overcome by a due regard being paid to matters which, in the healthy state, are simple enough. When the motions of all parts of the body are free, as in

the state of health, any prudent amount of exercise is harmless, safe, and invigorating; but when local disease shall have supervened, and even after more than one organ or part is involved, no success, but rather danger, can attend the practice which is not based upon sound medical knowledge,—grasping the *unity* of the human framework, and its withal striking complexity. For, it must be evident to the impartial inquirer, that if this branch of medical science be of any use at all, it must be applied with strict attention both to the harmony and functions of the structure, and cannot be explained away by the allegation of its being *nothing more than simple exercise,* which any person can follow at will. On the contrary, even simple exercise may be, and is hourly, although barely heeded through ignorance of the laws of the organism, injurious and debilitating, and it is so because the nervous force is thereby called into undue activity. A man is recommended to walk much in some cases, and the result is that instead of feeling the stronger therefrom, his own senses inform him that he is much weaker; and for this reason, that the nervous fluid is as readily expended as the sanguineous, and the weakness he feels is not purely muscular, for that is greatly benefited, but some other tissues or organs are deprived of a required share of stimulus necessary to their persistency, and in due consequence the

harmony of the whole machine is deranged. These remarks must not, however, be misunderstood as to their meaning and intention, being merely offered to show the intimate connection, even in the healthy frame, between all parts in the disposal and application of its nerve force or nerve stimulus. They further disclose many of the truths which this branch of therapeutics opens out to us, and refer, in language at once forcible and reasonable, the student and practitioner to the chief latent causes of serious organic disturbance, and to the rationality of a mechanical treatment to parts of, or the whole frame, when the vital forces ebb or yield to apparently insurmountable obstructions. The means are, so to speak, known to and practised by Nature herself, instinctively as well as from *forethought;* and one of the great attainments of medical science is in no case more wisely adapted, than in that of combating the *chronic* stage of a malady by weapons portrayed in the perfect working of the human system. Familiar instances of these instinctive acts for the preservation as well as recall to harmony of the various functions, may be found in the following:—

First, in the order of their importance, we have *inspiratory* movements, absolute to the very existence of the living body, in truth the vehicles of life. These not only oxydise and purify the blood of its carbonic acid gas and other exhalants, but assist, by

the agency of the diaphragm, combined with the *recti* and other muscles of the abdomen and chest, in stimulating the liver, stomach, intestines, and other important organs of the viscera. Artificial means for the production of these movements both in the case of the fœtus and the adult, have long been known to medical practice; and in addition to the process of inflation of the lungs, applications such as *kneading, heaving,* &c., means acknowledged and used in the branch under notice, have not failed to produce beneficial results. The movements controlled by the *will* of the patient act strongly upon the arterial as they do upon the venous stream; in expiratory efforts mainly on the former. We need not allude to the effects of the *emotions* and *passions,* and such like manifestations, which come undoubtedly within the scope of the moral laws, yet have their peculiar results, for good or ill, upon the frame. *Deep breathing, free breathing,* together as mechanical acts, rid the body, as already said, of the hydro-carbons, and the human system seeks to extend, moderate, and guard those powers of its own accord, as we find in asthma and consumption where chest expansion is controlled and limited, also in the fits of the former and the resulting remedial secretions of the mucous lining of the lungs; and when it is said that pathological anatomy indicates an artificial and natural emphysema for the

cure of tuberculous deposits, as urged by some authors—all these are as much instinctive as are any of the vital-mechanical motions. Were it not for catarrh, whether naturally or artificially induced, as urged by Dr. Ramadge, and apparently well borne out by the tenour of Laennec's general arguments, no relief could be found adapted to infarcted conditions of the bronchial tubes, at least with reference to the accumulated sputa. Here, then, is an instinctive act. To these we might also add others of no less importance, as being in themselves natural curative methods, allied to that inherent power of the organism known as the *vis medicatrix naturæ*, such as the concussion produced by coughing, sneezing, and the like, together with the moderating influences of concurrent nausea and vomitings in the early stages of disease. But a full consideration of these would unnecessarily lengthen out the bounds of the present work, and may be studied at large in those compilations wherein they are treated in a style commensurate with their importance. It is sufficient that they are here attended to more for the purpose of showing how clearly the efforts of nature may define remedial agents, in perfect accordance with her own plans both in health and disease.

Finally, our attention is drawn to the fact that, among the ancients, the simple attempt to give

harmonious development to the frame, and in the general pursuit of other prophylactic methods, a knowledge, which remains to be perfected by the present age, dawned upon the minds of then existing medical writers of the highest eminence. They found that if these appliances were adequate to the task of warding-off and staying diseased action, they could be equally brought to bear upon the body already within the compass of its malign influence. Not only do we find the practice of the *Iatraleiptes* much in vogue, but even the limited use of *frictions* and *gestations*, productive, as they ordinarily are at the present hour, of striking and specific benefits. Notwithstanding the constant practice of this science, and its early acknowledged position in the domain of Medicine, it appears to have declined only at that period when Italy, with great difficulty, retained as it were the scientific records of the civilised world; and in due consequence of her precarious position, this, in common with other important arts and sciences waned and became lost, whilst the difficulties attending its resuscitation, as well as the manual labour attached to it, combined to give a feeling of distaste towards it on the part of the medical practitioner. Still, a few of its principles yet remained, for we find, so late as the seventeenth century, one Fuller, in his 'Medicina Gymnastica,' recommending, though partially, this science, whilst

Dr. Callaway, in the 'Jacksonian Prize Essay' for 1846, mentions the advantages of *passive* motions, flexion, extension, and rotation, in the after-treatment of certain dislocations; and his views are borne out by the frequent instructions of existing eminent surgeons: though as these matters are left usually to a *third party*, they are obviously neglected, if they be not contemned. It would be tedious, however, to extend these examples; but we cannot forbear giving the testimony of the learned professor Bock, of Leipsig, whose invaluable *Atlas* is a monument in itself of his powers of making clear the structure of the human frame, giving moreover his tacit sanction to the practice. Speaking of certain phenomena (in his 'Pathological Anatomy') he thus writes: "the above-mentioned reflex motions must also be observed in *therapeutics*, in order that by irritation of the sensitory and motory nerves, *reflex* and *associated movements* be produced, especially in the respiratory, circulatory, and digestive organs. The cure of many diseases by the medical gymnastics of Sweden, depends on these circumstances."

The success of the treatment hitherto, both in this country and that wherein it has already attained to high perfection, has been so complete, that we fervently hope the day is not far distant when men high in the profession will render their valuable

assistance to that development of which it is still susceptible, and suffering humanity be induced to rely upon another species of aid, which, under the guidance of qualified men, will be, as it ever has been, at once valuable, unempirical, and unpretending.

MEDICINA MECHANICA.

THIS branch of therapeutics comprises a system of motions and mechanical applications adapted to diseased conditions of the human body, and with reference to the physiological and anatomical bearings of such derangement. It is also governed by the rule,—that if exercise be absolute to the maintenance of health, specific exercises, among other forms of treatment, are especially needed to restore a normal action to parts, and subsequently to the whole organism. The curative effects are, therefore, brought about by manipulations applied to the muscular and nervous systems, separately or unitedly.

Of the *modus operandi* we may consider three principal methods of action or fundamental principles, such as *excitation, derivation,* and *roboration* or strengthening. In the *first,* we endeavour to overcome a morbid state of organs or tissues, by imparting vigour to the nerves and vessels connected with those parts, at the same time stimulating as

well as promoting the reproductive processes. In the *second,* we seek, by acting upon the superficial or deep-seated nerves and vessels, to derivate the blood either from internal to external parts, or from any organ wherein a morbid circulatory action shall be established. Whilst, in the *third* form, we strive to diffuse a proper amount of innervation throughout the system, re-educating, as it were, the natural functions, and thereby completing the work of a true curative agent. Yet these are not the only means suited to the purpose, for by way of example we may here state, that, in the Royal Institution of Stockholm, to the practice of which many hundreds of persons owe their health, others have been found available in the greater number of *chronic* diseases,—in affections of the nerves of every description, in all those which depend on circulatory derangement, as in rheumatisms, marasmus or emaciation, profluvia and suppressions, dyscrasia or a bad habit of body, on deformities and other disorganisations, scrofulous cases, even diseases of the skin and chronic inflammation, being perhaps only contra-indicated in acute inflammation and fever.

From this it will be obvious that these motions are chiefly available in the *chronic* stage of diseases, and are ruled by the nature, situation, and extent of the complaint; for, in the *chronic* form it may be held that the sufferer is on his part debarred even

the ordinary exercises and enjoyments of health, and the practitioner is forewarned of the results of this *hiatus* in the natural operations of the human machine. In consideration of this we are told to "place the body in certain angles rather than in others, as the first step of the mechanical treatment." As already premised, these motions are adapted in all cases to the existing condition, temperament, idiosyncrasy, and vitality of the patient, as will be exhibited at large hereafter. Their principal offices are to rouse generally the torpid frame, to enliven the activity of organs, to promote absorption and secretion, to cause a metastasis or derivation in cases of congestion or the like, to impart vigour to the circulatory powers, to re-educate the frame to that proper exercise of its common functions which may be almost lost or at least impaired, and lastly to induce harmonious development.

Among the most familiar examples of these defects, we need only refer to the physical and intellectual conditions of those who follow for a length of time hurtful and confining trades and other callings, to such as are necessitated to occupations of a sedentary nature, to that amount of mental oppression and overtasking of the vital powers which appears to increase upon the more struggling and active masses of this country, and on this account it is that we find nervous diseases and nervous irritability almost

confined to certain of the higher classes of the community. Now, simple as it may appear, *muscular* motion can almost of itself be so applied as to remedy the greater part of the above morbid conditions; it can, in fact, be applied to any portion of the frame to subdue or impart energy to the several movements within. Thus these effects, which in health can oftentimes be produced by ordinary exercise, may be equally brought under the course or rule of scientific application; for it is an established fact that muscular motion acts upon all the systems of our bodies, after its own inherent fashion, thereby rendering it as powerful in therapeutics as it is safe in its hygiènic results. The very stability and form of the human structure unitedly depend upon the healthy disposition of this all-important tissue; the positions of the bones, their directions, the relative situation and extent of their articulations, are amenable to its full control. Even the uninitiated in medical science are cognisant of its effects upon the circulation of the blood, in developing animal heat, and rousing the energies of the frame; and when we know that no muscular contraction can take place without imbibing from the sanguiferous circle *a more than usual supply of blood*, we need not refer to the advantages of exercises, but we can see by this fact that we have therein the best of all known means *for derivating the blood from congested organs or parts.*

The *lymphatic* and *nervous* systems are, in the economy of the frame, in a great degree subservient to the operations of this tissue; by muscular motions their tone is increased and heightened, and in the absence of necessary exercise both become manifestly weakened. With reference to the *lymphatics*, we find a treatment suited to their nature, and although artificial, so far as the operator is concerned, yet produced by natural means. Both by direct and indirect pressure exercised upon the nerves, chiefly through their superficial branches, we take the part of ordinary muscular motion, which, in its own effects, either stimulates, tempers, or calms these vital chords of our frame. Pressure, moreover, whether muscular or artificial, is a powerful *absorbing* agent, and it is scarcely necessary to point out those sad and often almost irremediable diseases which require for their cure the strongest absorbing efforts. Anything, in fact, which can, in *spinal* or other similar cases, rouse the absorbents, must be invaluable to the practitioner, and this can be effected by a proper application of these manipulations. It is also obvious that the *venous* stream, the great channel of absorption, dependent as it is in the healthy state upon muscular force, can be increased by mechanical pressure used to the extent of which muscular power is itself susceptible. There can indeed be no rational objection to exercise, even without these other

adjuncts, being brought into a scientific system, when we are directed by the philosophical and oft-quoted rule—"*Nunquam aliud natura, aliud sapientia dicit.*" Thus, too, like many medicinal agents, it has its several derivative, stimulating, and roborative effects, and in *chronic* diseases is found to supersede the former, the limits of which are here perhaps more accurately defined than in any other instance we could adduce, and without disparagement even to the universality of their efficacy. The researches of this treatment depend in truth upon a familiarity with those laws which govern medical science at large, for, to derive an adequate benefit from these movements, we are bound to study the relative positions of organs or parts, to form, as it were, the "starting" points at which the practice should commence. The leverage of the animal framework, the change of action, antagonisms and other dispositions of the muscular tissue, are matters for study and care, or we fail in producing the required result or any decided curative end whatever. Many thousand movements, therefore, follow in the order of diseases or derangements presented for treatment, and the majority could be described with no particular certainty, and perhaps be less applicable when so given. The science itself, however, bears no mystery on the face of it, nor does it exclude a persevering endeavour to accomplish either its aims or intents.

To pursue mechanical movements with success, there must be a strict attention paid to *uniformity*, such indeed as the laws of animal mechanics specify, both as to *time* and *direction*. In Ling's 'Analysis of the Physiological Effects of Movements,' we have the following, which may be studied with care and attention :—

"1st.[1] That the effects of these movements may be transferred to any part or organ of our organism.

"2d. That the strength of the movements may be modified and regulated from the most feeble to the most powerful.

"3d. That *passive* movements in general affect the sensitory and excito-motory phenomena of the nervous system and of the *absorbents*, and, increasing thereby the absorption, advance the retro-metamorphosis (waste) of the organic textures, (shorten the periodical cycles of duration of the nucleated cells constituting the tissues ?")

"4th. That *active* movements augment the activity of the arteries, and the innervation of the motory nerves.

"5th. That they increase the animal heat.

"6th. That they advance and support the progressing metamorphosis (repair) of the textures, (increase the deposition of nucleated cells to constitute new tissues ?)"

[1] Georgii's Pamphlet.

It would be difficult to embody the substance of his views with annotations in a manner more clear than that of the foregoing; although they appear to have been limited by the character of the pamphlet from which they are extracted.

Exercise, indeed, is, in a scientific point of view, that which gives to every muscle, or tissue of the body, just enough exertion to promote the harmony of the entire system; suited to all ages and all constitutions, it can be made to act in the *highest degree* energetically, or in the *lowest degree* mildly. The questions relative to its application are simple enough, and in the treatment of chronic disorders are thus considered,—what can, with the greatest facility and safety, promote the circulation of the blood, give tone to a subdued nervous system, and put the digestive and other organs of the body again into a normal state of activity? Those movements which exercise only a few sets of muscles, such as walking, riding, and the like, are doubtless very good in their way, and while the frame is capable of supporting them; but even these are frequently contra-indicated by the feeble vitality of the patient, and oftentimes productive of much injury to the general tone of the system. *Specific* movements, under the guidance of medical laws, are, on the contrary, beneficial in almost all cases, at least so far as we really have the power of mitigating the sufferings of the

patient. Let us suppose, for example, a person with a narrow and contracted chest, a feature which clearly shows how much the sources of vitality are hindered and impaired,—suppose such a person placed under the care of a practitioner of this science,—has he not the means of applying suitable muscular movements to the development of that chest, and not only this, but of causing the lungs to fulfil their proper office, the arterial streams to be chemically affected and again properly distributed, and the whole body thereby to receive its required share of the *pabulum* of animal life? The ancients, as well as those who flourished in the Middle Ages, owed much of their success in the field to bodily exercises, and the striking proofs of these effects served to guide the then existing practitioner in the medical art to the springs and sources of healthy existence,—hence the application of these methods to disease. In the absence of these assistants of health we cannot fail to observe the frequent source of *cachexy*, the loss of vigour and elasticity to the animal machines generally, as well as the frequent congestions and clogging of the blood-vessels of the body. The root of all may be traced to that condition which is prejudicial both to the body and the intellectual faculties of mankind. It is, however, not equally clear that the ancient physicians applied these motions to the scientific extent of which they

are capable, and by which they can be satisfactorily explained and proved: much yet remains to be done. They seem to have effected little more than the *preventing* of the inroads of disease. Still that they used them for bodily development, and as a means of *cure*, are established beyond doubt.

These remarks are borne out by a Dr. Londe, a French physician, who, writing on the subject about thirty years ago, thus expresses his views:—"It is not enough for the medical man to know that *bodily exercise* is useful in disease, but he must also be enlightened by physiology, in order to be able to prescribe *what* kind of exercise must be used. He must *previously determine the changes to be produced in the different organs*, and know how the organisation will gain the different advantageous modifications from the movements. If he has not this indispensable knowledge, his remedy may become very dangerous, and will be always imperfect in its results." The art has therefore a greater claim on public attention when it can itself show how directly it is based upon the laws of anatomy and physiology.[1]

Three principal directions or propositions are therefore allied to this treatment, namely, first, to cure certain organs or parts without the necessity of involving other organs or parts, or, in other words,

[1] See concluding "REMARKS," p. 101.

at their *expense;* secondly, to balance and adjust the antagonistic forces of the frame; and thirdly, so to develop the unity of the structure that there may be no return either of the disease or the symptoms. And this brings us to consider the nature and character of the several orders of motion.

The *movements* already established are of three kinds, *passive, active,* and *mixed.* The functions of these will now be treated *seriatim.*

PASSIVE MOVEMENTS

Are those which are independent of the *volition* of the patient, or, such as are transmitted to any part of the organism by an external force or forces. They consist chiefly of the following, namely, *vibration, percussion, longitudinal or transverse pressure, friction, rotation, lubrication, ligature,* and *firm or subdued irritation.* That sort of motion which is applied by the hand of one person upon another is called *passive,* in order to distinguish it from *active,* which is a muscular motion performed by the patient himself. *Mixed* movements result from the combination of these two separate forces.

Vibration.—This remedy, both fixed and moveable, is powerful and speedy in result as it can promote or change molecular motion; by the latter its effects are usually communicated; also when the nerves are

stimulated, by being propagated as other influences are. It hurries on the circulation, and thereby removes the congestion to which organs and parts are liable; it in fact modifies the vital acts, and reacts strongly upon the whole organism. Chemically it acts upon *respiration, secretion, sanguification, assimilation, innervation,* &c. Its results depend upon the strength with which it is applied, and *directly* on those points or parts where it is desirable to produce certain effects. By way of example, we may premise that it is usually performed with the finger ends of both hands, and in the epigastric region. Acting as it then does upon the great *solar plexus,* or its branches, the several organs of the viscera are unitedly or separately stimulated, proving it highly beneficial in hysterical and hypochondriacal disorders, and the common conditions of dyspepsia; if to any of the articulations, it affects the vessels and ligaments of the joints. In fine, it allays pains by hurrying on the circulation and removing pressure, is adapted generally to inactive organs or parts, gives tone to these whether near or deep-seated, and above all is strongly *absorbing,* whether extended to a larger or smaller amount of surface.

Percussion.—Chiefly stimulating and absorbing, and may be sharp or flat. If it be used sharply and gently, with the flat of the hand or an instrument, it produces a quick and powerful venous absorption;

but it is much stronger if it be done in a "hacking" way, as it were, with the edges of the hands for instance. By flat and sharp percussions applied to the chest, the respiration is made easier; and this is partly effected by the direct action being upon the respiratory muscles, and partly by the passive motions communicated to the lungs. This application performed upon the extremities produces there a venous absorption, not only within the cutaneous tissues and fascial structures, but also within the muscles, and even upon the deeper seated periosteum. Thus it may be regarded as one of the most efficacious means of therapeutic manipulation in order to increase the amount of venous absorption.

Longitudinal and transverse pressure.—These operations are also directed to certain points, and chiefly in order to compress blood-vessels or to affect nerves; but the qualities of pressures as absorbent powers are too well-known to medical science to permit us to digress at large upon them. It may be said, however, that by these compressions prompt and great effects are produced, and lively reactions called forth. Agues, toothache, rheumatic affections, nay, even schirrous tumours, enlarged and inflamed glands, varicose veins, even popliteal aneurisms, and other inflammatory cases, have been entirely cured by properly-directed compression. Applied to the jugular veins, for example, it has a strong effect upon the

sinuses of the dura mater, whereby the brain has been put into an artificial state of congestion, which at length, when the pressure was removed, caused a continuous venous absorption, relieving the surcharged vessels of the brain, and giving almost immediate comfort to the patient. In some cases this effect has been simultaneous with the removal of the ligature, and may be safely applied in all those where what are called "nervous diseases" result from excessive momentum of blood to that region; while it is needless here to say how frequently nervous affections of remote parts may be referred to the brain as a cause. But it is not to our purpose to enter into these discussions in the present work.

Friction.—This has long been acknowledged as a powerful agent in medical treatment, but its importance is circumscribed through lack of attention and the labour attendant on its proper application. In surgery, however, its uses are too well-known to need particular notice. The frictions commonly adopted in this treatment are linear, circular or cycloidal. Quite different effects can be brought about by any or either of these, according to their application to the several tissues of the body. For a more particular account of the several advantages of frictions and inunctions of the body, the reader may consult both ancient and modern medical authors, and amongst the former the systems pur-

sued by a class of Greek physicians, denominated "Iatraleiptes," are well worthy of attention. Yet, to consider its ordinary effects, it may be held that they are according to the different degrees of strength, or the different kinds of means with which they are applied. Performed gently on any part of the surface of the body, friction hardly does more than cause an increased venous absorption in the cutaneous tissues; but combined with a little pressure, it acts upon deeper-seated parts, it enlivens the minute branches or nerve-fibrils, and distributes both plastic lymph and other assimilative materials of the blood. Applied again to the neighbourhood of a diseased organ, it will allay pain and divert congestion; directed towards the region of the abdomen, it serves to promote the activity of the venous and lymphatic systems, and to assist the functions of the liver, intestines, &c. When traced along the course and ramifications of the nerves, their tone is heightened, whilst like effects may thus be conveyed to the near or remote nerve-centres or ganglia, applying equally to the brain and spinal cord. A friction passed along the surface of the cranium, immediately above the *superior longitudinal sinus*, combined with a vibratory movement, produces a general venous absorption within the several sinuses of the *dura mater*, giving rise to a cold sensation along the spine, indicative of a connective

result. In a relaxed condition of the *uvula,* resulting from a momentum or determination of blood thither through irritation of adjacent parts and membranes, a cure is often effected by applying friction along the roof of the mouth, near to the *velum palati,* and is best done with a metal instrument, such as a small spatula. The instances of successful use of this valuable agent are endless; it may be taken, also, that both as a counter-irritant and derivative, as well as stimulant, it is invaluable and effective in all cases.

Rotation and Lubrication.—Rotation is commonly productive of the latter, and is a motion performed with a part of the body, as, for example, the hand or the foot of the patient. If it be exercised properly, it tends to lubricate the particular articulation, by stimulating the synovial membrane, causing a passive play of the ligaments and tendinous sheaths, increasing the animal heat; and, after dislocations, is a most excellent means both of restoring a normal state of ligaments and promoting a natural secretion of synovia. To this end, it is successfully advocated in many of our largest hospitals and infirmaries. Again, if a rotation of the head upon its axis be undertaken, a sensation of vertigo is produced, by the venous blood being then partly retained in the sinuses, which, on cessation of the movement, has for effect an increased degree of absorption. If a further rotation be performed with the trunk, when

the pelvis and lumbar region should be held or fixed, the capillary vessels of the heart and lungs are affected unitedly.

Ligature.—This is an appliance of the greatest use in the mechanical treatment. It is fixed round the base of the skull, and just above the frontal sinuses; round the chest and abdomen, but especially the latter; round the arms and legs, and wherever it may be desirable to retard the venous stream. The effect of this, particularly when the ligature is applied to the extremities, is not only directed towards the superficial vessels and parts, but to the periosteum and osseous tissue itself. Thus it is, that it is so successful in cases of varicocele, tubercles of the bones, serous infiltrations, flatulence, &c. The common tourniquet is obviously very well adapted for the majority of these applications, and ordinary belts or bandages in other cases where its use is restricted.

Strong irritations.—These are applied chiefly to the superficial nerve-branches, in order to stimulate, by reflex action and sensation, adjacent and even deep-seated parts, the diagnosis of each case determining both the amount and direction of this external force. In the same category we may place a very advantageous movement, known as "kneading," which, unlike the general operations of this sort in *shampooing*, may be successfully applied to the colon,

commencing from the cœcum, along its ascending, transverse, and descending portions to the sigmoid flexure; and admirably adapted to aid inactive bowels.

In addition to the foregoing, we have the following which are worthy of a brief description.

Raising and depressing the Chest.—This is a passive movement, although it combines an arterial effect, and is one of the weaker respiratory motions. The diameter of the chest is enlarged, by the patient being lifted gently up, after which, (the hands of the operator being planted in the axillæ,) the movements of the lungs, and the circulation of the blood in them, are rendered more free and energetic.

Rolling.—This acts partly on the superficial blood-vessels and adipose tissue, and partly on the muscles, deeper-seated vessels, and internal organs.

Circular pressure is chiefly used in cases of swollen glands, and the like.

Friction combined with vibration.—This, when taken as a *special* movement, is applied to parts where large groups of glands are situated, as in the neck, axilla, and groin.

ACTIVE MOVEMENTS

Are such as depend mainly on the *volition* of the patient. They are more numerous and complex than the *passive;* indeed, the knowledge and skill

of the practitioner must ordinarily supply them, according to the special demands made, either by the condition of the circulation, that of the muscular innervation, nutrition, &c. The most prominent *active* motions are, *flexion*[1] and *extension*, both of which are obvious as to their application, and require alone a thorough acquaintance with the anatomy of the muscular tissue. It is equally clear that, in both these examples, the operator *resists* the patient, slowly and in uniform time, that the most decided and permanent effects may be secured. The following are the most important examples of this series of movements, viz. :—

Raising the trunk by means of the arms.—This affects those muscles which are attached to or chiefly inducive of the respiratory motions, causing, in a great measure, an equalisation of the circulation within the lungs, which again results in a more perfect chemical effect on the constituents of the blood, leading also to an improved growth and development, as well in the muscles of the shoulders and breast as in those of the arms. It enlarges the chest in fact, and increases the "vital capacities"

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[1] Some writers appear to disagree on the point, as to whether *flexion* and *rotation* belong more to *passive* than to *active* movements, at times placing the former among the *passive*, and the latter among the *active*. Experience, however, seems rather to justify the position they assume in the present work.

of those who labour under the *contraction* set up by disease or proceeding from sedentary modes of living, or natural deformities.

Bending the arms, neck, or trunk.—These motions increase the *momenta* of the blood towards the muscles, fascia, and ligaments of the several parts.

Opposing the limbs generally.—If the upper extremities be acted upon, the movement affects the pectoral muscles, the posterior muscles of the shoulders, and the *serratus posticus major*. If the lower extremities be acted upon, it affects either the abductors or adductors, their nerves and vessels, in each instance.

Drawing or bending the trunk backwards.—If a support be applied to the lower part of the back, the feet fixed, and the upper portion of the body pulled backwards, the motion affects the muscles and fascia of the abdomen and front of the thighs, and thus acts upon the superficial vessels of the anterior and lower part of the body. But it does more than this, for, by acting upon the *recti* and oblique muscles, and partly on the *psoas* and *iliacus*, a result brought about by the resistance offered by the operator to the patient in raising himself up, the arterial circulation within the abdomen and pelvis is manifestly augmented; at the same time that pressure, exercised by these muscles upon the intestines and portal vein with its branches, alike stimulates the one and in-

creases absorption within the other. It is, therefore, invaluable in a chronic torpidity of the bowels and other organs of the same region.

Bearing-up of the entire body.—In this, the patient is stretched out between two objects, his hands laying hold of one, and his feet fixed against the other; in this position he then *bears* himself up. The effect of this motion is an equalisation of capillary action and innervation, throughout the greater part of the muscular system.

Raising the trunk from a bent to an erect posture.—This is chiefly an arterial motion for the muscles of the neck and back: but it is also venous. By means of the changes of angles which the trunk forms with the lower extremities, the diameter of the abdomen is decreased; and, as the inspirations are almost continuous, and only varied by a few expirations during this kind of motion, the quantity of venous blood within the vessels of the abdomen is diminished, and thereby absorption is increased in the abdominal organs. If it be desirable still more to increase such absorption, a gentle pressure must be made upon the abdomen, and if this be accompanied with resistance on the patient's back as he is raising himself up gently, a decreased secretion takes place within the intestines, and thus the motion becomes highly serviceable in such a case as *chronic diarrhœa.*

MIXED MOVEMENTS

Are the *active* and *passive* combined, and need no lengthened description, as the practitioner will be guided in using them in cases only where it is desirable to join, moderate, or exert more powerful degrees of action. The following, however, are two of the most familiar examples of this combination.

Torsion or turning.—The patient sits astride a low chair, his legs fixed (active); the knee of the operator is then placed against the lower part of his back, and in this position short and quick twistings are repeatedly made by turns to both sides. The body of the patient ought, at the same time, to be kept backwards (passive), as the operator presses his own knee forwards. This motion increases the arterial supply of portions of the viscera within the pelvis.

Lateral twisting of the trunk acts differently according to the manner in which it is done. This movement acts partly upon the superficial vessels and nerves of the abdominal muscles, and partly upon the deep-lying larger blood-vessels, in proportion to the resistance which the patient may make. The abdominal organs, therefore, are acted upon with greater or lesser power according to the various changes of angles into which the trunk is put.

Let us now consider somewhat more at large the general effects of these several orders of movement, and a few of the most striking methods of application. And first, let us remark as a general rule, and one worth noting, that *passive* motions are to be used chiefly when we wish to affect the *venous* system, and *active* when our object is to act upon the *arterial.*

In the disposition of *passive* movements the patient gives himself up entirely to the operator, who, chiefly with his hands, applies the motions to one or more parts of the body, as may be required. The efficacy of passive motions in the treatment of disease is more universal than that of the active, for we find that daily exercises are not in themselves sufficient to prevent organic derangements; active movements consequently require frequently the reaction of the passive, and again, the latter would often be too feeble if not conjoined with the former. These facts should be carefully weighed, or, as in other branches of medicine, we may fail both in our diagnosis and after-treatment. In the active we have the "will" or voluntary power at work to aid us, but in the passive simply an external agent, be it of whatever kind it may. In the physical world in which we move, and to which our bodies have intimate and inseparable relation, that agent is present everywhere; in the succour we ask and receive at the hands of the

medical practitioner when afflicted by disease, he himself is the external agent. So that whatever is done to our bodies in these cases, and in which operation we have neither share nor control, is obviously of a *passive* character. They may also produce a *psychical* influence. Yet all such effects as tend to improve the nervous system must do this no less readily, whilst the stimulus of movement, although it be felt at first in single parts, is *reflected* onwards, till the whole mass, as in the instances of that applied to the nerves, partakes of the force imparted. In mental diseases, therefore, these motions are of paramount importance.

All secretions and excretions are vigorously promoted by *pressure*, as in the case of the liver which ordinarily and mechanically is affected by the movements of the diaphragm, as well as the intestines which depend for their healthy functions both on the above muscle and others of the abdomen. Without weakening the system in any form or manner, these movements distribute beneficial effects in every region, enlivening at once the dynamical and chemical forces. In the operation of "kneading" the bowels the *sympathetic* chain is generally affected,—although the application be local, and primarily intended to stimulate the several divisions of the colon, and at other times those of the small intestines. The natural functions of the several organs

so roused are not in any way *changed* but merely *impelled,* actively or moderately; for, as general good effects arise from the *unity* of the system, so these which are called to influence that system, are intended to produce *motion*—an expression of life, whether of the entire organism or of its component organs individually. Not so, however, is the tendency of these movements in morbid products and conditions of hypertrophy, for in these cases absorption is a force so active when roused, and kept as it were in a state of irritation, that it may overstep the limits of safe action. If we *change* functions at all, it must either be in substituting normal for existing abnormal ones, or, in extending beyond their proper boundaries the absorbing forces of the vessels or channels connected therewith. The injurious results of this nature which sometimes attend incautious medical practice, may be traced to an undue prolongation of absorbing efforts, or to long continuance of passive applications solely. The law of antagonism being here as elsewhere paramount, we need only to keep a correct balance between these two chief forms of movement, namely, the active and the passive. It must, therefore, in practice, be borne in mind that these movements should not be allowed to succeed each other too rapidly. Their object is *to strengthen without unduly exciting the system at large,* and this is more particularly exemplified in

the positions occupied by the patient during this treatment, such as the vibratory motions to the epigastrium in the horizontal posture, rotations of the limbs and trunk, with many others as they may arise from the nature of the malady and the existing physical or mental condition of the patient.

In cases likewise appertaining to this particular form of movement, the knowledge of the practitioner is required to direct it to certain parts, or to limit its action at first to a certain organ, as in that which is directed to the liver, kidneys, spleen, the lungs, or the bowels; and he must then refer to the means already detailed. To these several organic parts of the body it may act either as a *sedative* or *derivative*. In the former example, when the irritation arising from congestion is present, vibrations or percussions promote absorption, by removing the pressure of the venous blood and imparting additional impulse to the capillaries; the brain and its tissues may be thus relieved, while percussions to the thorax are equally effective. In the latter example, the same motions result in the diverting of the arterial stream from the congested parts or organs, together with the *absorption* which assists also in the same effect, or, in fact, antagonises the morbid parts. The "starting" points, to which we have elsewhere alluded, are generally indicated by the mechanical laws of the body itself, by which we trace a greater share of

mobility enjoyed by some parts over others; consequently the movements we use should in all cases be *specific*, giving rise to the terms we frequently find of *specific active* or *specific passive* movements.

Active motions, as we have already said, are those which mainly depend on the volition of the patient, but yet are to be performed in a *uniform* manner, and with regard to the extent of time to be occupied by them. In the majority of these there should, of course, be a prescribed amount of active resistance made by the operator, who himself determines the changes of angles or positions which the different parts of the patient's body may assume. For example, suppose the patient were to extend his arms in a lateral and horizontal direction, and the operator placed his hands upon the wrists of the patient, and in uniform time slowly depressed the arms, while the latter gently resisted, giving way only by degrees, the motion becomes clearly an *active* one. The same process may be also carried out with the head or neck, the trunk, or the lower extremities.

Every *active* movement must therefore be adapted to the characters or limits of the various articulations, but more especially in accordance with the natural extent of muscular contractility, as well as the exertion connected with the *leverage* peculiar to the single muscle or the group so acted upon. It is thus

that the predominancy of the voluntary muscles enables us to extend to an almost indefinite number the *active* movements. But yet it must not be supposed that we confine the treatment entirely to the use of the voluntary muscles, as will be readily understood when the reader glances back at the description of *passive* movements, where we act powerfully and generally on the *involuntary* or the muscles of organic life. In ordinary exercises we confine ourselves chiefly to the *active* state, and very frequently at the expense of the *passive*. This may be all very useful, so long as the body shall maintain the condition of health, but in disease it is absolutely necessary that our exercise *should be confined to specific movements;* for in the latter case it is necessary above all things to be sparing of the expenditure of "nerve force," such as would be consumed in efforts like to those of walking, or even riding on horseback, where large and important groups of muscles are required to be in constant action, and make an equally constant demand upon the nervous powers. Another example of active movement is to be found in the operation of *bending* the knees of the patient, who kneels upon a couch in the erect posture. In this case not only the *extensor* as well as the *hamstring* muscles of the thigh are actively in force, but the *recti* of the abdomen, together with the *psoas magnus* and *iliacus internus* are wrought

upon to recover the upright position on the part of the patient, who is drawn backwards by the operator. The effect of this upon the circulation is a powerful diversion or derivation of blood towards the extremities and adjacent parts, being as it were divided between these muscles and those within the the abdomen. Here also it will be evident, that so strong and valuable a motion could not be brought about by the patient spontaneously, an *external agent* (the operator) being the cause of the existence of a large amount of force in the movement. For a person can, by the simple act of flexing or extending his arm, produce an active movement, but without the manual resistance of the operator that movement would have little or no effect, of a *derivative* character at least, on the arterial stream.

Again, it would be almost needless to point out the paramount aid of *specific active* muscular movements in the above cases, and all such as may require strong derivative motions remote from the seat of congestion and the like,—it would be almost needless to do so, we repeat, because we have the physiological and undeniable fact ever before us, namely, *that no muscular contraction can take place without a rush of blood in supply,* imbibed to the extent of the required contraction and exercise, at once oxydising existing fibrils to perfect their contractile power, diffusing plastic lymph, and rapidly

absorbing, in the pressure sustained within and without the muscle, the waste material. And this is observable in the undue development, either in health or disease, of certain parts of the human body, by constant and, as it were, almost specific exercises; bulk and strength being, in truth, the never-failing products of active motion. The popular examples furnished in the highly-developed state of the blacksmith's arms, together with those of sailors, and of the slender legs of these men comparatively, while the opposite condition of development and strength may be seen in the limbs of the opera-dancer, are apt illustrations of these points. Nor do we require to have a very profound knowledge of physiology, when these facts are presented to us, to reason *à priori* upon the effects this therapeutic agent may produce in numberless cases of obstinate chronic disease, aided, as it also is, by the ever-present truth that our organism is a *unity* in itself.

Still it must be evident that any high degree of activity in one organ or part must cause a proportionate loss of tone in others; whether near or remote, some part is robbed of its share, either of the sanguiferous current or the nerve-force, or of both unitedly. This, which may be observed in simple hypertrophy or other kinds of morbid enlargements, is, in the majority of cases, consequent upon *partial* exercises to the frame, the pure result of those

endless artificial calls made upon our systems by the necessities of highly-wrought civilisation. But, at the same time, we derive a practical benefit from this knowledge; for it enables us both to judge of and determine the means whereby the strength of any part can be increased at pleasure, whilst the undue strength or excitement of another part can be, in the self-same form, diminished.

Moreover, there are other points which bear upon the inquiry. We certainly observe the beneficial effect of specific muscular exercises upon the nervous system, locally or at large, in the resultant activity of parts within the influence of such motions, as partly shown by the increased development of animal heat. The dominant functions of the *will* are here recalled to healthy vigour, and antagonise the frequent depressing influences of involuntary emotions, heedless passions, and the like; so that by active movements we can localise effects, can direct, too, the cerebral influences upon parts of the frame as may be desired, and assist the organism to recover from the impediments existing to a free exercise of its functions: and place it in a position to repel those increasing shocks which may impair its harmony, and which gradually involve the whole sympathetic chain, one link, so to speak, after another. Ling compared the active movement of muscles to the operation of bleeding, but with this

important difference, that in the former you derivate the blood without removing it from the system or altering its qualities, and in the latter you remove it entirely, in addition to those unorganised constituents derived from the nourishment afforded it, which are necessary to the repair and maintenance of tissues. Finally, therefore, we have in specific active movements, *reproduction; metastasis* in cases of congestion or other morbid actions; increased activity to the *nervous*, *arterial*, and *venous systems;* the development of *animal heat* by a natural process, which vastly surpasses all artificial methods; together with a general restoration to those former conditions of health from which the human structure had slowly yet progressively relapsed: whilst, as a necessary consequence to a treatment based on the laws of nature, *its effects are in all cases of a permanent character.* The muscles, too, brought into play during courses of these movements are obviously all the most important *active* ones of the body, such as the flexors and extensors, abductors and adductors, levators, those which make up the erector spinæ group, and many others of a similar character, of which any particular notice is barely required. The same remark may also apply to a minute physiological detail of the effects produced,—things with which every student or practitioner of medicine is or ought to be acquainted.

On the subject of *mixed movements* but a brief notice is necessary, as they combine the two modes of operation just enumerated, namely, the *active* and the *passive,* which, in a prescription, are conjointly made use of. The importance of this combination, however, is made evident by the following condition, which we have elsewhere already remarked upon, and it is this,—that the efficacy of *active* motions might often be annulled were they not modified by the reaction of the *passive;* and again, on the other hand, the latter would often be too feeble in their influence if unsupported by the arousing of the *voluntary* power. But this is not all that might be said on the subject of *mixed* motions; for, in the illustrations of them in another place, we observe that the patient gives himself up to the operator but partially, some one portion of his body being *active,* as in the muscular effort required to keep himself fixed in a firm position. Beyond this there can be no useful or available distinction made to the advantage of the practitioner. The movements he adopts are almost invariably the *simple active* or the *simple passive,* the combination being usually brought about by the positions required of the patient, and the method of best disposing of the remainder of his frame. Nor could we enlighten the reader any more upon those somewhat vague terms which have been used by writers

on this subject, such as the *active-passive* and *passive-active* movements, examples of which have thus been given :—1st. "If a person begin to flex his arm or leg, and another retains it, then the movement is called an *active-passive* flexion." 2d. "If another person hold the arm of a patient, and begin to flex it, while the latter resists, this is called a *passive-active* flexion." Now it is evident there is in these cases a "distinction without a difference," for both are *active* movements. The simple act of *beginning* on the patient's part is of no use to the operator, who might as well be a hundred miles from the spot,—during that portion of the movement at least. In plain language, our meaning may be thus conveyed:—All *efforts* on the patient's part are manifested by muscular action, whether to maintain the position of certain parts of his body while under treatment, or to resist that portion under the control of the operator; in the active flexion of his arm (resisted by the operator), certain physiological processes are at work, and equally so are they in the tense condition of the muscles of the extremities, when the movements of "torsion or turning," and "lateral twisting" are proceeding. It may be said that this is no instance of positive movement; yet it meets with the same results as in any of the most *active*, and is itself decidedly *active*, though it move not from one spot.

These few arguments are offered to prevent, if possible, a continuance of that misapprehension into which many have fallen on the subject of *mixed movements*.

Let us now direct attention to some of the existing laws of arrangement according to which this branch of medical treatment should be conducted, bearing always in mind the one great condition—*that all movements should be uniform, as to time and direction.*

Every *prescription*, therefore, is divided into *three* parts, each part consisting of *two* groups of movements. The first and last parts correspond with each other, that is, both are chiefly made up of movements for the muscles of respiration and the extremities; movements for the head, abdomen, and pelvis, are introduced in the middle.

The following may serve to explain the *order* in which the movements take place:

No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
0	0	0	1	1
4	4	3	3	4
0	0	0	0	0
0	1	0	0	0
3	4	3	4	4
0	0	1	1	1

No. 6.	No. 7.	No. 8.	No. 9.	No. 10.
1	0	1	1	1
3	3	3	2	2
1	1	2	2	3
1	3	3	3	3
4	3	2	3	2
1	1	1	1	1

No. 11.		No. 12.		No. 13.	
1		1		1	
2		1		1	
4	1-2	4	2	4	2
2		3		4	
0		1		0	
1		0		0	

In the above plans, the two small lines separating the figures indicate the different divisions of the prescription. The figures themselves point out the number of motions, and the small figures (1-2) (2) (2), at the side of the middle parts in Nos. 11, 12, and 13, indicate also movements for the extremities to be introduced between those of the head, abdomen, and pelvis.

It is clear that No. 1 is intended for a very weakly person, whose external or topical condition is very much reduced in consequence of the internal organs being obstructed with blood, or, in other words, from congestion arising from functional torpidity. Here we find that all the motions are for the extremities, which are four in the first part, and three in the third. The same view will apply to the remainder, which obviously denote increasing strength, both as regards the patient himself and the movements to be prescribed, and should be adopted by the practitioner only with reference to the existing condition of the diseased person. They are, in fact, merely rules for his guidance in the order and quantity of movements, for it is clearly impossible,

in a treatment of this nature, to propound undeviating terms of practice, as we are enabled to do in the domain of medicine upon the long experience of its followers. Any such attempt would prove, if followed, a never-failing source of embarrassment, doubtful in its results, and certainly deserving of less attention and credit for the harmony the treatment is found to assume with that displayed in the moving powers of the human organism.

However, to furnish an example of a case wherein the prescription alluded to may at first be used, let us suppose one of *Chlorosis*. In such a case the symptoms would be much of this nature—the colour of the skin of a sickly hue, and the cutaneous vessels apparently empty or impoverished. The paleness of the skin is not that which is apparent after hæmorrhage, but exhibits a mixture of yellow and green. The muscular system is then very weak, the patient becomes soon tired, or after the least exertion. Then follow difficult respiration, palpitation of the heart, want of appetite, weak digestion, costive habit, and so forth.

Now, the object of the mechanical treatment in this case must be a general development of the dormant functions of organs; and as the appearance of the patient denotes a wrong sanguification or want of common tone in the vessels, it will be necessary to begin with respiratory applications, in order to

favour a healthy reaction in this apparatus; and as a rule it must be observed, that the motions applied ought at first to be of a very gentle nature, as well with regard to their quality as to their quantity. The treatment begins, therefore, with a few vibratory motions of the chest, in a half-lying position. These motions are entirely of a *passive* kind, and have a mild and beneficial influence on the patient's respiration. Vibratory and stimulating motions should then be applied to the epigastrium and other parts of the abdomen, in the half-lying posture. Besides these, the first prescription ought to include a few gentle twistings for the trunk, together with rotations of the hands and feet as often as required, and gentle bending motions for the extremities. Moreover, as this disease is often accompanied by amenorrhœa, it is necessary to let motions for the sacral region and the lower extremities predominate. As the strength of the patient increases, and her appetite returns, the second prescription may be used, and other applications succeed, as they may be exhibited in the progress and extent of the affection.

Free breathing has ever been esteemed to be one of the most important vehicles of life. The first and last movements in a prescription ought to consist of some respiratory motions, except in cases where the heart and lungs are affected.

The number of motions in each department are

not always the same, being either more or less. For instance, in the prescription for general weakness, the first and last departments predominate; and the same arrangement may likewise be pursued in cases where some important organ is affected by disease.

The middle department is often excluded altogether, or consists of a few motions only. In other cases the same department ought to be composed of the greatest number of motions, having for their object to act especially upon the internal organs; but it is to be observed that in movements, one following another, *the effect of the former ought not to be liable either to moderation or subjection by the effect of the latter.* Thus, for example, "a transverse abdominal friction" should not precede "a twisting of the trunk," if it be meant by the latter to act upon the *transversalis* and *oblique* muscles of the abdomen.

Yet, the statements or rules in the foregoing paragraph do not always hold good when, at the commencement of the treatment, care should be taken not to act upon any internal organ; for then arterial movements for the muscles of the abdomen are to be performed in order to prepare the internal organs for receiving a more powerful effect by applications subsequently directed to them.

The effect of applications to the nerves, as well

as that of the absorbing movements in robust individuals, may be annihilated by a few active muscular motions, so that such applications and movements ought to have their place at the end of the prescription; but, should the patient be insensible to impressions arising from motions in general, these applications should then have their place in the middle department. If, therefore, it were necessary that the chief part of the treatment should consist of *absorbing* movements (venous), every arterial one ought to have the least possible connection therewith, so far as the relationship of parts acted upon may be concerned.

Sometimes it will be necessary that the movements for the pelvis should precede those for the head and abdomen, in order to increase the innervation within the pelvic organs, although the reverse is generally the case. If there be any organ of the pelvis affected by disease, applications for the same ought to be first adopted, as in the second or third prescription—in a word, the middle department is that which is submitted to the greatest alterations. Again, if the middle department contain the greatest number of motions, it is supposed that the patient is recovering strength, and also that one or more prescriptions have preceded.

From the foregoing, it may be easily foreseen, that the more powerful motions applied to separate

parts are followed by those which will effect a reaction in other parts of the body, in order to equalise the amount of innervation within the first-mentioned parts. In like manner, and under the same circumstances of the case, *two* motions for the chest, abdomen, and pelvis, may immediately succeed each other, it being supposed that the patient has gained more strength and development of body; otherwise, movements of the extremities alternate with the former in order to equalise the effect of the before-mentioned motions.

The time occupied by each prescription will, as before explained, depend upon the nature of the complaint, and more especially upon the peculiar strength or vitality of the patient; in some cases extending to periods of half an hour, three-quarters, or one hour. These points are to be determined by the judgment of the practitioner,—for, as in the ordinary routine of medical treatment, the movements are not prescribed by *chance*. In the same view it is obvious that the movements can scarcely be associated *alike*, even where symptoms are found to agree in the chief matters of detail; and with regard to changes in the treatment, a judicious management of the new applications is equally required. Our main attention should be always directed to *effects*, that we do not neutralise one set of motions by any that may succeed,—a know-

ledge that can only be arrived at by a thorough intimacy both with the physiological and anatomical relationship of parts or functions. As a general plan it may be laid down that *passive* movements precede in treatment those of an *active* nature, except in such cases as those of strong determinations of blood, where a few active movements to the extremities are indicated. Yet, even in the latter example, passive absorbing movements are most required. As the health improves so do the *active* movements advance, and the *passive* give place. It must be borne in mind also, that subsequent movements are to depend more upon the effects of those previously given than upon the original prognosis of the case; for this reason, that we have at once a guide to the means of recovery, as well as to the deep-seated cause, in the effects given forth by our previous movements.

In the general run of cases it is merely necessary to repeat the prescription *once a day*, usually in the morning, without interfering with the meals or more active employments of such patients as are able to follow the routine of their daily duties. The practitioner should be guided by the patient's account of his own pains or sufferings, and of the seat of mischief, *only so far as* his own knowledge may convince him that they are well borne out by reputed facts. It is his duty, in pursuing this treatment, *to*

confine himself less to local than to general applications for the benefit of the whole system. For, even the result of local applications in removing symptoms dispersed as it were throughout the frame, is a sufficient proof of the *unity* of the structure.

The attention of the patient, it is also obvious, should, in all cases, be directed to the proceedings of the operator, and particularly in the *active* forms of movement; whilst strict silence should ordinarily be enjoined. Moreover, patients should at all times breathe freely, make use of moderate and not unusual exertion, and rest for a brief space, say one or two minutes, according to circumstances, between each set of movements. This last precaution is necessary for the physiological effect of the movement, and it has also been recommended that the patient walk a little between them, a practice that may nearly always be safely adopted.

To non-medical persons many of these movements may not only appear simple in themselves, but matters of little import, nevertheless they are as important and effectual as the most complicated; and the practitioner should himself be on his guard against neglecting the use of them from a similar feeling. Nor should he allow himself to be restricted in his applications, either by the imaginary fears or wishes of the patient, who is too often the most unfitted of all persons to judge of the real condition

of his frame, ruled, as he naturally is, by symptoms and conditions of a purely sympathetic nature.

Ackerman, viewing bodily exercises in their proper light, was led to declare that "he did not know which was most necessary to man, *food* or *exercise*." Harmony of the body is only to be maintained by a due perfection and relationship of all its organs and parts, and when we find that one part has a degree of *over-strength*, which must be followed by a proportional *weakness* in some other part, we must be struck with the rationality—to say the least—of a treatment which, by its well-directed exercises, can give strength to the weaker part and restore a balance. It is true that we cannot develop the body beyond that extent which its peculiar nerve-force shall point out, but yet we may, if we do no more, remove the impediments to its free scope of action. This is the received opinion of the science at the present time, and it remains to be proved whether we cannot, by artificial appliances, cause even the nervous system to add to its nutriment, and obviate congenital defects in its substance or function. It is clear that sedentary occupations, and, in fact, the whole compass of artificial existence, maintain a powerful hold upon the system in repressing, checking, and even ultimately destroying the better faculties of man. So it is evident, in the majority of cases, as to the root of chronic diseases,

wherein the animal heat, the circulation of the blood, the animal spirits, and the numerous secretions of the body, are all deranged, and the reactive force no longer resides there, or, if so, is too tardy of manifestation,—leaving the cure to be performed by mechanical agency, in perfect accordance with the laws of the human subject.

Let the reader consider for a moment how much of health depends on a full development of the chest, and how much is performed therefore by a treatment which expands that chest—an operation which is safely carried out by properly-directed muscular exercises. This example is a diseased condition of the body as much as any other, and it is simply by removing, in this case as in others, existing obstructions, that similar diseases can be cured. The little knowledge we have attained of the subtle laws of Nature, prevents our giving a clear and succinct account of the physiological results of our movements, at least in the minutiæ of reproduction, absorption, and the like. It is ever our plain duty to follow Nature, and *act* by her indicated examples. Ling, ever mindful of these difficulties, has very ably given us *three* deductions connected with even an ordinary diagnosis. They are as follow, namely :—

1st. "If the dynamical (nervous) agent is the predominant, the disease shows itself by more me-

chanical phenomena;" as we may observe in the various involuntary emotions and passions, displayed in powerful or subdued muscular action, whether internal or external.

2d. "If the mechanical (muscular) agent is the strongest, the phenomena are more chemical;" as in the accelerated course of the circulation, increased nutrition, or in the lengthened chain of the *momenta* of the sanguiferous system.

3d. "If the chemical (sanguineous, &c.) agent is prevalent, we may mark more dynamical symptoms;" as in all those cases where the *vital* forces are disturbed, such as in the various conditions of fever, mental disturbance, excessive sensibility, and the like.

Notwithstanding the apparent clearness of the foregoing rules, and our own annotations thereon, we should nevertheless exercise due caution in forming our conclusions respecting the phenomena of diseases presented to our notice; for, possibly, in no two cases are they to be found alike. An accurate diagnosis of disease, or at least such an one as might appear worthy of constant application, has always exhibited itself to us in the same light as we are disposed to view the endless endeavours of the "panacea-mongers," whose toils are ever fruitless, and whose gains only prominent in the fastidious follies of the hour. Yet, as hypotheses, they are

worthy of the highest regard, not only on account of the definite order they bear to physiological *data*, but from the exalted character of the authority from whom they emanated. Our remarks simply apply to that caution which is necessary among practitioners to avoid the rocks and shoals on which men too often wreck their hopes, in the belief that they can reduce to positive mechanical order the whole of the complex and mutually-dependent machinery of the human frame, the most minute part of which affords a life-long study and the utmost stretch of their comprehensive faculties. Ling, doubtless, gave these three orders of phenomena with a far different view than that they should be a stumbling-block to his followers and successors.

So also we might remark with regard to a more detailed statement of the various forms of *chronic* disease which this treatment is so eminently adapted to cure, but which after all may be more clearly indicated by the extended inferences we have drawn from the mechanical and other forces of the human system, considerations which close the present work. Nevertheless, the few that follow may be useful to the practitioner.

During each operation it is of the utmost importance that the position of the patient should be attended to; for he can receive the applications in a recumbent position, when the circulation of the

blood is lowered—chiefly by the whole muscular system being at rest, or in the "sitting," "standing," or "twisted positions," whilst in every one of these the effect of the self-same applied motion is different. One application is generally sufficient during the twenty-four hours. The practitioner is constantly left to his own resources as to what may suit particular cases, some forms of application being suitable in one case and some in another. Without a proper knowledge of the anatomy and function of parts, as mentioned elsewhere, it is clear that much mischief might be occasioned; for it would be obviously dangerous to introduce active motions for the upper extremities in a case in which a patient suffered from an enlargement of the heart, or arterial motions for the neck, through the exercise of its muscles, in a case of determination of blood to the head.

In a chronic case, such as *hypertrophy* or enlargement of the heart, the main object of the treatment should be to form new groups of vessels within the peripheral system of the circulation; to diminish the circulation within that organ, or at least relieve the pressure upon its walls by diverting the sanguineous stream to other tissues. Here we have a purely active treatment, mechanical applications being directed to those parts which are situated farthest from the heart, or by such motions as serve

to develop the smaller vessels of the muscles of the extremities. As an adjunct to this, direct pressure on the nerves of the arms, thighs, and popliteal region, as well as on the lumbar nerves, provided only the cutaneous circulation and that of the muscular tissue should be found much weakened by the existing disease—symptoms which are usually prominent. When we find, too, that the activity of the superficial vessels and of those of the extremities have increased, the muscular system becoming likewise more developed, the arterial supply within the pelvis will partake also of the general improvement. But here the practitioner should be cautioned against using active applications for the upper extremities and the respiratory apparatus until the end of the course, directing such at first to the lower extremities. In fact, when we begin with the latter, *vibratory* motions and *percussions* should be applied to the chest and back in order to promote *absorption* within the heart and lungs, and the stronger applications to the muscles of this region ought only to be commenced when the unnatural energy or strength of the movements of the heart are diminished, the breathing easier, the signs of impaired circulation in the superficial vessels decreased, the animal temperature particularly in the extremities heightened, and both appetite and rest at night have returned.

In *premonitory symptoms of apoplexy* this treat-

ment may be truly said to be invaluable. The causes of this often-times fatal malady are pretty generally known, whilst the usual antiphlogistic measures serve only as palliatives, and the *stamina* of the patient being reduced frequently by the most powerful of them, such as bleeding and the exhibition of purgatives, the seizure has only been postponed for a short time. The manipulations, in this instance, are to be applied to the vessels of the surface of the cranium, light pressure being made with the thumbs rapidly along and above the eyebrows, with fixed vibrations on the arteries of the temples, thus stimulating the frontal and temporal vessels; and, by increasing the external circulation, as it were, the brain will be considerably relieved. Hence we observe, as a result of this, that in a short time the giddiness and dimness of sight, with other distressing symptoms of which the patient complains, are removed. After this, motions of pressure may be performed along the arteries of the neck and throat, as formerly recommended by Dr. Parry, though not exactly according to his plan; then upon the external jugular veins, and, lastly, upon both at the same time. This also assists in relieving the brain. It has also been found beneficial, during the operations on the vessels of the scalp, to give, now and then, one rotation of the head of the patient, the operator at the instant placing his hand, with light pressure, on the top of it.

But, as these are passive manipulations, they should alternate with some active motions, gently, gradually, and cautiously applied to the lower extremities, to divert the blood to those parts. A great advantage is, however, gained by these movements, and it is this: that the vessels themselves soon acquire a greater amount of strength and elasticity to withstand the pressure of the blood upon their walls. If, then, we continue these passive and active manipulations for some time, and the patient avoid any of his old habits which might have separately or collectively originated the attack, all the serious symptoms will soon disappear; and, even in cases where effusion appears already to have taken place they cannot be too highly extolled, as a means for the promoting of *absorption* within the brain or its membranes.

With regard to the causes and effects of that very common complaint known as *Costiveness*, we must refer to remarks elsewhere. However, therapeutic manipulations may be safely and effectively applied, in the way of cure, in the following manner:—First of all, they ought to be directed to the abdominal viscera, by gentle vibratory motions being given in the region of the liver, to stimulate that organ to a greater and healthier activity of function; after this, pressure along the intestinal canal, with vibrations of the intestines, together with sharp percussions on

the abdomen, performed by the hands of the operator, whereby the blood is led in greater quantity to the internal parts of the abdomen. It should be the practitioner's aim, after this, to strengthen the *recti, obliqui,* and other muscles of the abdomen, that nature may again perform her functions properly. For this end, movements have been already given. But, for example, we place the patient in the horizontal position, he then raises himself up by degrees, and with a little assistance from the operator, until his trunk arrive at a right angle with the lower extremities, the knees being kept down by the operator's right or left hand; and, in the same manner, the patient returns to the horizontal position. The effect of this movement is, of course, a rush of blood to this region; and diverting manipulations, chiefly transverse pressure, should be used by the operator directly after each motion. By these simple means the most obstinate costiveness may be cured, and, unlike the results of strong purgative medicines, the abuse of which it is difficult indeed to avert in these cases, the patient will gain strength and power, neither at the expense of his nervous system nor of any other vital organs or parts. The *rationale* of this movement, performed as it of course is in uniform time, may be thus explained. The trunk of the patient acts as a lever of the third order, the *fulcrum* of which is the hip-joints, and the *power* the

contracting recti muscles, which are here placed between the fulcrum and the weight.

In the early stage of *phthisis*, or before the existence of tubercle has been confirmed in the substance of the lung, as well as in common pulmonary complaints and congestions of these organs, certain forms of manipulation may be safely tried, and, in many cases, have resulted in the most signal success. Here *passive* motions are chiefly used, and subsequently those of an *active* nature, yet with the greatest care. In the beginning, the grand object of the practitioner is to promote *absorption*, and then to expand the contracted chest. In the first place, he ought to make use of gentle *friction*, with pressure of the palm or flat of the hand along the arms, sides, and back of the patient. Following these, are fixed vibrations under the chest, together with passive motions with the patient's arms, and, lastly, abdominal manipulations and other active derivative movements. A vibratory motion is also applied to the trachea, for the purpose of promoting secretion and easing expectoration, and with this the nerves and vessels between and under the ribs, which are always relaxed, should be duly stimulated. The march of the treatment in these too-often fatal complaints, is much of this kind,—that, when the nightly exacerbations begin to decrease, and other signs of improvement to intervene, gentle and

cautious active motions to the lower extremities, with rotations of the feet and legs, may be brought forward. With the passive manipulations, also, smart and quick strokes upon the soles of the patient's feet, in order to increase locally the circulation and animal heat, have been found highly effective. Should the recovery of the patient be rapid and permanent, then the usual revigorative measures are demanded, as in other cases.

It is worthy of remark, that, in *passive* movements, though they be continued never so long time, there is no feeling of exhaustion experienced by the patient: whilst also, even in the *active* motions, owing to their being executed in *uniform time*, there is far less exhaustion experienced than in ordinary *active* exercises, though they may be somewhat prolonged. And it is from the latter circumstance, that the patient finds himself, as it were, refreshed, after the prescribed course of daily treatment. Again, in making an active movement, we ought first to stimulate the nerves supplying those muscles by which the movement is effected; but it is obvious, in a *passive* application, that the patient's "will" does not in the least influence the motion of the part, nor the condition of the motor nerves. It is clear that the nervous system is, to a certain extent, impaired by strong active exercises, and therefore the *passive* form is primarily the most desirable.

As a general rule, then, it may be taken, that if any new symptoms are produced by over-activity, the same form of treatment should be lowered, in order to obviate a too great expenditure of nervous energy.

In all cases of muscular distortion, as in deviations of the spinal column and the like, this treatment is obviously more rational, as it undoubtedly is more effectual, than in many forms at present in use in the Orthopœdic establishments, the results of which prove, that unless we restore the muscular balance, and forbear to produce atrophy of that tissue generally, by permanently withholding its natural activity, the *lateral* curvatures, or whatever form such may assume, will return, so soon as we remove the *corset*, or stretching and confining apparatus. This will be self-evident, when we consider not only what spinal curvature really is, but how the column is supported. We speak, of course, of *lateral* curvature, *angular* curvature being a disease of the bones, ligaments, or of the intervertebral substance. As a familiar illustration, we may compare the spinal column to the mast of a vessel, which is itself supported by the stays and shrouds, and, if one side be slackened, the mast must incline in the opposite direction. So is it with the spinal column, which is "stayed" by the muscles, and when certain sets or slips of these are weakened, the small jointed-bones, called the *vertebræ*,

have, of course, no power of themselves to maintain the erect posture, but being, unlike the mast, composed of several articulated portions, the superincumbent pressure must produce certain curves, and, as we generally observe, commencing in the lumbar region. Here, therefore, it is the duty of the practitioner of this treatment to exercise those of the weaker side; taking, according to their several orders, and with reference to their attachments, the *sacro-lumbalis*, *longissimus dorsi*, and *spinalis dorsi*, together with the *trapezius*, and even the *latissimus dorsi*, as the case shall direct. Added to this, he should stimulate the *spinal accessory* and muscular branches of the spinal nerves of the weak side, and with proper care, cannot fail in effecting a cure, though it be tedious; whilst, in the orthopœdic plan, a perfect, that is, a *permanent* cure is more than doubtful, the straining corsets and the like, being contra-indicated by the very nature and character of the affection. Other assistants, such as friction and lying upon the face for a period, are of course requisite, but they come not under the description of the necessary manipulations. It may not be out of place to mention here, that Dr. Neumann, a physician of some eminence at Graudenz, who has written largely upon this treatment, corroborates the fact of its efficacy in deviations of the spine, as well as ulcerations of the legs, opacity of the cornea, &c.

The testimony, also, of a Dr. Bogosloffsky, a physician of St. Petersburg, is well worthy of the reader's attention, although it is but a tithe of the praise lavished upon the treatment by members of our Continental Schools. This gentleman, in giving public notoriety to his cure, thus expresses himself:

"The benefit several invalids, particularly medical men of my acquaintance, had derived from the gymnastic treatment, induced me to give it a trial, being myself seriously afflicted. I will not enter into any details respecting my illness, suffice it to say that for upwards of *thirty years* I was constantly more or less inconvenienced with hæmorrhoids, in addition to which, I had violent spitting of blood, obstinate cough, and a severe asthma; in short, I was reduced to a pitiable condition. My last resource was to give up my daily occupation, and to seek a more genial climate. It was in this extremity that I had recourse to medical gymnastics. They commenced by derivating the blood towards the loins, then to the legs and arms. My muscles became animated with new life, and, in the space of one month, the cough and asthma had entirely ceased. I felt my strength renewed, and, at the present time, I feel better than ever. It is not to show my gratitude, but simply by stating facts that

I will prove to the public that I justly appreciate the effects of the medical gymnastics."

Finally, the following may be taken as some of the principal chronic and oftentimes malignant diseases, to the remedy and cure of which this therapeutic agent may also be safely and effectively applied: viz. — *Dyspepsia and General Debility; Chronic Rheumatism, articular and muscular; Gout; Constipation; affections, and even incipient abscesses, of the Liver;* all kinds of what are generally known as *nervous* affections, such as *Spasms, Cramp, Headaches;* in the first two stages of *Pulmonary Consumption;*—and it is even efficacious in many *acute* forms of disease, such as *Pleurisy* and *Pneumonia; in Struma or Scrofula;* in morbid conditions of the glands of the *Mesentery,* of the *neck,* and other parts of the body; in *Paralysis; Asthma; Catarrh, Chronic Bronchitis,* and *Influenza;* in Diseases of the *Heart* and *Circulation; Congestions of the Head, of the Spine, and the several organs of the Viscera;* in Tic-Douloureux and other *Neuralgic* pains; in *Rickets;* in producing absorption of large fatty depositions in various parts of the body, from which degeneration too often proceeds, and particularly amongst elderly people. The treatment is, in fact, indicated in all diseases which spring from a defect in the natural momentum of the blood,

be the seat of this where it may; in all cases where the ordinary adjuncts of medical art fail to revive a torpid system; and it is highly useful to *convalescents* after fevers. For cases illustrative of many of the foregoing examples of Disease curable under this agent, the reader is referred to the Appendix.

REMARKS

ON THE CHIEF

VITAL-MECHANICAL FORCES OF THE HUMAN BODY

IN RELATION TO THE CAUSES AND TREATMENT OF CHRONIC DISEASE, AND DETERMINING MOST OF THE PHYSIOLOGICAL PRINCIPLES BY WHICH THE PRACTITIONER OF THIS BRANCH OF MEDICINE SHOULD BE GUIDED.

To pursue the treatment by movements and manipulations with any degree of positive success, it is absolutely necessary that the practitioner should possess the usual knowledge of Anatomy, Physiology, and Pathology, together with a correct understanding of the mechanical functions and forces of the Human Body, both in health and disease. Indeed, it is obvious that upon these several acquirements, rather than upon any set or order of rules which might be laid down, difficult and oftentimes embarrassing as they would then be, that he can rationally hope to grapple successfully with the multiform conditions even of chronic disease he may be called upon to treat. The following pages are, therefore, devoted to these subjects, and may be found to con-

tain nearly all that investigation has yet revealed as most prominent and useful in the exercise of this particular art in Medicine. Yet, before we attempt this, a few words are necessary on the character of the *nervous system*, in relation mainly to its government of the *unity* of the human organism.

The "nervous system" of man and other animals is that to which all the corporeal systems are subservient; for, the ultimate design of these individual systems appears to be that they should minister unceasingly to its nourishment and support, and receive, as it were "in return," and in accordance with the common laws of unity, that vital stimulus on which depends both their activity and power.

The principal masses of that peculiar substance known as *nervous matter*, are technically divided into a Brain and Spinal Chord; with the former reside chiefly the phenomena of the perceptive faculties and higher sensation, whilst the latter presides over those of voluntary motion combined with lower sensation. The brain has been aptly termed "a temple for the soul to inhabit;" and, although it be the seat of the organs of special sense, still the spinal chord shares largely in the functions of common sensation,—though that sensation be in no way connected with what is understood by the term "perception," which is alone a faculty of the Mind. From either or both of these proceed, however, large and small

nerve-branches, ramifying into every the most minute portions of the frame, following frequently the course of the numerous orders of blood-vessels, distributing branches and fibres into the muscular and other tissues, nay into the very bones themselves, supplying vital energy to the deep-seated organs as well as to the glands of the integument, and finally expanding upon the most superficial parts of the latter structure, and there ending, in looped form, in the papillæ of the true skin.

Yet, although such is the ordinary display of nerve-force throughout, as proceeding from the brain and spinal chord, there is another chain of nervous matter which has received the title of the "sympathetic system," from its apparent isolation; and thus we have, as it were, three separate departments of nervous agency, though in the high perfection of the human species their unity is established. The first two imply strictly the offices of sensation, perception, and motion—the true functions of Organic Life, in which are comprised all the operations of Secretion and Excretion, Ingestion and Egestion; in short all those by which the entire fabric is nourished and purified. If it profit the reader at all to indulge in classical idiom, he may with some show of propriety esteem these three as the real "tripod of life," though it has pleased some authors to assign this character to the Sanguineous, Nervous, and Mus-

cular systems unitedly. Each division, however, is of such paramount importance that we would willingly dwell upon them to far greater length than our space will admit of; but this would involve the entire physiology of the nervous system. Moreover, the functions of the Brain are of a character too speculative to admit of concise description here, and consequently we can only offer a brief digest of those common to the *sympathetic system.*

The latter is denominated the system of "organic life," on the fair presumption that all organised parts sympathise with each other, and thus balance or harmonise the functional powers which they are separately or collectively called upon to evince. The *sympathetic system* can be best described as "a chain of nervous ganglia," the latter of which are knots of fibres diverging or converging from or to a centre, and are therefore better known as "nerve-centres." It is, in fact, a great circle of ganglia within the body, extending along the anterior surface of the spinal column from the head to the lowest vertebræ, and communicating with the brain and spinal chord in certain parts of the frame, being, as it were, an appendage to them. The filaments of this system, however, are not given off to nerves of "special sense;" and this must be understood as proving its intimate connection with organised parts, such as the heart and vessels, the kidneys, liver, stomach, and intestines.

Yet its several ganglia, whether situated near the brain or along the spinal column, receive abundant filaments of a motor kind chiefly, which are fused into its substance, as its own are into that of the foregoing. It sends also numerous filaments both to arteries and veins, the greater part to the former, while it has been rightly esteemed to be the chief agent *in the formation of blood.* These are important points for the practitioner of this treatment, and should be held by him constantly in view; for they exhibit at a glance, the comparative ease with which he can reach this system, and impart the required stimulus by means of certain manipulations in the way of producing local or general effects upon the person of the patient.

That it differs so much in its functions as to be entitled to the claim of a separate system, is apparent when we find it governs all the *involuntary* movements of the body. It both directs and governs all those movements of which the mind is barely conscious except in the effects produced. Those movements are observable in the heart, lungs, stomach, intestines, liver, kidneys, and spleen; in truth, in all which bear upon the operations of the sanguiferous system, either in relation to the quality and supply or to the purification of the blood. To understand this we should turn to the muscular system, and consider the nature and character of

involuntary movements. In the ordinary actions of the heart and other organic parts, (at least, in the condition of health,) we are, happily for our own personal comfort, perfectly unconscious of that powerful mechanical force which, each moment of our lives, moves them in an appointed manner, and in unison with the general demands of the frame. It is, then, only in the morbid condition of these organs that we have cognisance of their several functions and the disturbance therein. Consequently, apart from the connection which actually subsists between this system of nerves and those of the higher functions of animal life, we have a continuous chain established between the several organs and active parts, and one obviously *sympathetic*.

It is also clear that, had the nervous communication that exists between these several *moving* portions of the human body not been of an isolated character, and one but partially under the control of mental efforts, the entire functions of our systems would be liable to constant agitation or derangement, in the multifarious phases of that mental state which is liable to change each moment of existence. Whilst even the brain itself, an organ also, though of a higher character, partakes of this common sympathy, if only so far as the circulation within it is concerned.

One great example of the integrity of the sympathetic system may be seen in the *solar plexus*, the

ganglia of which, arranged in semilunar form, join in a bond of union the liver, stomach, intestines, kidneys, spleen, and others. The specific passive movements of the operator in *epigastric vibrations*, not only result from a knowledge of these circumstances, but are eminently successful in stimulating adjacent organs, for the mechanism of these influences is apparent even in the supply of blood to these several organs. At certain periods of the day, or during the condition of fasting, the stomach lies dormant, the quantity of blood distributed to it being enough merely for nutrition of its textures, and at this time other organs, such as the liver or kidneys, may partake of an increased quantity of that fluid so necessary to their active duties; and again, the seat of this may be changed on the coming on of the digestive process, consequent upon the reception of food within the cavity of the stomach. Thus it must be obvious that the vibratory movements applied here are vast in their effects upon the proximate part, as well as upon the general tone of the system at large, and it is on this account that those movements ordinarily occupy a prominent place in prescribed forms of treatment. To act upon the *motor* nerves by muscular exertion is another step in the treatment, and to stimulate the *sensitive* nerves by pressure, friction, and the like, are also other rules for our adoption.

Therefore, although we would willingly ascribe several mechanical forces to the economy of the human frame, still we should ever allow that the *nervous* system is the great controller of functions, the almost sole cause of harmony in the structure. Without it all development, whether in embryonic or adult life, is suspended; it governs the human machine to the extent of its whole duty, and is itself subject to the material world, even to subtle atmospheric influences. What its own peculiar law is we shall doubtless know if we ever succeed in tracing out many of the far more simple laws of nature.

To the practitioner it offers a boundless and fruitful field of observation, and defines more than any other the limits of his art. Nearly all chronic diseases are dependent on this system. Nervous power is wanted to overcome, and the impaired system cannot of itself regenerate that power. We are told that nerve-substance, when destroyed, is seldom or ever replaced; but not so when it is *weakly*, for, as the nerves can only be nourished by the highest kinds of blood, so by attention to other forms of treatment, to which this art bears an important reference, vigour may once more be procured, if only by small degrees. Here we must at once refer to the mechanical functions of the body as our guide, for on them, high as it is, the nervous system is itself dependent, the human body being

one whole in all its relations. We affect the nervous system by external stimulus such as it experiences in the operations of the material world around it, or by the agency of the foregoing functions, or by artificial appliances such as may increase its nourishment, divert congestion, and enliven without producing depressing reaction, as may be found the case with ordinary stimuli foreign to the order of the system. Every impression, also, which excites a muscle irritates the nerves connected therewith.

It may, therefore, be held, that the dependence of all organic divisions of the body on the *nervous system*, as in other departments of medical science, is the foundation-stone of this branch of therapeutics. It is this nervous power which our manipulations are frequently to subserve, even with regard to its own restoration, by removing organic impediments through natural and instinctive, though mechanical, means; whilst it is the aberration of this force—the vitality of the organism—that constitutes the essence of disease.

The term "chronic," as here applied to certain conditions of disease in the human subject, derived as it is from the Greek word *chronos*, signifying "time," affords evidence of local or general impairment such as the remedies usually exhibited, or the exertions of the *vis medicatrix naturæ*,—which is, in fact, the power possessed by our frames to resist the

progress of disease or set right functional errors,—are alike wanting among the means for the restoring of health. In the "acute" form, characterised as it is by greater severity and longer duration of symptoms, there may not be absent many of those which usually usher in the "chronic" stage, or, in other words, the former conditions of disease may subside into the latter, the "resisting" power having failed to accomplish its accustomed curative effects. In proof of this, we may readily call to mind the early sufferings of the patient, and the length of time which had elapsed before the disease had settled down into the chronic form, or its perfect hold upon the system had been fully established. In this the efforts of the *vis medicatrix naturæ*, for a time exhausted, are in no case more apparent. On these conditions, also, are we disposed to deal with the term "chronic" disease.

Even in the healthy body, "waste" and "repair" are the two great instruments of vital action. This action is maintained, as we have elsewhere stated, by the mutual balancing or antagonism of the chemical and vital laws. Every atom of the human frame lives and moves its appointed time, and finally submits to the chemical laws—it dies, and is cast out; while a new and living material is brought to supply its place. This material is furnished in the elements of the air and of proper food, and is de-

pendent for its powers of nourishment on the characters of both. Again, every the most simple movements of the body, each operation of the intellectual faculties through the brain, together with the motive force of the "will," are accompanied by "waste," so that the sum of this waste is determined in all cases by mental and bodily exertions. When, therefore, in addition to the common requirements of the body upon its vital forces, the human frame is called upon to accommodate itself to a morbid quality of those functions by which these vital forces are exhibited, it is, in contradistinction to accidental or acute disturbance, in the "chronic" stage of disease.

But the *vis medicatrix naturæ* has in no sense departed from a frame so afflicted; it is but temporarily subdued. Without it, no remedial agent could avail. The practitioner can never exalt it too highly, or regard it too submissively. A series of years of suffering to a greater or lesser extent, accompanied by languor, inertness, and an indisposition to share alike the pleasures and troubles of existence, afford abundant evidence of a long-continued resistance to the progress of bodily derangement,—resulting from causes evident or obscure, through accident or by predisposition. More clearly shewn, likewise, is this inherent power we possess, in the fact of that rapidity of recovery

which supervenes even upon the chronic stage, and teaches us that the great Author of our being permits this small organism in the universe to apply its own powers to its own perfection and maintenance, and to yield tardily to the ravages of time and the mishaps foreordained regarding it. Hence we have, not intellectually but physically, more power over the movements of diseases than they have over ourselves.

Chronic diseases, therefore, while they are but too often abandoned to the fate of incurable things, are accidents to which, having become confirmed and rooted in the system, the appliances of medical art and skill are more bound, to effect what can be effected, than to all others. It may be urged that to nip them in the bud, that is, to attack them when under the acute form, is the only safe proceeding on the part of the practitioner; and that often, when the chronic condition is assumed, his efforts give place, and baffled art resigns its staff of action and retires from the field.

This course, however, would be far from honorable—in truth, it is neither fair, nor just, nor reasonable; for, as we have already shewn, the "resisting power" of nature, upon which, too, the success of his own skill and treatment, he must allow, ever depended, is exhausted of her labours, and, less willing than man further to damage the

system by powerless efforts, is content to leave the subject to work out the remnant of existence with reduced vitality, and with a diminished disposition to awaken again the calls of active life, or jeopardise even the wreck of its former self. The patient, now that the remedial agitation has ceased, and the doctors, too, as people oft declare in ignorance, "have given him up," resigns himself to the humility of a curtailment of his once fair proportions, and prolongs vitality as best he may or as instinct may guide.

It is Nature, in fact, which has itself for a space "given him up;" and it is now time that the physician take him in hand. It is no disparagement to Nature that it has done so, and for this reason: it has no control over our artificial life; it gives us a wide range, and invites us to enjoy. It is but a dumb and patient thing, permitting us to exercise freer scope than, judging by the ordinary use we make of it, we really deserve. From time to time, through its own changeless and unerring laws, it sends forth the warning note of pain, corporeal disruption at once loathsome and destructive, and other forms of annihilation which strike terror into the hearts of men; or we are suddenly cut off in the pride of life and apparent health. This is but too often the result of the unaided efforts of Nature; and it is for us to weigh well the amount

of care we have taken to avert these seemingly inevitable evils, and to apply at once our artificial remedies, to counteract the hurt and damage which former careless or reckless modes of living have undoubtedly superinduced.

Nor should we neglect this application of every remedial means which our intellectual capacities furnish because of a predisposition to organic change existing already in the human subject, either to check its advance or actually to prevent its disastrous progress. Abundant experience has hitherto been arrived at to prove how even hereditary transmission can be met and dealt with, so far as to ward off, for a time at least, if not permanently, that threatened danger which certain symptoms brought timely to view. For we should judge but harshly of the real vital strength of the various races among men, were we to admit *partially* the existence of a renovating force inherent in the system, with which, if we proceed judiciously, and in accordance with the rules and laws of nature itself, we can either develop that which the accidents of birth or connection have given to the world in an imperfect state, or bring back to its former safe channel the healthy course of a being whose errors and frailties had debarred the simple and frugal enjoyments of life.

We have the unqualified testimony of some of

the most eminent of medical writers, that the majority of diseases, and chiefly those which are apt to assume the chronic form, have their roots in some sort of impairment of the circulation; and it will be hard to set aside this assertion, when we keep in view the fact that every kind of nutrition to the tissues, and every process by which repair is brought about, are alike dependent on the perfection of this one function. The thousand-and-one morbid growths, and even local enlargements of parts, those products which the great skill of modern surgery is called upon to remove or to extirpate, are clearly errors of nutrition. How great is it to obviate the use of the knife! or, as Abernethy used once to phrase it, "the removal of a limb is the reproach of the surgeon." Our science and our practice may well deserve the gratitude of mankind, when we can find some method for the restoring of the balance of the circulation, and diverting the abnormal *momentum* of the blood from that portion of our frame in which is building up some foreign structure that feeds upon the general health, or rapidly exhausts the already impaired functions of the mass.

Without entering into the minutiæ of the nutritive process, we cannot fail to find, while the operations of nature are truly and faithfully followed, strong evidence of the great truths which Hoffman left to the unbiassed investigations of a succeeding gene-

ration; and though he broadly asserted that "all diseases proceeded from faults of motion," there is more real truth in the declaration than many even of the modern schools are willing to allow. The best explanations which he gave in defence of his theory, were those which exhibited the effects of this principle both in congestion and inflammation; and if he erred at all, or made too extravagant a use of his discovery, his misconceptions are to be traced to a perhaps unintentional disconnection of *the vital force* which rules and governs the whole, and is displayed more particularly in the latter kind. Those, therefore, who are disposed to join with us in the adaptation and reception of what we believe to be the true natural processes of the human organism, must be prepared to receive, almost as an axiom, *that the majority of those morbid derangements commonly called diseases which afflict the human body, both arise and proceed from an abnormal condition of the circulation, from too slow or too quick movements of the blood.* And truly, if we will but consider the matter well, we may feel satisfied that we are not far in the wrong when, receiving the well-established doctrines of physiologists that the blood is at once the agent of nutritive maintenance and of repair, we adopt the natural suggestions that arise from this knowledge and belief.

For the main-spring of the mechanical powers of

the circulation, we must refer to the source of all motion in the "vital capacities;" but it is enough that we dwell on that which is patent, displayed at all times and seasons equally to the non-professional as to the professional man, and discernible even by common intelligence.

All diseases of the body are abnormal to its structure,—are hurts, damages, accidents, derangements; brought about of its own will, by the common vicissitudes of life, the burdens of overwrought civilisation, by predisposition or hereditary transmission. Though viewed by man oftentimes with feelings of doubt allied to despair, they are clearly agents for his good, for the perfection of the order of his nature, and for the continuity and maintenance of the undeviating laws of the universe. Judging by the conduct of many of the subordinate ministers of the healing art which man has invented, the world might with some show of reason think otherwise. It might class the responsibility which is attached to the great gift of Reason, and the errors which originate in the brain under its control, with the accidents of the material part, and say that both are under an ordained inevitable capacity for error. Anything approaching to reflexion, however, must disperse both the gloom and misconception resulting from such opinions. In simple language, we may add, that if we look well after our bodies,

if we take nature for our guide, study well its periods of action and repose, the common suggestions in fact which seem to arise in so many divisions of our frames, and be careful that we neither prolong nor overwork either one or the other, the perfection of the system as it stands will be apparent, the rules of health very clear,—all else is artificial, and evolves a chain of consequences. It is no disproof of the perfection of a work that it is hourly subject to these mischances, for its healthy existence even for one hour would declare it to be perfect. Let us proceed to apply this view, for it is the only one which will in any way account for all that we suffer, and all that we do to mitigate our pains and penalties.

The present consideration of mechanical forces over the *greater* and *lesser circulation* involves no neurological discussion of the *primum movum;* we treat solely of the disorder of that which is a unity in itself, and hence can only describe its diseases as abnormal conditions of parts or of the whole structure.

Chronic disease, when resulting from defective circulation, is nothing more than the acute form prolonged beyond the period when we might suppose the existing impediment to have been removed, or, in other words, is that condition when the *vis medicatrix*, acting powerfully in the acute, has ceased

to exert any influence, or a very imperfect one at least, in the removal of the obstruction.

In this wise most of the diseases of the heart and circulatory apparatus may be considered. Those most commonly assumed by medical writers appear under the following heads: viz.—atrophy, fatty degeneration, softening, dilatations partial or impartial, dilatations of one ventricle with hypertrophy of the other, simple hypertrophy,—though scarcely to be considered as a disease,—indurations of the muscular structure of the walls of this organ, of the valves, of the aorta or great trunk, polypi, cartilaginous or osseous productions, inflammation of the endocardium, of the cardium, and of the lining membrane of large arteries, hydropericardium or dropsy of the heart, spasms, and some others, together with congenital malformations and displacements, though the latter are found to be exceedingly rare.

The sum of these diseases, though dependent for the most part on the condition of innervation at the time of their appearance, may yet be taken as proof of the rules laid down regarding the general momenta of the blood, in the healthy or deranged state of the circulation. For, among the alterations of tissues or organs which we find on autopsy to have resulted from diseases of the heart, there are, besides lesions of the organ itself, all the signs of sanguineous congestion,—the liver, lungs, mucous and

submucous membranes are gorged with blood; and it is but rational to conclude that these effects are of themselves more than sufficient to frustrate all unaided attempts of the vital process to recover its lost ground. It is true, notwithstanding, that, as many of these effects take place at the latest moments of life, many and peculiar difficulties beset the investigations of the pathologist,—though such sterling advantage has hitherto accrued upon this method of tracing disease to its root, that we are rather prone to take for granted *post-mortem* proofs, than doubt of their value. A due caution and a warranted scepticism are alone needed in the inquiry. The diminished actions of various organs affect the heart usually to slowness, and thus, particularly in the "calm decay of age," and the prostration of vital powers which precedes dissolution, congestion and fulness of active organs and parts must inevitably result. The majority are subject to these changes. And, as in life we mark the resolution of forces, whether of a morbid or healthy nature, so we estimate the extent of damage to the system at large, when its organic functions are brought to their lowest ebb,

> "Nature, as it grows again tow'rd earth,
> "Is fashioned for the journey, dull and heavy."

As at the close of life we perceive the gradual extinction both of power to repel and to assist the

circulation, even in parts uninfluenced by actual disease, so we find in the chronic stage of a malady, the evident signs of a temporary abeyance of its natural vigour. To make this clear we may take for granted, that in *passive congestion,* which is the true chronic form, there has been a gradual increase of the circulating fluid in the part or parts, commencing at first either in the demands for an increased supply of blood, proceeding from artificial causes or positive obstructions existing elsewhere in the frame, and ending with an infarcted condition of those parts, increase in diameter or bulk, and the usual train of morbid symptoms. We see also the resolution of force, and how it is in the power of medical art to bring it about, and how those powerful processes which nature adopts to get rid of this abnormal position may be directed in their development, and the injurious results to an already impaired system actually averted. Let us consider first, the causes, symptoms, and connections between the parts which make up the entire circulatory apparatus, before we apply those natural suggestions by way of *remedy* which these changes of themselves supply.

Variable as the causes of circulatory derangement are, we yet find that the greater part, if not all, proceed from some condition foreign to the *order* of the system, be its seat where it may. Possibly

in the early stage of disease, the heart may present merely the form of simple hypertrophy, to admit of increased strength being given to its contractile or propulsive powers, and then the numerous train of consequences may ensue. In this, one effect is oftentimes very striking. The ossification of the valves, or more especially the fungoid excrescences seen upon their free margins on examination of bodies after death, are often the work of comparatively short periods, and are clearly errors of nutrition in the first case; whilst, in the latter, they result from a slow movement of the blood, depositing its layers of fibrine, after the nucleus of these vegetations had once been formed. They are such occurrences, therefore, as we seldom meet with until the entire mass of the machinery is thrown, as it were, into disorder, and the last efforts at the maintaining of its equilibrium are fading away.

Among the several causes adduced for chronic diseases of the heart, setting aside those of a moral nature and more allied to the intellectual part or the sensorium of our system, are those which have origin in the several organs which minister to its purification and nourishment. The three chief gradations of power in the human organism consist of the following:—a nervous system to impart vital impulses and control the order of the structure,—blood, to supply nutrition to that system,—and

subordinate organs, both for the elaboration and purification of that blood. All systemic changes, therefore, which offer impediment to the free course of this fluid involve the heart; beyond this there is no implication brought about by any peculiarity of its own, or connected with its simple structure. We might almost as fairly consider it exempt from a share in the morbid changes or aberrations of the system generally as any other portion of our widely-spread and extensively-developed muscular tissue can be found to be.

Commonly, however, all those circumstances producing violent *dyspnœa* or difficulty of breathing, when extended to the chronic stage, necessarily give rise to dilatations of its walls or to enlargements. Thus in *pulmonary phthisis, emphysema, pleurisy, chronic pneumonia,* and other diseases of the lungs, there is more effort required to force the blood onwards, particularly in the latter organ, and hypertrophy is the necessary consequence. Like all muscular tissue its volume is increased by exercise; and this feature is in ordinary life apparent in the arm of the blacksmith, the leg of the opera dancer, the shoulders, arms, and hands of most workmen, such as porters and sailors, all of whom apply constantly to this portion of their frames for the absolute requirements of their several callings. A neglected cold is often a frequent cause.

The symptoms of this perpetual derangement of the course of the circulation are, to common view, more strongly marked than perhaps any other classes of disease. We observe in them habitual pallor, or livid hue of the lips and around the cartilages of the nose; œdema of the limbs, general or partial, as well as of the trunk; short and impeded respiration, aggravated by any unusual effort; frequent dreams, sudden starts in bed, and violent actions of the arms and legs, as if to ward off some impending danger, but, in reality, to assist in restoring the almost suspended circulation; and all these several effects resulting from causes which, if we use strong derivative means, may be entirely removed, the heart may regain its healthy function, the pallor, lividity, and distressing dyspnœa, together with the other chain of miseries, disappear at once. We shall be enabled to judge, too, of the apparent smallness of the means by which these disastrous stages are one by one evolved, if we adopt the notion of Laennec, that "the general circulation is not always so much altered in cardiac diseases as the capillary;" and this brings us to consider much that has been very ably supported by this great authority, as well as by others, regarding the pulse and arterial pulsations generally.

That a fair and accurate prognosis of existing forms of disease can be arrived at through the agency

of the pulse, is much doubted by Laennec and others; indeed, the former goes so far as to affix the very general view of practitioners regarding it to something allied to absurdity, if not to mal-practice. This distinguished writer has shewn, by many forcible examples, that the pulse is no test to the practitioner, and is only to be taken into account by the latter in those cases where its action is synchronous with that of the heart. He has shown, also, that the capillary is in some sort independent of the general circulation, and has pointed out, at the same time, the unmistakeable difficulties which beset our views of the therapeutics of the case. He admits that there is a reciprocal dependence in the various systems of organs subservient to the circulation, but has uniformly found that they have frequently an isolated or individual existence, and one which does not correspond with the belief that the arterial pulsations follow those of the heart, in regular and undeviating order. The results which careful stethoscopical observations yielded him, during a period of ten years, furnish several valuable facts, of which the following are the most prominent.

In depletory or derivative bleedings, for example, he noticed that very great relief or absolute cure had been effected by hæmorrhage of a few ounces, where copious bleedings, in similar cases, had failed in effect; and compares this with the small amount

of weakness produced by uterine discharges, or by copious hæmorrhoidal fluxes; while, in the same individuals, faintings had been occasioned by the application of a few leeches. He relates the case of a man, who had been bled several times to the extent of from eight to twelve ounces without feeling weakened, but in whom the application of two leeches, at a subsequent period, had produced excessive prostration of strength. "All practitioners are aware (he says) that in some cases, and especially in apoplexy, peripneumony, pleurisy, and inflammatory diseases of the abdominal viscera, the weakness and smallness of the pulse do not always contra-indicate bleeding, *and that the artery will even often resume its fulness and strength, in these cases, after a loss of blood.*"

In the latter remark, there is certainly strong evidence of the different effect of venesection to that hitherto ascribed to it, and of the necessity for that careful diagnosis of the real state of the patient which the stethoscope is so admirably adapted to confirm. He adds, on the practice of bleeding,—a practice now, happily for the safety of society almost exploded,—that "whenever the contractions of the ventricles of the heart are at all energetic, we may bleed without fear, (presuming, of course, an existent necessity,) the pulse will get up; but, if the heart's contractions are weak, although the pulse

be still rather strong, we must be cautious in abstracting blood." He styles bleeding, moreover, to be, "one of the most confessedly useful or injurious therapeutic means in the domain of medicine." Again, we have in the apoplectic, as well as in other cases where the heart's action is moderately energetic, a strong pulse!

How, then, are we to deal with these open and manifest incongruities, if we do not reject the notion of the pulse being a safe guide to our diagnosis of the existence of diseased circulation? How determine the course to be taken, or our early prognoses of fevers, and other violent workings of the system, by examining the most fallacious of all acknowledged guides? The difficulties are insurmountable, and the practice very questionable. Nor is there, in reality, any great impediment to our forming some conclusions from all that we see in the variations of the pulse and its uncertain career, irrespective of the supposed isochronism with the contractile force of the heart. All that can be said of the functions of the muscular coat of arteries, and the variations both of demand and supply seated in the tissues and organs to be nourished by the blood, will apply here. We would fain hope, likewise, that the lovers of venesection, and other such counter-irritant or derivative processes, are as fully prepared to show the beneficial results of their theory, and how, by re-

motely acting upon the venous stream, they can affect local arterial congestion, or do otherwise than lower the system, by the removal of that which gives it life, which, on the contrary, should be supported by every means within reach.

It must have been a course of erroneous reasonings, much of the same character, that gave rise to the monstrous fallacy of "transfusion," a mode of treatment which resulted in many fatal cases, in increase of the existing disorder, and general perturbation of the system. Dr. Parry, while speaking of the tendency of plethora to produce local disease, and condemning the before-mentioned practice, makes the following remark, which is really so apt that our readers will pardon its insertion. He reasons thus:— "When we consider the sanguiferous system, not merely *as a set of dead tubes,* but as a *living machine,* having in itself powers of accommodation, whether morbific or salutary, to the relative situation in which it is placed, we cannot wonder at all those circumstances of affection or action which result from the influence of *external agents,* modified by those inherent powers."

Again, our view of these conditions of the apparatus would be incomplete were we to omit a short notice of those common occurrences denominated palpitations, irregularities, intermissions, intensity, and the like. The first of these presents to the

auscultator the following phenomena:—Strong impulse of the ventricles, with a more considerable upheaving of the chest than usual; increased pulsations of the heart, though with diminished pulse; joined with great sense of suffocation. In this state of the patient, hypertrophy may or may not exist; the whole may arise from moral causes, the spring of which it is too frequently difficult to make out. Laennec and others deny that hypertrophy or dilatation are the origins of these palpitations, proving that persons have laboured under these distressing afflictions for many years, with no manifest sign either of one or the other, and that, except in the aged, they are not attended with any symptom of pectoral or cerebral sanguineous congestion.

"Irregularities," which, it is allowed, may exist without the former, are perhaps the only set of positive symptoms with which we find a due accordance in the state of the pulse. It is thought that some irregularity in the contractions of the auricles may give rise to these appearances, though the diagnosis has been hitherto obscure; and, as they have been more frequently noticed during violent fits of coughing and other spasmodic action, it may be held that they are more influenced by moral causes than by any probable disturbance of the contractile forces either of auricles or ventricles.

"Intermissions" are also changes ordinarily accompanied with corresponding conditions of the pulse. Like other derangements of the circulation, in the prime of life they are consequent on some organic change in the structure of the heart, but in the aged are more attributable to the decay of vital power, felt alike in every portion of the frame. There may be intermissions, such as have given rise to the terms *true* and *false*, which depend on a diseased state of the arteries or impairment of the circulation generally. Thus, for example, it is said that "the dicrotous pulse is found to precede or accompany nasal hæmorrhages, the undulating to coincide with perspirations, the intermittent pulse with diarrhœa." In diseases of the lungs and chest, a perfectly natural pulse is frequently found; in diseases of the heart, though its impulse be great, the pulse may be weak, and, as said before, in apoplexy a strong pulse may be felt, though the heart's action be retarded. Thus it is equally difficult to account for many attributes of abnormal changes in the heart and its vessels, as it is to reconcile to our belief in the persistent independence of the former, the many changes which really accrue in order that it may the more readily adapt itself to the multifarious purposes it is called upon to serve. The *intensity* of these irregularities is also as difficult to account for; yet they may doubtless be taken,

both as regards the pulse and the pulsations of the heart, as tendencies to one and the same proper end, and that end to remedy obstructions of some kind, to restore the due course of the circulation to its pristine vigour and proper channel, and maintain its equilibrium intact so far as other forces of the body are concerned.

The foregoing proofs of mechanical force, regulating the entire circulation and adapting it to all the varied conditions of animal existence, lead us now to the consideration of the effects of external applications, either to the development of the system or its restoration from disease to comparative health. If we are daily and hourly witnesses of the conjoint efforts of Nature itself to restore the lost balance of parts, to provide against the contingencies of our active and changeful life, to redeem the misspent moments which bring their train of artificial disasters, to adapt us, in fact, to every variation of clime and season, to permit us to enjoy all that the intellectual and physical being can grasp in the great world which it inhabits,—then should we testify to the truth that we have evident control over the health of our bodies, and that natural means are presented—the more so because they are simple and natural—whereby that health is to be maintained.

In fulfilling its own prescribed duty in the work

of supporting health, Nature has, through all time, yielded glimpses to man of the machinery of his construction, and in no case more openly than in that portion at present under our consideration. It was these occasional manifestations of her plan that imbued Ling, the great founder or reviver of the science of curing and averting disease by movements and local applications, with that spirit of investigation, the results of which bid fair to rival the most valuable of those curative arts which the genius and farsightedness of modern times have called forth. He saw plainly that there existed neither accident nor chance in the meanest operations of the human system; that these efforts, whether spontaneous or involuntary, had always some specific end and purpose, were definite and decided in all cases, and in no instance failed to act in one and the same manner, and with a regularity no less astonishing than perfect. He saw, too, that, as the aberrations and impairments of our bodies were the certain produce of artificial modes of living as well as of extraneous hurts and injuries, so by artificial appliances these could be corrected, and the normal state once again restored; the whole process being directed by the laws of physiology and pathology, the same laws under the guidance of which all medical knowledge is or ought to be found.

Here the reader will doubtless demand of us, How the errors of the circulation are to be remedied by external applications, or, in fact, by any methods that man can instinctively foresee to be fitted for such purposes? In reply, we would ask, whether he has ever yet endeavoured, or is now willing, to account for the many movements and positions to which he finds himself subjected by some involuntary or intuitive faculty, whenever he experiences fatigue, or suffers injury, or endures pain? What is it that urges us, under the influence of severe neuralgic pain, such as tooth-ache, for example, to apply the pressure of the hand to the part; and what is it that gives temporary relief in this case but that pressure? What induces us to sigh and yawn, and stretch forth the arms, raising them upwards, to remove some indescribable feeling in the chest, but a sympathetic response of the system to the demands of the right division of the heart, which craves to be relieved of venous blood, gorged as it really is at the moment? What bids us, when we experience aching pains in the muscles, after riding or walking, to elevate the limbs and give them rest, but that, by muscular relaxation, the fulness and impulse of arterial blood may be overcome and diverted from the distressed tissue? What tells us, of our own accord, to apply frictions to the surface of the skin after blows or

contusions, as we all so frequently do, and particularly the juvenile portion of our species, but that *absorption* of the hurried circulation towards the part may speedily take place, which is actually the result of such a proceeding? What, indeed, are all those natural efforts which we trace from infancy to old age, but mechanical forces for development or remedies against the decaying functions of existence? Consider the writhings and facial distortions of the infant, the munchings of old people to augment salivary secretion; they are but one and the same indications of natural action. Whilst, with the exception of the last, all may be found to be resultant movements essential to the mechanism of the circulation.

Impressed, as we must be, with these very evident laws of the system, we shall find that they equally foreshadow at least two thirds of the true diseases that afflict the human race. The blood moves too slowly or too rapidly; either may be a proximate cause of disease, and, if continuous, assume the chronic form. The effects, too, may either be *productive or destructive.* The type of the latter may be detected in "passive congestion;" that of "active congestion" of the former. Both are to be taken under the same circumstances of "determination" of blood which have been hitherto established by pathologists. The proximate cause

of determination may be a healthy condition of an organ, such as that which we have already mentioned regarding the stomach when actively secreting; or it may result in symptoms of an unhealthy character, such as ensue in inflammation. Hurts and injuries, or the presence of foreign bodies, seem in the latter even yet partially mysterious occurrence undoubtedly to produce this determination for a wise purpose, though the result may be an involvement in error of nearly all the processes of nutrition. Though "life" be not, as Bichât described it, "the sum of the functions that resist death," it is yet evident that, according to other writers, it may be that its exercise leads naturally to decay, and from decay to death; as seen frequently in the nutritive errors resulting from long-continued and ill-directed inflammatory action.

There appears little doubt that the phenomena of excessive nutrition to parts, or abundant excretion by such organs as possess this quality, dependent as they are on an enlarged supply of blood, explain the process by which the vessels themselves are often relieved of excess of blood, though such may not in all cases be natural to the same parts or organs. The blood is certainly purified by a similar course, for the several organs are found to minister to its purity. There must, however, be a clear under-

standing of what is meant by *fulness*, as it is not always, in a general sense, connected with *determination*. During life and health, all the blood-vessels, whether arteries or veins, are full; there is no vacuum in any part, or otherwise the one propulsive power of the heart would constantly fail in effect, or be supplanted by arterial action. It means merely such a state of the vessels as dilates them beyond their ordinary limits; and it was much on this account that the quondam practice of "transfusion" gave rise to so much injury and systemic disturbance.

In the case of a patient suffering under hypertrophy or simple enlargement of the heart, as well as from a more determined malady of that organ, in which the valves may be implicated, let the practitioner use such agents as will, by diverting the blood, or causing it to circulate more freely throughout the system, relieve the surcharged organ, and it will recover; nothing can prevent such a consummation; nor can it be for a moment doubted that it would. Do not truly the various muscular exercises, taken even during a state of health, assist that organ in its work, and regulate the momenta instead of its being directed towards them, as in the stagnate condition of the tissues of those especially who lead sedentary lives, or "live well" without proportionately exercising their frames. If the blood

in the vessels be stimulated *internally* by the very wants of the secreting and excreting organs, it is easy to foresee that by mild external applications it can be brought also to the integuments. We can stimulate the peripheral system of nerves by acting upon the skin, and can do so with no less vigorous result in the case of the vessels.

The arterial system does not actively contribute to the mechanical circulation of the blood, nor is there any propulsive power in the capillaries, but it may be held that when the former are preternaturally distended with blood, a subordinate expelling or propelling force may be existent. In this case the expansive power of the capillaries affords an outlet of escape, though their common functions appear to be closely allied to the general laws which govern what is termed *organic attraction.* In these minute offices nature is so subtle, that even they have rarely yielded to the test of man's experience and most careful investigation. Yet, after all, their characters have been found so simple, that external absorbing movements have in no experiment failed to effect, in the human subject, those results which elsewhere follow capillary attraction.

The majority of *nervous* disorders, intimately connected as that system is with the extent and duration of determinations of blood or excessive local fulness, may be traced to defective circulation, so also may

the idiopathic or primary pains and distresses which accompany most of them; for, otherwise, it would indeed be difficult to account for those species of disorder which autopsy so often fails to reveal. In truth, the practitioner is too frequently baffled in the attempt to trace out the cause of that frightful suffering which, during life, it is his unhappy lot to witness without being capable of affording even temporary relief.

As external applications may come from the hand of the operator, whose design should be, of course, *specific*, and under the guidance both of anatomical and physiological knowledge, he may produce as clear proofs of the utility and safety of his labours as he observes to result from ordinary stimuli; there will be found little or no perceptible difference between that he employs, and that which has the same relative tendency in the *natural* stimuli of internal organs and parts.

It is certain that there can be no great difficulty in perceiving the hourly occurrences which wait on these generic dispositions of organs and tissues; they unerringly take place, and are marked by sensations of pleasure, pain, or abnormal violence. We have determinations to the skin, to the various glands seated near or beneath the integuments, to the mucous and other membranes, and to the organs of secretion or excretion; all depending on a certain

stimulus, be it whatever it may, and which stimulus, if prolonged by morbid causes, will produce the various degrees of congestion, such as of the liver, lungs, brain, and spinal chord, stomach, intestines, and many others; while the results of these are hepatisation with subsequent inflammatory action, dyspepsia, diarrhœa, strictures of the œsophagus, intestines, and other portions of the widely-dispersed mucous membranes of the body. In the latter case, a common cold is an active congestion of the mucous membrane of the nose, gullet, or fauces, producing intense secretion; so also in catarrhs of more severe kinds, and many forms of asthma. So also in the process of ephemeral fevers, or such as are of a more prolonged and uncertain character; so also in the turgescence of the generative organs, and many other symptoms which will be readily present to the memory of most persons.

In the numerous phenomena attendant on pulmonary complaints, we assuredly must admit that the lungs, from their simple structure, have little or no inherent susceptibility to inflammatory action; the destruction of that organ following in the common wake of nutritive error, which will destroy, with greater or less speed, all parts of the system. In the most common form of this sad and too often fatal disease, we have, first of all, engorgement, then hepatisation, and lastly the purulent infiltration with its

consequences. But even here, despite all that has been said and written to the discredit of medical science by its own children, the application of such forces as can act as derivatives and absorbents will prove as effectual as in any other more simple part or structure of the frame. More caution is undoubtedly required, because of the vital importance of the organ, and because the body appears to set up muscular and other resistance to movement, which might divert the congestion; but, in reality, this is not actually done. For, although inspiratory acts are cut short and impeded, there is no disposition on the patient's part to abandon all other active exertions; whilst a good effect may appear even in this abnormity. The inactivity of the chest and its muscular and osseous apparatus, take from the *usual* momentum of the blood to those parts,—an important feature,—and other parts of freer agency not only diminish its supply, but by their activity divert it. So that when nature sets up, as it does in this disease, an invariable rule, that rule is well worthy of our adoption and practice. It prevents active circulation near the injured parts, by quieting or withholding all muscular action there, and thus congestion is further obviated. It is manifest, therefore, that the operator, by certain muscular actions in *remote* parts, may not only prevent congestion setting thither, but divert that already ex-

isting within the diseased organ; and at the same time that he does this, he checks the course of that erroneous nutrition which at once debilitates the system and destroys the parts in which it is seated. Formidable then as this malady is to medical art, or utterly unavailing as medicines frequently are to check or remove the cause, there yet remains a form of application, such as we describe, alike conformable with the laws of nature and the disease itself.

Though there be but two distinct degrees of disease in which the circulation is involved, yet there may exist many gradations, such as doubtless give rise to the numerous distinctive titles with which the science of medicine is oftentimes encumbered. In the chronic stage the vascular disturbance is aprently, if not actually, less than in the acute, and there may be no clear constitutional disturbance, but yet the secretions are strikingly disordered. It is more especially to the latter fact that the attention of the practitioner should be directed; for it is obvious, judging by the almost invariable rule of symptoms, that some unseen agency is at work to overcome the influence of morbidly-conditioned blood upon the several organs, as well as to purify, as far as it can, that imperfect blood by similar means.

We mark, too, as coincident with these appear-

ances and changes, that diseases originating with the blood, and belonging to that fluid, are of a *symmetrical* character. If a man have chronic rheumatism, which is a disease of the blood, in one knee joint, he will have it in the other; and so also where corresponding parts or sides of the body are affected. Such are, of course, more apparent in certain divisions of the human subject, as the joints and limbs. These circumstantial evidences of deranged circulation, however, are only useful to our practice so far as we see unity of design, and act in harmony with it; they instruct us also in the methods to be applied, for we there fail not to observe how slight an irregularity of this great vital force is sufficient for the general derangement of the whole machine.

Consequently diseases connected with the circulation have their gradations from one and the same common causes, whether in abnormal conditions of the tissues, in local obstructions, or nutritive errors, resulting from a disregard of proper forms of diet or repose, congenital malformations, or the casualties of existence. It is impossible for us to declare how long the untoward agency has been at work which deranges our systems. It may be speedy in its operations, or it may be gradual in its advances; both alike are sufficient monitors of the *change* which should be brought to bear either to counteract

or subdue. Unlike the admirers of such derivative processes as venesection, who try to repair the lost balance by aiming a blow at "the life of the blood," and who, at the same time, deplete and damage the equilibrium of that which on the contrary should be maintained, let us rather seek to correct those errors which our habits and customs bring about, and judiciously apply those instincts, whether we denominate them exercises or what not, which the great Founder of the work has implanted in our natures.

The whole mass of the blood moves in supply, is retarded, or accelerated to meet the demands of the nutritive and reparative functions, and, though primarily propelled onwards by the heart, is governed by the *order* appertaining separately or collectively to health and disease. It is in the power of the individual to do much, though he be unable to account for that instinctive "will" which impels him to adopt certain positions or cautions. Assuredly, then, it is in the power of every minister of the healing art, whose judgment and skill are based upon the laws of nature, and upon the peculiar instincts which are not only guides to man but controllers of the common path recognised even by the brute creation, to bring his knowledge to bear upon every point as it may be presented to him; and not to endeavour, by the abstraction from the

body of any of its essential ingredients, to remedy its defects, but to restore proportion and harmony by developing the natural action of that which is impaired, or by leading back to its pristine perfection the abnormal course of the circulation. The rapidity, too, with which that circulation is accomplished, both in the venous and arterial systems, might be brought in here to prove the great speed so absolute in all the requirements of active life: yet that life scarcely may be deemed "to hang upon a thread," for it may be our happiness to know that it does battle for its existence, and manfully does it fight both for its persistence and integrity.

Therefore, exclusive of these inherent powers which a well-exercised body presents to ward off or remedy aberrations of its functions, there are agents more active still, and of these we shall now proceed to speak.

The whole of the inspired air has, in man, to pass through the lungs, though, in the case of many animals, it is found that only a part is essentially required to perform such a passage, or minister to so important and enlarged a process. The rhythm or order of the pulsations of the heart, is dependent on the equilibrium of a force necessary to the process of nutrition, or the supplying of the material to repair the waste of tissues which is constantly going forward in all stages of vitality; and it will

therefore be evident that the *periods* of life are concerned in the process, the pulsations occupying three distinct stages of comparative activity, being more rapid in childhood, softer and more equable in adult life, and proportionably feeble in old age. These periods may even be taken as corollaries adapted to the general treatment of a diseased circulation. The rhythmic movements are controlled, equally with the organic fibres of other parts, by the influence of the sympathetic system, that is, by a continuity of stimulus commencing at a point, or in certain fasciculi of fibres, and being gradually communicated to the entire bulk of the organ. Stimulus artificially applied to this system will, therefore, affect the whole circulation.

The impulse of the heart, resident in the muscular fibres of its walls, is worthy of consideration in its mechanical action, though it be not so clearly denoted as what are called the "sounds" of this organ. In the healthy subject there may be heard two sounds, of valvular origin, commonly known as the beatings of the heart; the first attributed to the tightening of the semilunar or arterial valves, and the second to the mitral and tricuspid or venous. These sounds are heard in health with the regularity of machinery of superior construction, but it is in disease of this organ that its true mechanical action is made more apparent than all. And as we were

justified in entering, though briefly, into the foregoing particulars, for the guidance especially of the non-medical reader, so are we now drawn more into the province of medicine, to urge the following considerations upon the attention equally of the medical student and non-medical classes.

That the motive force of the heart is alone sufficient to maintain the circulation of the blood, has long since been well-established by the experiments of Mr. Hunter, those more recently by Dr. Sharpey, and other eminent physiologists. It is therefore no longer necessary to refer to the cogent reasons for such presumption; nor is it needful to treat here of the aberrations of this natural function, points which apply to the consideration of nervous influence in regard to it. That it maintains that inherent power after removal from the body, and when divided into numerous portions, has also long been established by authorities of the accuracy of whose experiments there can be no question. Nor is it less definite, from the experiments of M. le Gallois, who states, "that if ligatures be thrown round the large vessels, at no great distance from the heart, so as greatly to lessen the extent of the circulation, this organ can still support it." And all this independent of the effect of spinal injury or other nervous hurt or damage to the system.

If it has yet been clearly manifested that the

heart cannot be much influenced by stimuli applied to the brain or spinal chord, then it must be held that the functions of the latter are more dependent on it, both for nutriment and healthy action, than it is on them; though we cannot reasonably separate their mutual balancing of each other, if only as chief in part of the great chain of unity manifested everywhere in the human subject. Corroborative evidence, moreover, is abundantly supplied in the instances of living anencephalous and acephalous fœtuses, the observations on which are too lengthy for insertion in this work, though the mere fact of life being existent in them, however short a time after birth, is proof enough, and more than enough, of the independence so far of the entire circulatory apparatus.

In considering the efforts of the heart to overcome obstacles to the course of the circulation, or maintain it of required strength to the proper nourishment of the tissues, the mechanical action ascribed to it is yet more forcibly apparent. The most common of these efforts lies in that process of excessive nutrition to the organ itself known as hypertrophy, which, though formerly reckoned as a disease having its seat in the heart, is now recognised alone as the ordinary result of over action, by which, as in the case of muscular tissue generally, parts increase in bulk to support the additional labour

they are called upon to perform. The activity of nutrition, it is allowed, is in proportion to the quantity of blood carried through a part, not merely to the time during which that blood remains in it, nor to the amount of vascularity of the part. It is found, too, in case of muscular structures, that the more they waste by action the more they grow ultimately. A mechanical law regulates at the same time the course of obstructions, the source being in the part next behind, and so proceeding onwards in gradual enlargement of the part or parts adjacent.

It may here be remarked, that the heart in common with other tissues of muscular construction, requires the stimulus of arterial or oxygenised blood; yet experiments have demonstrated that a supply of venous blood will rouse it, though the work performed will be more slow and imperfect. Again, it may at the first glance appear somewhat surprising that, unlike muscular tissue generally, which is admitted to require stated periods of rest for repair, this, which is also a muscular structure, ceaselessly acts with perfect synchronism during life. But this is by no means the true state of the case; for the heart experiences periods of rest of an extent fully equal to those during which it is in full force; and, although it may seem ever active, ever restless in its function, it nevertheless is on a par, so far as the required cessation for repair is concerned, with the

antagonistic and other forces of our muscular framework.

In cyanosis, or blue disease, a malady so fatal in its nature that but few attempts are ever made even to relieve the paroxysms which accompany systemic excitement or over-muscular exertion, this organ is found to pursue, for a time at least, its ordinary routine, overcoming the obstacles invariably and unceasingly presented to it. The common view of the origin of this grievous malady, distressing no less to the sight of all beholders than to the physician whose skill is baffled and set at nought, assumes two general hypotheses, viz., the patent condition of the foramen ovale, or the non-obliteration of the ductus arteriosus. Laennec gave it as his opinion that the foramen ovale remaining unclosed was the chief cause, though he was led to think, at the same time, that this condition is not always congenital but accidental. Certain forms of the disease have also been apparent where autopsy has exhibited neither one nor the other incongruity of structure. But, be this as it may, it is certain that, amid all such physical impediment, the heart can ordinarily support the general current of the circulation, and overtop the resistances undoubtedly present either with less frequent or recurrent energy. So, likewise, may it be enlarged without disease; and, in the case of a young or middle-aged man, no

inconvenience may be felt, excepting slight dyspnœa and occasional palpitations. Wolf speaks of a case of malformed heart with one ventricle and two auricles, yet the patient lived twenty-two years.

Difficult as it has hitherto been to account for the many cases of simple hypertrophy, such as we before noticed, and hypertrophy with dilatation, there can be little doubt that distinctions which range within lesions of the valves, their ossification, and cartilaginous growths in those parts, together with the rare phenomenon of ossification of the coronary arteries, separate from general disease of the substance of the organ, are all of a doubtful kind, at least until a period very near the close of the patient's existence; while many of the sounds which diagnose these, particularly in the "bellows' sound" and "purring thrill," the proximate cause may often be traced either to a diminution in the quantity of blood or alteration of its principles and constituents. Nor should we be deceived by the results of numerous nervous affections which tend to diminish or accelerate the circulation generally, and indirectly influence the heart. It is now an established law of physiology, that the growth of parts of the body, even that of morbid excrescences, precedes the supply of blood; and these, with other conditions of the system, may control the otherwise imperfect routine of the circulation.

It is a maxim, also, with the celebrated Laennec, when alluding to the heart, that "its most serious diseases arise from a defect of proportion,"—"limited pulsations, thick walls, and *vice versâ*." This, therefore, is a point of most prominent importance to the correctness of this or any other theory that may be raised to account for the peculiar features of this great agent of organic life. Without demurring at the conclusions of so estimable an authority, we may yet find some proof in the consideration as to whether that which arises from "defect of proportion" can be justly styled disease, that is, in an extended sense of the term. We are assured that hypertrophy may exist without the heart being diseased; and it thence becomes evident that still more widely-diversified mechanical forces appertain to the heart than are admitted, regulating the size and strength of its walls and orifices to the many phases of a system so complex as our own.

It is probably, also, much on this ground that pathologists have of late years treated this organ with seeming neglect, though they have failed to give clear expression to their views on the subject, and have exhibited a no less marked distaste for grappling with it in the light our own speculations, from contemplation of natural laws, should lead us to consider it. We think, then, that the "defect of proportion" assumed by Laennec is not to be

called disease, any more than the increase of muscular tissue arising from constant use and activity, and absolute in the process of maintaining that activity, is to be considered as a defect. To the studies of the painter, or to the admirers of "Nature's fair proportions," ungainly enlargements are not the things to be applied or sought after, either in the one case or the other; but we must all, nevertheless, esteem them as taking part in the full course of that wondrous economy by which alone our entity is fixed, and the short-comings of our erring natures both remedied and removed. If, then, by sympathetic forewarning, or by any title we may please to call it, the walls of the heart are required either to increase or diminish their functions and powers, we find that they do so, and that these are natural and not morbid processes. This may include, likewise, all that relates to the effects of moral causes and aberrations of the nerve-force.

The dicrotic or double pulsation can never disturb our view of the harmony of the circle, so long as we bear in mind the simultaneous actions of both divisions of the heart, and the actual unity of the "greater and lesser circulation." "Intermissions," also, so generally reckoned as the results of positive disease, may be after all nothing more than the natural regulations of that spiritual mechanism which surpasses our understandings in its minuter

laws, yet is not, as a whole, equally hidden from the sense. The heart, in these instances, may be rationally presumed to pause, that the arteries, or more distant tissues, in which the disease actually exists, or the obstruction doubtless occurs, may in their turn overcome impediments to the life-giving process; and surely we cannot be far wrong when we release that organ from positive implication in these difficulties. On the contrary, it is hence most clear why its "independent action" has been granted, and how wisely ordained that which, judging from the effects of controversy, would seem to be a stumbling-block rather than a help to our investigations of the mysterious science of life.

The true diseases of this organ may consist in fatty degeneration, atrophy, partial or aneurismal dilatations of the ventricular walls and valves, or of those of the auricles, ruptures within the walls and endocardium, and a few others which prove alone the *accidents* to which, in common with the rest of the frame, it is liable, and in which the rhythm or order of pulsations, together with the one controlling mechanical force, have no form of real connection. It must not be omitted here to mention the usual amount of hypertrophy which is found in the left ventricle exceeding a similar condition of the right, lest some should consider that this would occasion an actual disturbance of the usual regu-

larity of the mechanical force; but further reflection would suggest that, although this is the case in order to control the greater stream of the circulation, the lesser is no less intimately concerned and influenced by this very hypertrophy of the left ventricle. A glance at the anatomy of the parts would abundantly refute any contrary hypothesis.

While it is admitted that there are few congenital disproportions of this organ,—and, when these do occur, an inherent power seems to be sufficient to overcome them,—it is clear that whatever arrests its course, and whatever again removes that impediment, are from one and the same root; and, as we may well marvel at a perfection so essential to the main elements of existence, we are still more forcibly struck with the established power of the heart to pursue its functions, despite lesions or injuries to its muscular substance, short of such an effect as might permit the free escape of the fluid with which it is charged. Among many remarkable events of this kind, there is, in the museum of a London Hospital, a specimen of the heart of a cow, which had sank gradually, to all appearance from some unknown cause, but which had, through wantonness or accident, received a piece of iron of about four inches in length,—no less, in fact, than a shoemaker's awl,—shot out of a gun, into the muscular substance of the heart; yet

this animal, exhibiting alone signs of pericarditis, remained at pasture, though poorly and dejected, for some days prior to death. Large as this foreign body was, therefore, we find that there existed less positive injury to the organ at large than to its enveloping serous membrane, the pericardium; the inflammation and its consequences ensuing in that membrane gave rise to the bodily distress apparent, and ultimately involved the organ otherwise but little damaged.

It appears absolute, at this stage of our argument, that, before we consider the intimate connections which subsist between the arteries and the heart, in the accomplishment of the round of the circulation, we give some brief notice of the ordinary processes of mechanical action.

A simple machine, according to the account furnished by writers on forces of this nature, "is an instrument by which force or motion may be transmitted and modified as to its quantity and direction." These conditions also give rise to two divisions of the science, viz., Statics and Dynamics; "the one including the theory of equilibrium, and the other the theory of motion." When viewed Statically, a machine is looked upon "as an instrument by which forces of determinate quantities and direction are made to produce other motions in other directions and quantities." If Dynamically, it is con-

sidered "as a means by which certain motions of determinate quantity and direction may be made to produce other motions in other directions and quantities." So far, however, as the results of the two forces are concerned, either in the activity or inertia of organic or inorganic matter, the two may be taken together, and treated of as applying to one and the same end. Equilibrium is so much an attribute or resultant of motion, that, in our case at least, we should effect little by the separation of them, whilst we should most assuredly lessen the value of that form of application which alone counterbalances the difficulties which rise in our path.

The *dynamical*, or true motive force, is one which has been by no means unacceptable to medical writers, more particularly to those who have treated largely and ably on the functions of the nervous system. That it may be applied as fully and as largely to those of the organ under notice, we think can no longer admit of a doubt. But, since the period when Hoffman published the results of his own partly unaided speculations and reflections, to the days of Marshall Hall, another champion for the truth against the tardy admissions of rival contemporaries, we have one unvarying course of evidence of the common existence of that faculty which does *not* judge "according to the sense." We are too often the slaves of authority,—of an authority esta-

blished, as it were, to uphold seeming certainties and vapid rules, whereby the wheels of progress, an unerring law of nature, are clogged and retarded. Scepticism could scarce work out its ends so thoroughly amongst mankind, did not idleness and oftentimes sheer vanities harness their lazy attendants to its chariot. So true it is in this, as in mechanics generally, that facts, if taken literally, oftentimes appear to be physically impossible. To what blind, yet seemingly able guides, is the student in medicine too often yielded up, until, amid conflicting rivalries, he knows not which way to turn, or to whose opinions the preference should be given; while he seeks in vain for some fundamental principles on which to ground his much-abused and unfairly dealt-with faith.

To this it doubtless would be replied, that as medicine is of necessity an experimental science, such fundamental or undeviating rules as he may require cannot be given; and this would be true, so far as it may extend. There is, notwithstanding, an obligation affixed to the characters of those who profess to *cure*,—that they give something at least approaching to fixed principles, or the world will estimate them, as judging from its conduct it too frequently does, to be triflers both with their fellow-men and the secrets which to themselves have been already imparted.

But, to digress no farther, we will proceed to consider the *dynamical* force, one which exhibits certain motions of determinate quantity and direction, and are at once led back to the circulation as dependent on the arteries, primarily influenced by the heart itself.

The arteries of the human body are commonly known as cylindriform tubes, ramifying into every tissue and process, and conveying the pabulum of animal life. They are made up mainly of three coats, the internal or serous, the middle or muscular, and the external or elastic; other fibrous materials are also existent in them, but we have only to deal with two whose actions are specific, and these are the muscular and elastic coats. It may, however, be added, that they maintain these characters or conditions even down to their most minute branches, and then the structure varies slightly.

In their *dynamical* character, they may be viewed as corresponding both with "the determinate quantity" and the "direction," of which the muscular coat is the type of the former, and the elastic that of the latter. Were they simple tubes, without the extensile and contractile properties of these coats, they would certainly be as essential for the conveyance of blood to the numerous organs of the body, as we admit the heart to be the sole agent for the propulsion of that blood; but the method, if we

may so express it, of the circulation, would be incomplete, nay, positively destructive of all order in the system. These remarks are made, only to show the mechanical agency of these vessels.

The "determinate quantity," as influenced by the muscular coat of these vessels, relates to the supply of nutritive blood to the various organs especially, but, at the same time, equally to all the tissues. We allow that the occupations or functions of the numerous secreting, purifying, or filtering organs of the body, such, for example, as the stomach, liver, and kidneys, determine the quantity of blood to be supplied them for such purposes; and that the periods when either of these is most actively engaged regulate the wants of each, for, the torpidity or natural inactivity of one will affect by an increased amount of blood not taken by it the others with fulness, and *vice versâ*. For instance, there are, doubtless, certain hours of the day, regulated or not by the stimulus of food, when the stomach may be more actively secreting, and, therefore, during this process, it seemingly *attracts*, or the momentum is increased, whereby more blood flows into the numerous vessels ramifying in its mucous lining. After this necessity shall have ceased, the liver may again draw upon the increased supply, for functions, be it allowed, necessary to the due process of digestion, or the completion of the work of decomposing the assimi-

lative materials of the food. To these ends, mainly, are the arteries formed with a muscular coat.

Now, if we consider the action of this coat carefully, we shall find, what has already been admitted by physiologists, that during inactivity of any organ the diameter of the arteries is decreased, so that the stream is proportionately small; but yet, there is no corresponding alteration in the propulsive force of the heart, the blood is merely diverted, on account of the *vis viva* inherent in all organs alike, from that which does not, at the time, require what may be esteemed as its usual functional supply. Moreover, for this wise purpose, nature has given a tortuous course to certain arteries of the body, such as may be observed more especially in the uterus, the internal carotid, and those also connected with the circulation in the brain; thus modifying the propulsive force when the stream should be more equable or voluminous for more complete nutrition.

By this mutual adaptation of the several organs to each other, viewed as part of the exemplification of the unity of the human system, we perceive the *sympathetic* chain to be unconnected with the simple method of the circulation, and obtain an insight into one of the chief causes of chronic disease. Were this not the case, other agencies than that solely appertaining to the heart would be continually called into action, and the circle obviously disturbed in

any accident to which the human frame is liable. The possibility of any defect in the general currency of the blood, is further proved in the conditions of malformation so commonly found, to greater or less extent, in almost all bodies, by which one organ takes off from the deficiencies of another organ, whether adjacent or remote, and thereby maintains the balance to be held by the entire substance of the frame. The seat of structural malformation may be in any one of them,—no matter; the chain is complete. Cases are recorded to bear upon this point of the question more especially, where atrophy of one of the kidneys has produced almost corresponding development in the other; in the lungs also; whilst innumerable are the instances of increase or diminution of substance to provide for contingencies of this nature, many of which are as marvellous as they are useful to the constant natural changes, as well as artificial and external injuries, which happen in the varied and eventful career of animal existence.

If, therefore, we be correct in ascribing to the muscular coat the power to determine *quantity*, we may not unreasonably, it is hoped, presume that the elastic has some share also in the *direction* of the blood. The mechanical power of elasticity common to the arteries, is coincident with the *primum movum* resident with the heart. Subservient as it evidently

is to muscular action, it can only be called into force while the latter is dormant, or, in the rules already laid down, something like a baseless theory would be apparent. The necessity for an expansive power by which the safety of the walls of arteries, acted upon by powerfully propelled blood, may be maintained, is too obvious to need attention here, but not so in the course and extent of the life-giving stream; for we find where special strength is required, it is given in an increase of elastic fibre.

The elastic coat maintains or governs the *direction* in this way:—it restores the ordinary size of the vessel or vessels after muscular contraction. This phenomenon has been held by one eminent writer, "to be dependent on a change produced on the tonicity of the minute vessels," an account rather vague we must admit, and no less unsatisfactory to the inquirer. For it is clear that the tonicity, if the term be fit, is so intimately dependent on the requirements of the organs or parts to which these vessels lead, that it might rather be held that the stimulus is given, or the tone imparted, for the reception of more blood, by them to the vessels, rather than that we should rest satisfied with the indefinite conception of an arterial influence solely in nutrition, which is certainly not supported.

So far as *direction* to the blood is concerned, we find the elastic coat serving every adequate purpose,

and by its mechanical power answering to every systole of the heart, and opening, as it were, the flood-gates of every channel of the body; and it accomplishes this independently of the one motive force proceeding from the heart.

Finally, it remains that we always keep in view a few prominent facts relating to the functions of the arteries. In the first place their chief characteristics are strength, elasticity, and contractility; that, as we said before, where special strength is required, it is given by the addition of elastic fibres; that the elastic tissue only restores them to their former size and form after muscular contraction of the middle coat; that this elastic power assists the ventricles *only*, whilst the force is with the latter, whose functions are to move the blood in the already full arteries and overcome the resistance of their walls; that, in truth, it is elasticity, a pure mechanical function, which keeps up the steady stream.

Whilst dullness of action in the arteries may cause enlargement of the heart, it would be well that we now consider this fact, more especially as it applies to the momentum of the circulation, and also to the theories by which we seek out the proximate causes of chronic disease, a condition attached to various organs of the body especially, and dependent, apart from the vital or nerve force,

upon the persistent errors of nutrition which result from defective circulation.

It is clear that in the lungs, the lesser portion of the circulation, but little can be referred to a mechanical action such as controls and regulates the movements of the heart; yet it is nevertheless influenced by a similar cause, as will be more particularly touched upon when we inquire into the sources and effects of muscular movements. For it will be evident, in this and all like cases, that elastic force is ever subordinate to some other form of motion, and to be reckoned merely as an auxiliary thereto; while there are other chances of error against which we should be equally on our guard.

There is no such thing as a vacuum created, either by the expansive faculty of the lungs or that of the ventricles of the heart; the thing is inconsistent with the purity of the mechanism of the circulation, and is easily disproved. In the first instance, there is amply sufficient power in the contractile force of the right ventricle, to propel the blood into the most remote or the smallest branches of the pulmonary arteries; and in the second, there is an adequate propelling power in the *columnar force*, which, after each contraction of the left ventricle, urges it onwards into the right, despite any resistance opposed to its progress. The uniform character of the latter force will be clearly exem-

plified if we consider the numerous seeming obstructions actually overcome. The *portal circulation* of the liver into which we need not here minutely enter, is one great barrier existing in the chief division of the venous branches of the circulation, as a portion of the returning blood is for a time thus diverted from its course, having to ramify through the lobular and interlobular veins of that organ, and then regain the *inferior vena cava* leading up to the right orifice of the heart.

The gravitation of the blood, once a misconception, but long since disproved by physiologists, is another matter of study, though of less importance to our subject. Were such gravitation existent under any circumstances than those of actual death, the whole order of the circulation would be annulled, and our proofs of the unity of the circle, the one originating control of the heart, and the columnar force, be alike disparaged and set at nought.

There is no other than the one inherent power resident in the independent action of the heart, by which every process and tissue of the body is nourished and repaired; and truly, if our admiration be called forth by a contemplation of the most trifling details of that great and incomprehensible machinery by which "we move and have our being," there can be none more strikingly unique in its design, or more eminently a reflex of Him whose

unerring wisdom endued it with adequate power and vitality, and permitted it to possess that power and vitality entire during the allotted period of human existence; rendering it at once *dependent* in the unity of the creature form, and again without dependence both for the safety and permanency of the high duties it unceasingly exercises therein.

Innumerable, however, as the forces are by which the unity of the animal framework is maintained, there is none more prominent, or more active in its specific and ordained duties, than that, the seat of which is in *muscular tissue* of our bodies. Hence we trace, even in the conventional usages of society, a direct acknowledgment of the effects of muscular exercises, and a sort of intuitive perception of the sad consequences of inert habits, which need not the established truths of Science either to strengthen, or, as it were, to open out. An instinctive reason urges this necessity upon all members of the animal creation alike; it enforces a law of nature by means which produce abundant gratification to the creature in whom it is evinced; it even exhibits to the sentient or perceptive faculties of the being the phenomena of "life" and "death"—as characterised in the first by *active movement*, and in the second by simple *cessation of movement*—while it spreads abroad with unerring order the impress of a oneness of design equally upon the denizen of the forest or the plain.

It does not, however, point out the source of the *spiritual* part of that "life," nor does it go beyond the manifestation of that which is alone clear to man as the *organic proof of vitality;* but it raises before him certain distinct signs, not only of those circumstances which apply to the maintenance of his health, but to the perfection of his bodily existence, and the varied enjoyments which spring from the ordinary operations of the universe to which he is attached. With this force likewise the chemical, dynamical, and other prominent laws of the human system are associated, the effects of temporary or permanent stagnation overcome, and all parts separately or collectively roused into healthy vigour.

Thus, the movements peculiar to the life of animals are termed "organic," that is, directed to a specific end, which, so far, seems to be the result of organisation. Yet, since Science has been cognisant of the aberrations, impairments, and changes, which ensue commonly in the "accidents" of existence, we can no longer use the term arbitrarily,—we must not bring finite ideas to judge of the infinite,—nor can we do otherwise than view organisation as the instrument of something higher still, something that cannot be in itself a compound, but a "simple, uncompounded, and indivisible" agent, such as we conceive an immaterial principle to be. It can be

alone on this principle that organised unity is itself effected.

We do not, however, purpose here either to weary the reader with like discussions, or to quarrel with the term "organic" as it stands; apart from any supremacy of function it is a very good term, and one well adapted to explain many of the phases of animal life.

As must be apparent to almost any one, the great bulk of the animal frame is made up of muscles. To give attachment to these muscles, to act as levers and pulleys, as well as to strengthen and impart consistence to the entire fabric, nature has formed the bones, which, in the head and parts of the trunk, are arched, or present grooves, depressions, and flattened surfaces, for the attachment of muscles or the passage of tendons. In some cases they serve as levers, and these may especially be found in the long bones of the limbs, which are hollow cylinders, so formed and constructed as to resist pressure and violence, or to support immense weight. The bones of the skeleton are, therefore, organs for the support of the animal frame, the beams and timbers, as it were, upon which rests the general superstructure, and by which its firmness, durability, and consistency are rendered perfect. To this extent we can alone deal with them, while we are left to consider them merely as passive agents, subservient to muscular power and development.

It is not in the province of a work of this nature to enter at large into the structural peculiarities of the muscular tissue, but rather to apply its uses in the economy of man, to certain considerations on which his activity and health are unitedly found to depend. It may, however, be necessary to mention, that the *fibres* of muscles are so arranged, that a greater or lesser amount of force may be developed in action, and among the most prominent instances of this adaptation may be reckoned the *lineæ transversæ* of the *recti* muscles of the abdomen, which are tendinous lines answering to the abdominal ribs of reptiles, and, being placed at equal distances apart from each other, serve to multiply the fibres, and consequently the force of the contractile efforts of the muscle. The filaments and fibres of muscles may be said to elongate of themselves, "letting go" gradually, and with a rapidity proportionate to their compactness and strength, as well as to the requirements of the animal.

The chief property of muscular tissue is that, independent of the nerves so far, it possesses an inherent power of contraction, and this power seems to be maintained so long as it is supplied with arterial blood; in fact, so long does it both perceive and respond to stimulus as its nutrition is kept up. Thus when, by any accident to this tissue, its nutritive vessels are impaired or rendered

inefficient, the whole is paralysed and useless, remaining so until the circulation within it shall be re-established. Numerous experiments have proved this, together with its capacity for receiving and answering to stimuli foreign to that usually supplied by the nerves. Experiments have also shown that, when the muscles appear tougher and harder during contraction, there must be an equivalent amount of resistance; as, when separated from their tendons, or from other tissues to which they may be partly attached, the same contraction ensues on stimulus, though of a nature more soft and feeble than in the first case. And thus we may perceive how the enormous power of certain muscles is produced, the aggregation of fasciculi or bundles, which in themselves may contain some hundreds of primitive fibrils, taking place in consecutive order, and yielding the required force by their mutual position and adaptation. A striking instance of this force produced by the simple aggregation of fibres is given in the case of common rope or ship's cable, for in these we find that increase of resisting power is given in the form of the cable or method of combining its strands, whilst rope-makers are aware that there is a degree of twisting, so to speak, beyond which they dare not go, lest they damage, by too great an amount of tightness or compactness, the force of apposition in which consists the strength of the fabric. The form

then of these bundles of muscular fibres, brought together as they are by the sheaths of enveloping tissue, aids in producing the greatest amount of required force, whilst, at the same time, no more destruction or damage ensues than that which follows in the active functions of other tissues of the body. The *mode of contraction* is therefore said to be effected by "an approximation of the constituent parts of the fibrils," so that they become "closer, flatter, and wider," without any diminution of bulk, gaining in thickness what they lose in length.

Following the law which regulates the supply of blood to all the tissues, in proportion to their activity and use in the economy of the human structure, it must be evident that the muscles are most abundantly supplied with blood-vessels. As we have before said, when this supply is cut off, the muscle is paralysed and rendered inert. These vessels not only convey the necessary materials for nutrition, and the repair of waste,—for muscles, especially, are always wasting,—but for the conveyance of oxygen, which is held to be the chief element of contraction; thus, when the blood is retarded, the muscle becomes paralytic, for the oxygen is then supposed to be excluded. How far the quality of a reagent may be applied to the amount of oxygen taken from the blood, which is doubtless greater in

extent than in the case of any other tissue, we have yet no knowledge, nor does our present view demand any expression of the current opinions thereon; we merely have to deal with the *mechanical forces* of this all-important tissue.

The minute blood-vessels lie in parallel lines, in all spaces between the fasciculi or bundles of fibres, abundantly anastomosing or uniting with each other. They, in fact, ramify in the different sheaths of the muscle in an arborescent form, thence leading into the spaces between the fasciculi, so that there may be said to be two sets of vessels, one for the sheath and the other for the fasciculi. Thus much it has been necessary to mention regarding them, in order that a more complete view of the method of supply may be obtained, and the perfect envelopment and order of the entire substance of a muscle be made manifest.

Muscular sensibility is of four kinds: viz., *sensation, fatigue, effort,* and *position.* These we need not separately dwell upon. It may, however, be taken for granted, that common sensibility implies "a man's feeling when he is touched." He derives, also, sensations peculiar to his muscles and many other of his tissues,—though the root of this may be traced to the nervous system. A common example of this faculty is observed in the case of *fatigue,* which of itself implies a change of materials;

that portions of the muscular or other tissue are worn out, and crave repair, and to this knowledge the nerves are certainly the channels. Thus, *hunger* is usually ascribed to the blood,—it is that which hungers,—not the stomach, which, experiments have long since proved, may be cut out without this feeling being removed. The *voluntary* muscles are those usually overworked, and then fatigue is felt, obviously from their more direct communication, through their nerves, with the brain.

To accomplish that rapidity and dispatch which are necessary to the perfect functions of the animal, as well as to evidence the extent of its laws of development and design, Nature has made the limbs of animals to be levers of the third kind. This, as we all know, is procuring speed at the expense of force. The socket of the bone is the fulcrum; a strong muscle, such as the *deltoid*, for example, attached to the bone near the socket, is the *power*, and the weight of arm and its burthen, in this instance, is the *weight*. It would, at the same time, vastly puzzle man to devise means for the adapting of any forms of combination to his own levers of this kind, such as Nature itself brings easily into play; impressing us in this, as in all its works, with that unity of design to which we seldom if ever attain.

The *movements* of muscles are *original* or *inherent*,

the *force* being in the muscular and the nerve fibres. Two great divisions have been created, the "voluntary" or "animal," that is, those under the immediate influence of the "will" of man, and the "involuntary" or "organic," that is, those not under the influence of the "will," or only partially so, and which are affected by stimuli of which the mind is not conscious, until at least the occurrence of such stimuli is apparent in some form of construction or change in the tissue itself. Of the first kind, the examples are those of the limbs and trunk; of the second, the alimentary canal, urinary bladder, and, in fact, all contractile tissues in which muscular may be mingled with elastic fibres.

The *voluntary* muscles answer immediately to stimulus, their fibres contracting simultaneously through the whole extent of the muscle, while the contractions of the *involuntary* are slow and continuous, one portion of the mass communicating the original stimulus to other portions, and so on. Again, muscles may be in action, although they do not absolutely contract; as when a man tries, but cannot raise a weight. As a general rule, the extent of *shortening* may be taken as one third of their entire length. These contractions are, moreover, limited by the joints and ligaments, as well as by other impediments, so that it is only on removal from the body that we can judge accurately of the

true extent of contraction of which muscles are susceptible. The most remarkable circumstance connected with this matter is, that they can contract even to the thousandth part of an inch! The majority of fibres, including both the voluntary and involuntary, contract simultaneously, the length of time determining, in each case, the length of contraction. As far as *velocity* is concerned, it is held that there are about 4000 movements in a minute. In a man running, there will be about 100 in a second, and in the wings of flies and other insects, probably about 4000 in a second. The necessity for a firm attachment to some hard and immoveable tissue, is accounted for by the existence of the osseous framework of our bodies, for, we find, that where tendons are divided the contractile impetus is lost or overcome. The influence of the circulation of blood in the vessels which supply them, is made equally clear, for we observe that, during sleep, the muscles have tone and fulness, though they be not in action, but, in paralysis they are, on the contrary, drawn down and flaccid. The terms *contraction* and *relaxation* are thus technically expressive of the condition of active exercise, and of the cessation of that exercise.

The ordinary degrees of what is called *effort*, may be connected with the senses, such as the sight of the eye; so, also, a man becomes cognisant of mus-

cular efforts, and of the strength required of him. We are told that, in the position of muscles, we are constantly learning the "position of feeling" of muscles. Before a voluntary act there must be a sensation, as when a man loses the sensibility of a limb he cannot move that limb. Cases, illustrative of this, have frequently been recorded by surgical writers, where persons who had lost the faculty of touch, and its consequent perception, yet could bring the necessary muscles into play by fixing the sight both upon the limb and the object, and lost this power only on the removal of this particular sense to something else, or in another direction. So, also, have we power of "willing" muscles into position.

With regard to the *strength* we possess in these operations of our bodies, physiologists hold that the "will" may, in fact, be transformed into muscular force, as, when a man gives the whole of his *energy*, he is found to increase that force. Energy is, therefore, better than weight, or even size; for one experiment proved, that a man could lift with the *gastrocnemius* or large muscle of the calf of the leg, a weight equal to about 711 lbs. To extend the four conditions of contraction, we may say that the following principles or ingredients are required, namely,—a supply of arterial blood with its bulk of oxygen, nervous force, a healthy state and tone of the tissue, a proper attachment of fibres, and perfect

attachment of the tendons. In the stimulus for those of the *voluntary* order, the brain, it is believed, must send out its nerve-force, whilst that of the *involuntary* or *reflex* must proceed from the spinal chord. And this is clearly proved in the cases of apoplexy and palsy, where muscles remain long inactive and ultimately degenerate. The "will" only acts on the *involuntary* when such are associated with the voluntary. The stimulus of air or cold acts quickly and powerfully on the involuntary, but rather decreases the powers of the voluntary. The latter is an event well worthy of the most attentive consideration. When, too, we find that the muscles take at least one-half of the nerves of the body, and that these nerves run *into* the fasciculi in most minute branches, and divide as the blood-vessels do, we have very strong means afforded us of judging how vast an influence the muscles may exercise in increasing the activity of nervous force throughout, as well as the general circulation in the blood-vessels.

To pursue still farther the important considerations into which we were drawn at the latter portion of the foregoing paragraph, we must dwell upon the bearing and effect of voluntary and involuntary action in muscles. Yet there is an apparent difficulty here which might possibly confuse the uninitiated; for it is found that the structure of

muscles does not exactly correspond with the voluntary or the involuntary modes, since muscles subject to the "will" perform many kinds of involuntary movements, and again others, ordinarily unaffected by the "will," are found to respond to mental stimulus. Enough has been said already to support the distinctions absolute in a deeper investigation of this particular tissue. The term *voluntary* clearly implies the agency of the will in muscular movements; but there are other forces no less peculiar to the muscles in the active functions of existence, of which it will be well to treat.

The chief of these have usually been styled "automatic" and "antagonistic." The former is that species of action over which we have little or no control, which is in a measure instinctive, and results from certain causes which, though partially obscure, are nevertheless signs of vitality, and a cognisance of the requirements or necessities of the entire system. Thus the great bulk of automatic movements are *sympathetic,* and are to be observed chiefly in the persistent functions of the heart, of the inspiratory movements, and of those appertaining to other organic structures whose duties are constant and unvarying in the healthy state. It is not needful to consider the nature and extent of the stimulus, whether external or internal, by which these acts are produced, as they do not in either

case alter the condition or order of contractions; there is obviously a sympathetic chain of causes ensuing with unerring certainty, so long as the healthy condition of the animal functions is manifested. Their continuance, also, as before stated in the case of the heart, after the removal of such parts from the body, exhibits an independent action which obviously may be taken not only as a safeguard to the integrity of individual parts, but as a somewhat sure guide to the practitioner in the curative efforts he may enjoin. Were it otherwise, we should be utterly puzzled to account for all or any of those persistent actions which are equally maintained during periods of perfect rest or of sleep, when the mind seems to forego much of its voluntary control, so far as the human being is himself concerned, or at least that control over these clearly-established automatic movements which are more evident on waking.

The *antagonistic* force of muscles is, perhaps, after all, the most important. Without a knowledge of the existence of this force we should still continue, and often do employ, our remedial agents in vain. When we consider for a moment how the entire framework of our bodies is supported,—and that not only for a brief space, but throughout the livelong day and night,—we find that the muscles are ceaselessly balancing and correcting the natural

as well as the artificial calls that are made upon them. By this all position is determined, no less in the healthy than in the diseased conditions of the human subject. People adapt themselves to all the circumstances of health and disease. Nature, as surgical writers inform us in language at once applicable and practical, on certain occasions sets up a resistance to further violence, and secures the damaged parts against secondary injuries; it also mitigates thereby the sufferings of the patient. But yet, if Art may be in any case allowed to assist Nature, it must strike the eye of the surgeon, and particularly of him of the orthopœdic school, that the fair operation of the antagonistic force is alone wanting in many cases where he could revive it; but he neglects to do so, or abandons it altogether, and alternately screws and bandages the affected limb, till the very muscles atrophy, and their antagonistic and other forces are together lost. The different groups mutually balance each other; and among them we observe flexors and extensors, pronators and supinators, abductors, adductors, and rotators, together with those which act as stays or supports to our bodies, so that the state of inaction or rest does not absolutely indicate entire relaxation of muscular contraction or energy.

In the erect position of man and some other animals, there are obviously a multitude of muscles

brought into action; the whole series of groups separately or collectively antagonising each other. The most remarkable of these is undoubtedly that group called the *erector spinæ*, with its multitudinous slips attaching to the ribs and the several processes of the vertebræ, the whole acting, in simple language, like the stays and shrouds of a vessel. The same may be said of the zygomatic and other muscles of the face, which are commonly seen, in paralysis of one side, to give those singular and at times frightful distortions to the countenance. In *lateral curvature* of the spine, which is clearly an absence of antagonistic or balancing power on one side, the matter is no less certain. The antagonistic force gives then, both to the muscles and the entire frame, all the forms of determinate position of which it is susceptible. Moreover, in the peculiar faculties of the musician, and in the education of all parts of our bodies, as well as in the movements which appear either awkward or graceful, there is evidence of that perfect system of training of which we are all equally capable, or nearly so, and by which we not only excel in life, but can also repair the damages sustained in its common path. For these great ends, upon which depends so much of the sensual happiness or misery we inherit, it is not necessary that we should know how the *will* acts in the brain, or whence it pro-

ceeds; it is enough that we perceive, without being able to account for intuitive faculties and movements, and, judging by their effects, learn to overcome and readjust our bodies to and from the abnormal conditions which proceed either from neglect or the errors consequent on our artificial state.

Before we close this descriptive account of muscular tissues, and proceed to apply such knowledge to the positive treatment of *abnormal* conditions of the body, let us turn our attention to a few conclusive facts regarding them.

In the first place, we find a marked distinction between the muscles of animal life and the muscles of organic life. In the former we have a powerful and simultaneous contraction of the whole bulk of the muscle, and in the latter, as in the uterus, digestive canal, and such like, we have a contraction when stimulus is applied and relaxation when it is withdrawn; whilst the former, as the maintenance of the body in its erect position will show, can support that contractile force for a considerable space. In the latter, however, no amount of heat or electrical disturbance has been observed, or at all equivalent to that resulting in the former. Here, heat is abundantly generated by all active movements of the body—an event equally clear to the experience of every person. Vital heat, so necessary

to the activity of all functions required to be in full operation during the great calls upon the system produced by muscular exertion, is no less a result than is increased movement in other parts, as, for example, the stomach and intestines, which are acted upon by the muscles of the abdomen.

It is not easy to account for the development of heat simply by muscular contraction. Some have alleged the friction of fibres as a cause; but it is rather held that it may be due to the *chemical* changes produced when a muscle contracts. The *heat* is equally diffused on coutraction throughout the substance of the muscle, which has become, as stated in another place, completely oxydised. Hence it is during the chemical conditions which ensue, that something like electricity is given forth; and this may partly explain the quality of *inherent* contractile power which muscles evince, though the increased supply of blood, which, it has been proved, is absolutely required for the office of contraction, is the channel by which the material circulates upon which such chemical or electrical phenomena depend. It is partly this supply of blood likewise, which, exhausted of its nutritive particles, causes the muscles to demand occasional rest, though the period of recovery be comparatively short; estimated by some at about five minutes for twenty minutes of active use. As in the case of the heart also, it

is stated, that in the absence of the requisite supply of arterial blood to its substance, venous blood will continue muscular action longer than no blood at all. The muscles of persons under the influence of chloroform, or at least so soon as the blood shall have become saturated as it were with that compound, are flaccid and atonic, affording those facilities to the surgeon for the reduction of dislocations and the like, which the antagonistic efforts of nature, to retain the parts even in their new position, display in this important operation in surgery. Chloroform, it would seem then, removes for a time the inherent power of the muscle; but, in reality, it does not do this. It acts upon the nerves through the blood, and may be considered only in its general effect upon the entire nervous system. Paralysis has, therefore, been said to be due rather to the condition of the nerves than to that of the muscles.

As to the *strength* of muscles, it has been reckoned that they can support from five to seven hundred times their own weight. From all that has been said hitherto, it will be seen that nervous influence is the common stimulus to muscles. Where this is damaged, either in the brain, or locally in other portions of the frame, as in apoplexy, hemiplegia, and paraplegia, the muscles remain for a greater or lesser length of time inactive, and their tissues

degenerate; the latter, we observe more particularly in old people, and such as are afflicted with palsy.

Regarding the latter, the most remarkable instance we possess of the separate characters of the two forces, namely, the nervous and the inherent contractile functions, is to be taken in that rigidity of the muscles after death, known as the *rigor mortis*, and ensuing as well as lasting a few hours, according to the state of the patient, or the disease which had operated previous to dissolution. This rigidity follows in all muscles and contractile tissues alike; it is a final expenditure of the capacity of contraction; commencing slowly from the head and neck down to the trunk and lower extremities. The nervous *control* has, in fact, passed away, for the irritability of muscles implies their contractility and perception of stimulus together, while the last symptom of the inherent force is alone visible. Five or six hours may yet intervene after death, according to the bodily condition in which the patient died. In those who have succumbed to phthisis, or after long continued or chronic diseases, there is an early coming on of the rigidity, and equally speedy relaxation, while in those who have perished by violence, or by lightning, there may be none at all. The rigid power of bodies, so long as this condition lasts, is so great as to prevent anything approaching

to dispute regarding the real force which is here operating. And to these few remarks we may add the testimony of one writer, who says:—"Its occurrence is not prevented by the previous existence of paralysis in a part, provided the paralysis has been attended with very imperfect nutrition of the muscular tissue."

By this time it must have been apparent to the reader, that, among all the active agencies by which the several functions of animal life are performed, the principal one resides in that which has been designated here and elsewhere the Muscular System. The ordinary routine of our daily existence, the common emotions of the mind, and the various movements which assuredly result from these emotions, are alike the symbols of vitality, the expression of natural requirements in the way of exertion or repose, as well as safeguards of health, and monitors against the insidious and rapid inroads of disease. If we look around us in the world, and survey the vast mass of mankind as it is, and not as it indeed might be were not the claims and assumptions of artificial life, the still more pressing duties by which we purchased, at times very dearly, the partial meeds of all-paramount civilisation,—if truly, we care to mark at all the hurts and damages which periodically, as it were, bow us down with afflictions, in which state of imperfection the human form as it

comes from the Divine hand undoubtedly embodies no part *as a cause*,—if, in fine, we contemplate all this under the guidance of that high and exalted spirit of reason with which we are endowed, and which no charters, or ceremonials, or authorities amongst men can either subdue or strengthen, we shall feel that the normal and abnormal conditions of our bodies are much under our individual control, abstractions only to such as are too indolent, or too careless to keep watch over their frames with the same vigilance they extend to the grosser pursuits of their career. It is telling no new thing to say this, nor is it claiming a greater amount of foresight than we observe evinced even by what we stigmatise as the brute creation: yet it is one that it appears must be repeated again and again (like the crusade long since opened out against the wearing of *stays* amongst women), that the sum of our *duties to ourselves* may be one day acknowledged. *Exercise* is an operation which, time out of mind, the most indifferent persons have failed not to urge and to applaud; but, it is one nevertheless suggestive of effort, trouble, and possibly of inconvenience. Seldom doubted, and less followed, it is a law of nature which the voice of science continually pleads for in vain; it is too great a truth, and perhaps too great a necessity, to be brought constantly face to face with an error equally potent—esteemed among

men as the *otium cum dignitate.* The dignity of what? the "dignity of nothing."

But it is not the mere exercise of walking which imparts tone to the several functions of the animal, although in this act a very considerable part of the muscular system is brought into play. We may fatigue ourselves by this process, and produce more harm than benefit to the cause of health. What are we to do then? Why, we must not be content with exercising the *extremities,* we must give every portion of our structure its proportionate amount. We admit that it is easier to write this than put it into force—the literary act is itself a forfeiture to the rule. But what follows? Not that the suggestion is otherwise than proper and correct, but that it cannot be at all seasons carried out. Exactly so. Yet we should not seek to enforce that which every one knows as well as ourselves, but in furtherance of our views of medical treatment. Yes, it is because we believe that nature has from the first marked out a path for science in this matter, by which, and in accordance with its own laws,—in consequence either of our indulgencies or the seeming necessities of civilisation,—the lost balance of the general system may be restored, and local lesions or impairments arising from one or the other, separately and safely treated. It will require no great stretch of intellect to fathom this

method, provided the reason be unbiassed by ancient or modern prejudices; for the laws of Anatomy and Physiology are adduced from no baseless theories; deep and subtle alone in the occasional misty technicalities of the schools, they are the offspring of actual investigation, changeful only in their particulars, or varying with the tastes of men; in fact, they are the "bulwark of our faith" in the remedial agents of mankind, such as they are, and upon them can we alone ground our claims to public consideration. With these laws for our guide, let us now ascertain of what the muscular system is susceptible, either to the prolonging of health, or the counteracting and subduing of those morbid changes which ensue in our bodies. With regard, however, to the former, health, it must necessarily be one of secondary consideration here, the object of all medical writing being ostensibly to the treatment of disease, though we by no means sanction the apathy of those who, by "letting well alone," as it were, fall into a snare at times cruelly disastrous.

Physiology, then, proves that the *circulation of the blood* is mainly accomplished by muscular effort of some kind or other. Of this the venous and arterial systems together partake. It is not, however, a matter of much importance to consider the extent of influence which either division separately enjoys; yet, there are a few facts worth noting. It

is found that, in the case of the veins, numerous valves, such as have been described elsewhere, are placed in those branches or trunks which, by their position, may be affected in muscular movements, and an absence or entire lack of these valves where such movements do not operate. Hence, muscular pressure chiefly affects the veins by accelerating the onward current of the blood in them; at one moment forcing the stream back upon the valves, or driving it forward, and again in the former example removing a temporary ligature, so to speak, and admitting the beneficial effect of the *vis a tergo* or the accumulated pressure from behind, which pressure is the result of the ordinary *columnar force* of the circulation. That the term *ligature* is not inapplicable, may perhaps appear when we call to mind the appearance presented by the integument of an arm or leg to which a tourniquet has been applied for a few minutes only. On suddenly relaxing the screw of that instrument, we observe a rapid blush suffuse the entire limb, a blush which has spread with a rapidity far beyond the ordinary impetus of the natural circulation. In common expiratory efforts also, it has been remarked, that the stream of venous blood becomes stronger, and, in venesection also, when the muscles of the fore-arm have been put into action, the venous stream has increased considerably.

Notwithstanding it should be held, that muscular pressure is more necessary to an increase of the circulation for some specific object, such as a speedy propulsion of venous or arterial blood, than as an indispensable adjunct to it; for instances are given in the conditions of paralysed limbs, which cannot subject their veins to muscular pressure, and in which the venous circulation is yet kept up. This evidence, however, is somewhat of a negative kind; for we already know that the venous stream, even in a paralysed limb, must be subject to the *columnar force* proceeding from the heart, while, at the same time, we observe in the very atrophy of that limb, a something wanting to its healthy nutrition, and this certainly originating in the slow movement of the arterial and venous streams consequent on its inactive condition. An experiment of Magendie established the fact of the stream of blood from a divided vein being increased at each effort of expiration, on the assumption that the pressure on the blood in arteries accompanying expiration is "propagated through the capillaries to the veins." While, however, a subordinate character is here given to muscular action in the case of the veins, there can be no doubt of its one and undivided effect in promoting and nourishing *arterial circulation;* for the muscles are said to *imbibe blood* during their partial or full contractions, and it is equally clear that each element

of nutrition contained in that blood is thus hurried on with increased force to its destination. Moreover, the absorbing power of the blood-vessels, that is, the faculty by which they remove the soluble materials lying around them in the several tissues, whether composed of waste matters or of morbid products, is vastly increased, and that which, if allowed to remain, would obviously, as it undoubtedly often does, produce disease, removed with a degree of activity greatly promotive of the health and vigour of the subject. Its influence, therefore, on the arterial stream, renders it at once a supporter of health, and a powerful agent in the diseases connected with it.

It may well be asked, in these days, what is disease? As applied to our own sufferings it can only be considered as the abnormal condition of a wondrous yet perfect machine—the equilibrium of which we of ourselves, or in the state of toil, hardship, and danger which are more or less the common lot, have for a time o'erturned. If we think to read it in the inventions of men, in their hundreds of mystic terms, many of which are the pure coinage of the ardent aspirants after fame in the world of medicine, we shall be grievously disappointed—the search has ever been endless. New diseases are constantly being found and as assiduously classified; for an abnormal condition may occur in any, even

the most minute parts of the frame, and puzzle science, in its classifying ardour, to keep pace with its erratic movements. Have we found out, then, any distinct type or form to make that clear which has been dark and mysterious in all ages? We fear we have not. But we should rather be followers of Nature than diviners of her mysteries. We observe that, in abnormal conditions of the human structure, she sets up certain manifest resistances and appliances, diverting the progress of what would eventually become morbid action, and that these processes are brought about by certain instinctive faculties we possess. If, then, Nature does this in the natural state, cannot we, in the artificial, apply our knowledge to produce good with the instruments which she has already placed in our hands? These things are more than worthy of the serious attention of all rational men.

Pursuing the subject of the effects produced on the venous and arterial streams, and with them on absorption and nutrition, by muscular action, let us put this simple question to ourselves:—Why are we told to rest after a meal? The common reply is, that digestion proceeds with more power and perfection during a state of rest. This is assuredly the case, generally, though it may not always be so; yet the latter is a mere exception to the rule. But why is it so? should we not understand the *rationale* of

this matter? These are very apposite inquiries. The answer is this:—The stomach is an organ very abundantly supplied with blood-vessels for the secretion of the gastric juice necessary to digestion; this supply of blood, until the stimulus be given by food taken into the stomach, is comparatively small, whilst it is obvious that the amount of gastric secretion depends on this supply; consequently, on the reception of food, its vessels expand, and the stream of blood is increased, robbing some other organ or organs, inactive at the time, of the same proportion of blood. When, therefore, we are told to rest, we are directed to avoid giving occasion to any abstraction of the necessary amount of blood that is demanded by the stomach; and, as we already know, no muscular contraction can take place without blood, the thing is patent to the meanest understanding—that if the legs and arms, with their numerous and powerful muscles, were alone put into action, the stomach must suffer to an extent if not to stop its secretion at least to prove hurtful to the cause of digestion. There can be little dispute as to the occurrences here detailed. To the still-existing disciples of venesection there may be some difficulty, but there can be none to the physiologist.

Perhaps, too, no better example of the effect of certain forces over the circulation could be found

than in this of the stomach. Derivate the blood from it during the secreting process and its function is partly suspended; so we should find the case in any other organ of the body, extending even to the least important among the tissues. Although muscular exertion does not actually interfere with the routine of the circulation, it influences that routine in several ways. In the first place, the over-activity of a part, whether it be of the brain, secreting organs, muscles of voluntary or organic motion, determines a flow of blood towards that part; and this determination, slow at first, gradually acquires strength,—is, in truth, *newly educated to a wrong motion,* and congestion follows, with its after-chain of consequences. It would be as easy, then, for the practitioner to avail himself of his knowledge of this train of events, and to lessen if not remove such congestion, as to apply the many impotent methods which medical art has long since condemned. If the blood follow, in sure order, the movements of muscles or other portions of our systems in a healthy state, it will do so in disease, on our exercising those movements *locally* which our judgment may indicate. And when we consider the extent and surface of the muscular tissue alone, we shall have no trouble in finding out methods to relieve oppressed organs or parts. A thorough acquaintance with the principles of Anatomy and Physiology is

alone requisite: further there is no experimental theory in the matter.

The influence of that recurrent pressure exercised by the muscles of the abdomen, is felt not only over the intestines and stomach, as an assistant to their ordinary functions, but on the *portal circulation* likewise. This subsidiary part of the general circulation is so essential in its nature, that we may trace many distressing morbid conditions of the inferior region of the body to it as a cause. The affection commonly known as *piles,* is due to a stagnation of blood in the hæmorrhoidal veins, consequent, it is believed, on an impediment or weakness existing in some or all of the several trunks which unite to form the *vena portæ.* In this view it will be easily foreseen, not only the liability of the liver to periodic derangement, but that that organ is of all others most exposed to the dangers which attend an absence of ordinary stimulus. It may be the fashion of the present day to neglect this all-important organ for the purifying of the blood, yet when we consider the number of diseases which are tacitly referred to it, there can be offered no just reason for its fashionable dishonour. It is evident, at the same time, that, as far as the entire circulation of the blood is concerned, there are more hinderances set up here than elsewhere in our systems. If we are led to assume that its circulation can be perfectly

maintained by the common columnar force of the sanguineous circle, we must not leave from the account some additional force which may be present to hurry it onward, through the portal canals and interlobular veins, into the entire substance of the liver. Had the ascending venous blood, without ramifying through this organ, to pass through the various trunks into the *vena cava inferior* at once, no additional force would be required. The additional force is then apparently yielded by the constant stimulus of the contents of the abdomen, acted upon by the superficial muscles. The chief of these are the *recti* muscles, which, by their contraction, as we observe often in the act of coughing, draw down the ribs and expand the chest, while, from their attachments, they are the main agents in raising the body from the recumbent posture. The practitioner, however, may impart a more perfect stimulus still to the portal circulation, by bringing the oblique muscles into play, and more particularly that which is known as the *transversalis*. This deeply-seated muscle, the fibres of which indigitate with those of the diaphragm, has, in certain positions of the body, strong influence over the portal circulation, and is somewhat assisted thereto by the *internal oblique*, the latter muscle having, in common with it, attachments to certain processes of the vertebræ. The *transversalis* loses nothing of its

power in this operation by its enclosure of the *quadratus lumborum,* for although the latter in its office of assisting the spine may often antagonise the former, yet in the position of the patient, while the pressure of the *transversalis* is being brought to bear on these parts, its office will, for the time, be nearly if not entirely suspended. Did our allotted limits permit, much might be profitably urged in support of these methods of stimulating both ordinary and morbid action. It must be nevertheless obvious to every inquiring mind, that the abdominal muscles play a more active part in the economy of the viscera than is usually allowed of them. Among all the numerous trunks and branches which unite to form the portal circulation, there are none more constantly liable to morbid action than the hæmorrhoidal veins, possibly from their being so remote; but it is evident this can only arise in the absence of that natural stimulus exhibited over these parts, and that stimulus mainly residing with the abdominal muscles.

The *circulation in the brain,* so obviously connected one way or the other with the majority of abnormal conditions of the system, is another matter which can be affected by muscular action. The various angles produced by the position and modes of attachment of the muscles of the neck, of the occipital region and the spinal column, intimately connected as they are with the large and small

trunks of arteries proceeding thither, may be applied so as to increase the ordinary propulsion of blood through the substance of the brain, and with it add to the necessary nutrition of that organ. There are many common efforts which we all instinctively employ for these purposes, either to diminish or accelerate the arterial flow. By elevating the arms above the head we decrease the circulation in the brain, either by extending the channel of blood in the subclavian and brachial trunks, or by decreasing that of the common carotids through the superincumbent pressure of muscles and integuments upon that trunk. But let this effect be produced as it may, it is certain that persons, such as labourers and young people, desirous of promoting sleep, usually employ this method, and with signal success. In many respiratory movements, in one especially, that of *sighing,* we not only relieve the heart but remove a degree of mental oppression for which we cannot generally account. We know, however, that strong expiratory efforts, affecting as they do the arterial system, are felt in the head to an extent which often makes us pause with a degree of fear, lest some damage might thereby accrue to the brain or its vessels. Where then the appliances of medical art are foreshadowed in the simple operations of nature, we may learn to apply our anatomical knowledge both to increase the nutrition in an

exhausted, overworked, or otherwise injured brain, and to relieve a partial or entire plethora existing there.

The combined forces of *inspiration* and *expiration*, the one muscular, the other elastic, are ceaselessly operating upon the circulation of the blood, and consequently maintaining the *life* of the animal. These are associated with a large share of the muscular tissue when there is a more than usual effort made. In the common course of proceeding, *inspiration* involves the *serratus magnus, serrati postici superior* and *inferior*, as well as the numerous *intercostal* and *abdominal* muscles. This constant call upon the muscular system for the means of producing the most important of all the vital functions is too manifest to admit of much dispute; and if we trouble ourselves to observe the resistance set up by phthisical patients in particular, against chest expansion, we cannot fail to attribute both the expansive force and the resistance to one and the same root, namely, muscular action. It will be needless, therefore, to dwell upon a subject which, from its constant and uniform nature, is open to the investigations of all men.

Again, an atonic condition of muscles, their atrophy or shrivelling, occasioned for the most part by that inactivity which is too often permitted in diseased subjects, may be alike remedied and

restored under a judicious application of the knowledge we possess in regard to their several uses. Among others of this kind may be mentioned that very prevalent distortion known as *lateral curvature* of the spine, which is purely of muscular origin, the too frequent result of tight lacing, or even using stays at all, and is alone to be safely treated by acting upon the muscles of the weaker side. And, with reference to the *cause* above adduced, it is not out of place here to support the common testimony of all surgical writers, who deprecate the use of stays in any form or under any circumstances; for it is in vain that the fair sex plead, in extenuation, that "the stays are not tight," "that they never lace them to the verge of inconvenience," and so on; we cannot admit their necessity at all, while we strongly denounce them as opposed to the rules laid down by Nature in constructing this portion of the frame. The form of the lower ribs, with their loose cartilaginous attachments, and particularly of the last two, which are "floating" as it is termed, will show at a glance how pent-up must be all the important organs of the viscera, and what unattributed diseases arise from indulgence in this cruel custom. Much might be urged, also, on the score of beauty and proportion,[1] where Nature alone is

[1] Erasmus Wilson, and others, on 'Diseases of the Skin,' &c.

the modeller, in whose design we perceive both. But what are the results of this inhuman custom? —for, after all, it is so. Briefly these; diminished action of the diaphragm, so necessary to assist, by its downward constant pressure, the bowels and various secreting organs; constipation; hysteria; enlargement, hardening, or other morbid conditions of the liver; indigestion and neuralgia resulting therefrom; prolapsus uteri, with numerous affections of the organs seated in the pelvis; and, in fact, a chain of diseases, ignorantly presumed to be what are called "nervous," no less startling than all-sufficient of themselves to mar the happiness of "Nature's fairest work."

In fine, the exercise of antagonistic and other forces of the muscular system is no less under the control of the practitioner than are the various states of congestion and other diseases of the sanguiferous system. To commence at a point, we take the heart with the mechanical functions of its muscular structure; subservient to it, in the circulation of the blood, we find muscular coats existing in the arteries,—in truth, muscular fibres working everywhere, and proclaiming their intimate alliance with the moving faculties of life. *Congestion* arising in the tissue itself can be overcome by exercise of remote parts, diverting the stream by the simple imbibition of muscles when in action,—a circum-

stance we have already explained on the authority of physiological testimony. So, also, by acting upon the one stream of blood, can organic congestions be removed, not temporarily but permanently; for, as there was one simple cause why the current should set more largely to particular organs or parts, and increase, as all morbid courses do the longer they continue, so the diverting stream will itself increase by the mechanical principle here acting, and ultimately overcome the former. This is further proved in the evidence we have of the progress of congestion. It is, happily for our own safety, very tardy in its manifestations; it is often checked and removed by causes or effects unseen and inexplicable to the patient, but not so to the practitioner who is careful to follow Nature, and happy is he if he gain but a glimpse of her simplest proceedings.

That these glimpses are in reality furnished by the phenomena of congestion in its earliest stage, by the thousand-and-one impediments to the free course of the blood and its circulation through the most remote tissues, as well as by the signs of impaired nutrition arising from inactivity of organs or parts,—that these faint impressions of that nice balancing of the entire structure should be the adopted guides to man, in the trials and remedies he may apply, is palpable and unmistakeable

we need not waste time further to declare. One thing above all others is certain, that muscular force and power are present in all the operations of healthy *nutrition* and *repair* proceeding from the blood in its unchecked course.

Regarding the peculiar properties of *animal heat*, or the proximate causes of this active agent in the vitality of the human system, so much difference of opinion exists even at the present hour, that it becomes almost impossible to indicate fairly the mechanical forces resulting from its presence. That it holds a large share, however, in the general functions of organic life, and that it has an indispensable if not mechanical duty to perform, science has every reason to admit; nor is there other cause than the difficulty before alluded to, why we should neglect a principle whose power and force in the material world have long been felt and acknowledged. Therefore, without entering into the discussions which the yet imperfect investigations of animal chemistry have produced, we shall briefly offer a few of the leading conditions and facts which seem to us to connect animal heat intimately with the true mechanism of our bodies.

In the first place, an uniformity of temperature is necessary to the healthy condition of all animals, be they warm-blooded or cold-blooded; and common observation will readily discern, that the

abstraction or absence of heat or warmth in parts of the frame will be followed by loss of vitality in those parts. This uniformity of temperature appears, nevertheless, to belong more especially to animals, such as the human species, who possess a nervous system in its highest form of development. Hence men are found to be endowed with that faculty of *resistance* against heat or cold which may surround them in torrid or frigid climes, and which enables them to oppose the common effects of each, and bear themselves unharmed against either the fervent heat of the Tropics or the chill desolation of the Northern regions. Other warm-blooded animals can do this but partially, in consequence of the lower development of their nervous systems. Animals, also, of the class called cold-blooded, partake in their bodies of the temperature of the medium by which they are surrounded, having no physical resistance against excess or diminution of temperatures, and are thus rendered either dormant or active according to the inherent "vital capacities" they enjoy. That is, man is found to maintain what has been justly termed "permanent heat," while the temperature of cold-blooded animals varies with each change of the atmosphere or fluid which may surround them. In the latter class of animals, heat is said to be produced in proportion to their powers of breathing, thus bearing out the effect of certain

chemical combinations which it is well-known cannot take place without evolving heat. Thus insects, which possess in all cases a most perfect breathing apparatus, have a high temperature, ascertained to be about 2° or 3° above the surrounding medium.

Although we have but slight knowledge of the quantity of oxygen taken into our systems during the space of twenty-four hours, except so far as we can determine its amount by the quantity of carbonic acid gas given off during the same period, yet there are a few points that materially assist us in the inquiry. For example, men breathe more oxygen in cold than in warm climates; in fact, we breathe more oxygen in winter than in the summer season. In colder latitudes, people consume more animal than vegetable food, and *vice versâ;* so that our bodies may be truly said to keep warmer upon animal than upon vegetable diet. Therefore, apart from other agencies in the matter, the combinations which ensue from the quantities of carbon, hydrogen, and oxygen taken into the system are sufficient of themselves to generate heat.

The average temperature of the human body, in childhood and adult life, is supposed to vary from 98° to 102° Fahr., being from 1° to 2° lower during sleep than while awake. These differences clearly arise from the comparatively dormant condition of every function in the one case; whilst, in the other,

bodily exercise as well as continued mental exertion operate in the way of increase. This we all readily experience. Experiments too have long established the inherent powers of *resistance* which sustain the natural and sufficient temperatures of the bodies of animals, and particularly of man, or in the various conditions under which circumstances may place him, and but slight changes have as yet been observable. And by the same law or attribute the so-called "permanent heat" of warm-blooded animals is established, yielding them an advantage over the cold-blooded so great as to permit of their accomplishing many higher purposes of existence, for which the human race above all others is so pre-eminently ordained. So man, in common with many other tribes of this class of animals, can, by his powers of resistance, sustain the effects of a temperature of nearly 200° Fahr., by supporting that required in the healthy and perfect condition of his organism, and in counteracting that constant radiation which is taking place at all hours, as well as rapidly supplying the loss thereby occasioned. A knowledge of this faculty doubtless gave rise to the often-quoted trick of the juggler, who was in the habit of entering an oven with a piece of raw meat upon a dish, and returning after a short period with the latter perfectly cooked; but with his own person unscathed. This feat has been accomplished

by his own body being enabled to renew the vapour it constantly gave off, that vapour being also a bad conductor of heat, while the steak, or whatever it might have been, possessed no such resisting virtue.

If we are bound to adhere to any one theory respecting this subtle question, or rather to consider the source and development of animal heat, we shall not wander far from the truth, if we reconcile the first with those chemical changes which are momentarily operating in every portion of our frames, and the second with the admitted influence of the nervous system, both to increase, moderate, or hurry on those changes. In all active displays of nerve-force, and in one especially, that of increased circulation of the blood, every part of the body will speedily experience an augmentation of its temperature; and it is our lot daily to witness in the symptoms of natural decay or the failing powers of life, even down to the last struggle of all which closes this eventful scene, the undoubted agency of that nervous power which presides over organic matter in all its conditions but the last.

Nevertheless, the unity of the system does in this, as in numerous other instances of its self-reliance, forbid us to weigh certain individual causes of vital phenomena apart and by themselves; and, therefore, it behoves us to unite the chemical with the nervous theory, and watch narrowly the results of

their mutual dependence. Nor, as yet, has much light been thrown upon the exact nature of those chemical changes operating in our bodies, simply because of the variations found by experiment in the respective amounts of the elements subject to chemical combinations; although, it may be remarked, it is barely within the bounds of the present work to enter upon their qualities and effects. It is certain, that any or all of these combinations cannot take place without the production of heat, and that consequently, these elements being contained in and carried by the blood to the most minute parts or tissues, an increase of animal temperature must take place in proportion to the activity of the circulation. Again, the rapid or tardy circulation of the blood will depend much on the condition of the respiratory apparatus, be it healthy or diseased, constitutionally active or otherwise defective, and hence the source and strength of its development have been wisely associated with that peculiar function. So that, notwithstanding the loss sustained both by radiation and evaporation, an uniformity of temperature is kept up. In fine, in all stages of activity of the entire system the amount of bodily development is the largest.

It follows, therefore, that the perfection of those breathing powers which more than any other determine the ratio of production of animal heat, is

intimately connected with the nervous energy which is, after all, the main spring of those powers. At the same time we cannot attribute the evolution of heat merely to nervous action, yet that it is regulated, and in many cases accelerated by it, common observation will bear out. If the nervous system act upon the several functions of organic life, rousing, depressing, or otherwise controlling, it must do so in this instance. In cases of paralysed limbs the temperature of those parts has not only been found to vary, but actually to decrease to the extent of more than 20°. The same deficiency has been experienced in tissues where a division of nerve-trunks has been had recourse to, as well as in cases where damage has been done to nerve-centres. But the most conclusive of all have been those upon the bodies of decapitated animals, in which artificial respiration was tried without maintaining a corresponding degree of heat, but, on the contrary, serving the purpose of cooling the bodies of such animals more rapidly than would have followed after deprivation of life. Without dwelling, however, longer upon these important points, the reader cannot fail to perceive the connection existing between nervous force and that innate power of resistance possessed by animals whose nervous system is highly developed, and to which we have already alluded.

It must not be forgotten that this faculty of resistance to variations of temperature decreases with age; it increases gradually a few years after birth, then remains stationary to the period of adult life, and then gradually declines. In all processes of active growth and development animal heat seems to be at its maximum. Consequently we should hold ourselves forewarned against that prevalent folly in the rearing of children, which is called "making them hardy." Children have not only less powers of resistance to variations of temperature, but the development of their bodies requires that additional warmth should be administered; and possibly no means of speedily dispatching them to the other world could be more auspiciously applied than by a neglect of these simple and obvious precautions. Its great office in developing the frame is therefore all-paramount. Whilst, also, active exercise is perhaps the most effectual means of maintaining the required amount of animal heat in our bodies, still there is an equal necessity for a proper attention to external covering and artificial warmth in our dwellings. In regard to the latter we must ever be guided by circumstances, and with reference to the medium which may surround us both without and within doors. To this end we should bear in mind that we are constantly losing heat both by radiation and evaporation, the former

being larger in amount in cold climates, and the latter in warm, proceeding, in fact, in an inverse proportion to each other, the small loss in evaporation compensating for the greater loss by radiation, and *vice versâ*. We should equally guard against an undue extension of all artificial methods which may destroy as well as preserve. We should clothe ourselves according to the period of the day, and court the sunshine and the pure breath of heaven as often as we can do so without danger,—though much of the latter is purely imaginary and too often but the dream of the valetudinarian.

But, not only in the active development of our frames from the earliest period of embryo life is this subtle *force* apparent, it may also exercise a *motive power*, and that of a mechanical order, equally upon the molecules of our organism as upon those of inorganic matter generally. The common effects of caloric are expansion or augmentation of bulk, liquefaction or change from the solid to the liquid form, and vaporisation or the passing of a liquid or solid into an aeriform state. Many, if not all, of these effects, may be each moment of our lives operating in a manner at once uniform and perfect. It has been affirmed by one writer that, "variation is produced in the volume of all substances of nature by changes in the temperature and pressure to which they are subjected; *liquids and solids are amenable*

to this law, and serve equally to develop the motive powers of heat." With equal cogency may we believe with others that every particle of the human body moves in some one way or another; or, rather, that *molecular vibrations* take place in living bodies possessing heat. To a knowledge of the exact order of these vibrations we may possibly never attain, the mystery lying in the different effects of the vibrations of the molecules themselves and the atoms which compose those molecules. These questions are at present too obscure for practical purposes.

There is, however, a vast difference between the mechanical action of heat in organic and inorganic matter, simply in the fact that the *action* in the latter is acknowledged to be peculiar to itself, and independent of the nature of the agents employed to effect it, be these agents gases or fluids. The *vis viva,* which is one of the most marked attributes of organisation, is maintained in defiance of the common law which regulates the disposition of inorganic substances, or, at least, by powers which both originate and control the caloric of the former, distinguished, as it here is, by the term "animal heat." Those powers, so far as we have yet discerned, reside with the chemical theory of combustion and the operations of the nerve-force unitedly in our bodies. How the one is exactly produced, subject as it appears to be to the control of the other, is

still a mystery, for when we do no more than broadly assert that by these certain degrees of temperature are produced necessary to the state of health, we leave our fellows as much in the dark as ourselves. Liebig has told us that the fatty principles of the body especially are so much fuel thrown into it for the production of heat, and others, again, cannot disconnect this with the nervous force which is, as it were, antagonistic, even as the vegetable is to the animal part of creation, and so on. But the resolution of this all-important principle of life is worthy of a better position than it occupies at the present hour, or is even conceded to it; although we do not profess to do more than call the reader's attention to the prominent work it has to perform in connection, as we have before said, with the true active mechanism of our bodies.

The chief points, therefore, to be kept in view, when we consider animal heat in its development as a mechanical force, are these; viz., an uniformity of temperature necessary to the active conditions of all animals; a loss of vitality following the abstraction or absence of heat or warmth; its being prominent in the processes of active development; and, lastly, its motive power in those molecular vibrations which are supposed to take place in all tissues alike, be they nervous or muscular. Moreover, we find that, if motion be an expression of *life*, it is

ever present with organic matter in its full integrity, and ceases not, even in the inorganic world, to exercise an irresistible power.

Let us now consider some of the most important functions of the *alimentary canal,* regarding chiefly the peristaltic or vermiform movements of the stomach and intestines, together with such particulars of the operations of *digestion* and *absorption* as relate more particularly to the subject in hand.

The entire human system, therefore, is nourished by elementary particles taken from the atmosphere and the aliment we daily supply for the purpose; and this process is governed by the same preordained laws that, from the earliest period of development, fashioned out the creature after its own peculiar kind. We can no more change the general structure of an animal by artificial diet, than we can cause it by the same means to assume the likeness of something else. We often do, however, mar the fair proportions of nature by following too closely the suggestions of depraved appetites, just as we of ourselves occasion the thousand-and-one diseases which serve to abbreviate our sum of happiness on earth. The laws of crystallisation have long been apparent to us as invariable; the laws of assimilation in the animal kingdom are equally so. The several tissues of our bodies both develop and repair themselves by certain unchange-

able laws: whether such be brought about by the mere act of *contact*, or otherwise, remains still to be decided. Materials, often composed of the same elements, are carried to every portion of the frame, be it of bone, muscle, or primary membrane, and there they take the shape of the tissue to which they arrive: let that tissue be healthy, they are engrafted there; be it diseased, an equal adaptation is present, and a consistent action thus pervades the whole. It is by these laws that the integrity of the animal framework is maintained; and we may well marvel at Nature's perseverance, seeing the numerous obstacles we hourly oppose to its proceedings.

Exalted far above the common lot of the animal creation, we observe that the teeth of man declare him to be a being destined to live upon varied aliments,—to roam from clime to clime,—to draw largely upon the general stores of the world he inhabits, and to enlist freely into his service the silent ministers of Nature which are spread in every land. How far the limits of his desires and his passions may extend, disease is perhaps the earliest monitor; nevertheless, he is invited to "go into the earth, and to possess it," and ought, indeed, to be satisfied of the privilege when that is burdened alone with the provision that he use it discreetly and well. Himself is part of the great chain of the universe,

and what he views around him are the links of that chain: if he break these he is punished—and deserves to be punished.

It was at first our intention to avoid mingling with our general remarks on the functions of this canal any minute detail of its common structure; but it soon appeared to be unavoidable that we should do so, more especially as these points might be serviceable to the practitioner of the treatment by movements, who is often called upon to apply his art to stimulate separate divisions of the canal, by the process of "kneading" or by vibratory movements, as determined elsewhere.

In weighing the facts which follow regarding the several divisions of the alimentary canal, he should moreover bear constantly in mind certain definite rules, such as these:—that *ingestion* applies to the stomach, *egestion* to the *colon* or large intestine; that all *secretions* are from cells, as evidenced, for example, in the gastric juice of the stomach; and that all *excretions* are, when distinct from this canal, only from the blood, and connected with the operations of organs such as the kidneys and liver, working separately from that under notice. These will make more clear the various offices of nutrition and purification in the system.

The *alimentary canal*, therefore, is a membranous tube extending from the mouth to the anus, and is

abundantly supplied with muscular fibres to assist in the several movements it is called upon to perform. The chief of its divisions are the stomach and intestines; but previous to entering the former the food passes from the mouth to the œsophagus, which is itself a straight flexuous part of the canal. The largest portion, therefore, is taken up by the intestines, which, in the human subject, are commonly estimated to extend to a length of 35 feet, of which the *smaller* occupy about 25 feet, and the *larger* the remainder, or at least $\frac{1}{5}$th of the entire length. Of these two divisions of the intestines, into the *smaller* and the *larger*, we are to keep constantly in view their separate offices, namely, the *smaller* being employed in the absorption of nutritive particles from the food, and the *larger* being channels by which chiefly the refuse or waste matter is carried off. The former differ in structure with the latter by presenting numerous folds upon their inner surfaces, processes by which the food is, as it were, delayed in its passage for the more perfect absorption of its nutritive elements; and these are found somewhat to decrease from the upper portion to the lower. At the junction of the larger with the smaller intestines is found a peculiar development of the canal called the *cæcum*. This may be considered as belonging rather to the larger intestine, and is remarkable for its pouch-like shape,

appearing like a second stomach, and doubtless serving many purposes in the completion of the digestive functions which have been hitherto undetermined by the investigations of anatomists. At the extremity of this pouch, or cul-de-sac, is a short tube of the same membrane, called the appendix vermiformis, and, although its office is equally obscure, yet it is considered to be but a rudimental form of the long cæcum found in many of the inferior mammiferous animals. It is usually seen "coiled upon itself," having in children a valvular orifice, which orifice, however, is open in the adult. In consequence of this difference of structure in children and grown-up persons, the former too often suffer from the dangerous lodgment of cherry-stones and the like—things that should be carefully placed beyond their reach.

Yet, before we speak of the main office of the intestines, it will be well to consider how the various divisions of the alimentary canal are brought about. The first division is the œsophagus, the straight portion of the canal leading from the pharynx down to the cardiac orifice of the stomach. It is then bounded by the cardiac orifice, which is closed by the efforts of muscular fibres, running in an oblique direction. The stomach, which is an expansion of the alimentary canal, is itself brought to a termination at the pylorus, a muscular valve

which permits only of the passage of properly diluted or digested particles of food. Extending from the pylorus, we have the largest division of the canal—the smaller intestines, presenting that confused heap of bowels which is first brought to view on opening the abdomen of any animal. The whole has been divided into three technical portions, namely, the *duodenum, jejunum,* and *ileum;* these are useful only in regard to their allotted duties in the function of absorption of nutritive matters, and, possessing no positive divisions in the shape of valves or otherwise, do not require further notice. We come then to the cæcum, the commencement of the larger intestines, the great receptacle, in fact, of that which we cram into our bodies and nature rejects as useless and unfit for nourishment. The cæcal orifice is a button-shaped valve, ordinarily closed by the distension of the cæcum, by which its edges are thus drawn together. Cases have yet occurred where injections have passed through this orifice and been vomited by the stomach; but these are rare, and it may be said to act much after the manner of the pylorus, which has been justly termed "the porter of the stomach,"—precluding the passage of other than waste matters, the materials, in truth, of which the fæces are composed. There are likewise no positive divisions in the larger intestines, such as distinct valves or orifices; but, nevertheless, three

important divisions have been created, and serve as guides to the practitioner in the removal of those dangerous obstructions, resulting, as they do, equally in the smaller intestines, in an entire suspension of the vitality of the parts. These consist of the *colon*, *rectum*, and *anus*. The colon, chiefly from its position, is thus considered: namely, in the *ascending* portion, arising from the cæcum, which lies in the right cavity of the pelvis; in the *transverse*, traversing the upper portion of the abdomen, beneath the liver, stomach, and spleen; in the *descending*, which is the same canal passing down to the upper margin of the pelvis, where it becomes *narrow*, and forms a curve in which the chief lodgment of fæces occurs, and terminating in the *rectum*. But, previous to its reaching the rectum, as before stated, the colon takes a curve, known as the *sigmoid flexure;* and it is in this curve that the fæces usually accumulate previous to dislodgment. The rectum is, therefore, the vertical termination of the bowels ceasing at the muscular orifice of the anus. Thus we have, from the mouth to the latter, one continuous canal, divided alone into such parts as accord with the separate duties of its organic character.

The main offices of the stomach and intestines will appear as we proceed in our investigation of the more striking peculiarities of the alimentary system.

The stomach is the first receptacle of the food, wherein it becomes for a while stationary as it were, in order that it may be diluted with gastric juice, and prepared for the absorption of the nutritive elements it may contain. The smaller intestines still further detain the food for the purpose of absorption, and the larger receive the refuse and unabsorbed particles which remain. These are briefly their common functions.

The *movements* of the stomach and intestines are accomplished by the aid of organic muscular fibres, plentifully dispersed in the membranes composing the canal. In the stomach we have fibres arranged in longitudinal, circular, and oblique directions, while in the intestines we have circular and longitudinal fibres. In the *larger* division we have, moreover, bands of longitudinal fibres called the ligaments of the intestines, adding doubtless to their strength, as well as serving other important offices in the way of increased action, or for a temporary detention of waste matters from the food, for the further absorption of which this portion of the canal has certainly an abbreviated faculty.

In the first place, the movements of the stomach are from *left to right*, that is, from the cardiac to the pyloric ends. This was clearly proved in Dr. Beaumont's celebrated case of his patient Alexis St. Martin. This movement is not only the

result of the stimulus of the food taken in, but works according to the condition of that food and the process of gastric dilution; for we find that the pylorus gradually relaxes its resistance to the passage of the food as the dilutive or digestive process comes to a termination, and as soon as the organ itself has exhausted its powers of action, both digested and non-digested substances pass together into the intestines. The food having then been prepared previously by mastication for entry into the stomach, is thus retained in the latter for the disintegration of its component particles, and rejected when so prepared by the peristaltic or contractile movement resulting from a stimulus applied to the several orders of its fibres already enumerated.

The movement of the intestines is of the same kind, and exercised in the same way. It is also vermiform or peristaltic, usually likened to the writhings of a worm. In healthy persons the transit of food may be said to occupy ordinarily a period of twenty-four hours. These vermiform movements, moreover, travel in a direction from above downwards, in fact in the manner to which we have elsewhere alluded when treating of the contractions of organic muscular fibres. The rapidity and force of these movements must of course depend on the amount of stimulus applied, and their healthy condition to receive and answer to such stimulus; in

the same way these fibres relax and become inactive on the stimulus being withdrawn. By way of example, we may state the fact, that, after diarrhœa, when the bowels become inactive, there is found to be a sudden falling off of the increased stimulus which had worked during the occurrence of such morbid condition. Constipation, also, which invariably follows much loss of blood, is ascribed by some, and not without reason, to an effort of nature to retrieve lost ground; that by such stoppage, after loss of blood, more nourishment may be got out of the food. Yet, after all, we find the result of these movements, both in the stomach and intestines, to be for the expelling or moving onwards of the several particles of digested and undigested food, and, finally, for the deportation from the system of refuse and waste materials taken into it for nutritive purposes. In health working uniformly if not mechanically, and in disease disarranging the whole vital nutritive and reparative processes.

Again, the uniform and orderly movements both of the stomach and intestines are of nervous origin, resident rather with the sympathetic nervous system than with the brain or spinal cord. So far then an independent action may be ascribed to them; and although mental shocks have been found to stop the course of digestion or secretion, as well as temporarily arresting such processes by division of

the pneumogastric nerve, still such evidence can extend no farther than as explanatory of what the entire system suffers through extraneous hurts or injuries. One fact, likewise, the result of experiment, goes far to confirm this view of an independent action to such portions of the alimentary canal, and it is this, that active movements of the stomach have followed stimulus applied to the pneumogastric nerve during digestive periods, but, during the inaction of fasting, the same stimulus has produced no effect. An instance of the general sympathy only of the entire system is given by one writer, who, endeavouring to stop the heart's action in a frog, failed to accomplish his end by the destruction of many important nervous trunks, yet, on suddenly crushing the stomach, the function of the heart manifestly ceased. Other experiments of the same nature seem to have established this beyond doubt. In two instances the spinal marrow of rabbits was entirely destroyed, and on one occasion the brain also removed, yet, on opening the bodies of these animals, the peristaltic motion of the stomach and small and great intestines was found quite as strong as when the nervous system was entire. The peristaltic action of these parts of the canal may therefore be held to result naturally from stimulus received by the impression of food, or other particles be they what they may, and the consequent movements to be of a reflex

character. Thus one portion of the stomach or intestines is first stimulated by contact, and thence proceed onwards the gradual vermiform movements resulting therefrom. They are likened, in fact, to centripetal or sensitive impressions carried through stimuli to certain fibres communicating with adjacent nervous ganglia, and then reflected back to the parts by means of other fibres proceeding from the same ganglia of a centrifugal or motor kind. In any case it is evident that the common stimulus of contact, mainly by the food received into its cavities, is the *force* by which peristaltic action is accomplished in the stomach.

In all actively-secreting organs the supply of blood is necessarily large, and, in the case of the stomach, is increased in amount during the process of digestion. At this period, it has been long since discovered in the stomachs of animals recently killed, and after having taken aliment but a short time prior to death, the entire inner surface of this membrane is turgid with blood, and from this turgescence the gastric juice is speedily produced. The simple contact of food with its surface is, in this as in the case of the peristaltic movements previously detailed, enough for the purpose. Although the subtle character of those chemical changes which operate in the whole process of nutrition are now as obscure as ever, still there is not the same doubt

respecting many forms of diseases of the blood, which may partly owe their origin to an insufficient supply of gastric juice in the first instance, or, at least from the absence of that necessary ingredient, to the difficulties in the way of absorption after the undiluted food shall have passed out into the smaller intestines. As the *plastic* or *formative force* is a law of nature which we can only detect without going farther, so the methods of assimilation of elementary particles from the food are equally dark and undefinable. The same may be said of the connection between this absence of proper secretion and diseases of the blood.

The gastric fluid, we are told, is poured out upon the surface of the stomach in minute drops; is perceptibly acid and saltish, inodorous, clear and transparent. So far it appears to be a fluid simple enough in its character, and, by soaking into the substance of the food, and mingling with the already received saliva, causing a disintegration of its particles. This is the office of the stomach, absorption being the duty of the smaller intestines. Therefore, although digestion may be apparently so easy an affair, the principles which should regulate our diet are by no means equally so. Every person given to occasional or habitual indulgence, as well as the dyspeptic, can yield abundant testimony of the results which accrue upon his swallowing those

viands which, in simple phraseology, "did not agree with him." Whilst the former, too, is intent on redeeming his error by the aid of some drastic purgative, the latter is bowed down with misery, and life itself is a burden hardly to be borne. Yet the difficulty of dieting lies here. Each, on his own part, is unable readily to account for the particular *cause* of his self-inflicted torture, and would fain ascribe it to any be it never so remote from the true one; for he finds—and this applies especially to the dyspeptic—that there are occasions on which he can even indulge with impunity, and again others on which the most simple diet apparently induces the fit of indigestion with its train of far from imaginative horrors. Thus men are too apt to consider the common rules of diet as something very dubious, if not empirical, and to pursue a course of irresolute living, as if they were the certain victims of some strange destiny beyond their own or human control. The truth of the matter is, that they do not view the complicated machinery of their bodies as under the influence of daily and hourly change, dependent on many external as well as internal causes, no less matters of fact because they cannot trace out or follow them. Among the chief of these are undoubtedly *atmospheric* influences, the tone of the nervous system resulting from the passing events of the hour,—all of which are

so rapid of action, or so subtle to the inexperienced, that if brought forward by the practitioner they are little heeded, if they be not spared positive ridicule. In this wise the aliment of yesterday may not be the origin of the miseries of to-day, or why is not the careful dyspeptic uniformly afflicted, or rendered obnoxious to indigestion and its gloomy train? Simply, because there are other portions of the machine no less implicated than the stomach, which remit and intermit their functions in accordance with the weak or vigorous condition of the vital forces; and again those forces are no less existent because they are beyond the grasp even of the initiated in medical science.

It remains now to consider the force which follows that by which the actual onward movement of the food and afterwards of its waste matter is effected, and this brings us to the *force of Absorption.* In defining the latter, we are compelled to acknowledge one of those difficulties which beset all investigations into the principles which govern the human frame, and can only state that we know it to exist from the uniformity of nutrition, while we have no clear knowledge of what may be called its "beginning." A common conviction is that it is not capillary attraction, because the absorbent vessels take up some substances and refuse others. Still it is no less mechanical, for it may be pre-

sumed to allow few elements to pass away that are necessary to the stores of nutritive repetition in the human subject.

According to the necessities of the system, absorption may be gradual or quick. By some it has been likened to the progress of the sap in trees and shrubs in Spring; yet it has, as it were, a course of its own, long since explained by the discovery of valves in the lymphatic vessels which ramify in every portion of the structure. The divisions assumed in explanation of this process are two in number,—the *primæ viæ* and the *secundæ viæ*. The former applies to the stomach and intestinal tube as the first passages; the *second passages* relating to the lacteals or absorbent vessels. To the latter, therefore, the present considerations wholly relate. It must be ever borne in mind notwithstanding, that the lacteals are not the only absorbing vessels of the human body. By far the greater amount of absorption is carried on by the blood-vessels; yet it seems to be the especial office of the lacteals to take up the *chyle*, the milk-like fluid into which the nutritious portions of the food appear to be converted. The *force of absorption* for nourishment of the whole body is resident with the lacteals; though the difference between their actions and those of the blood-vessels seems to consist chiefly in this,—that while the latter take up matters as it were in-

discriminately from among all the tissues, the former are confined to the one simple office of receiving only such particles as are fit for assimilation thereto. Perhaps there is no evidence greater than this of the inscrutable and wondrous laws which govern the entire animal kingdom, one in which the vast economy of the human structure alone is presented to the eye of man, though excluded from the ordinary light of Reason the greatest of all its endowments, than this.

Some writers have objected to the term "absorbents" being applied to the lacteals, regarding them more as blood-making organs. There is doubtless great propriety in this view of their condition, as well as distinction of their functions; but, as we deal with them only in their proper order, that is, as connected with the intestines, and not mixed with the general mass of lymphatics which permeate the system, there can be no necessity for calling them otherwise than what they really are, namely, *absorbents*. Nor should we throw more light on the subject were we to enter more minutely into the structure of these vessels. Some conditions, however, are worthy of note. The coats of the great *thoracic duct*, which discharges its contents into the *superior vena cava* near the junction of the jugular and subclavian veins, are characterised by being more muscular than those of the veins. Among

other peculiarities too, such as the gland ducts, we find that they possess valves directed towards the heart as in the case of the veins. Consequently there is an *absorbing force* impelling onward the fresh nutritive materials to be formed into blood; and, in the changes which that blood undergoes, crude and impure as it is brought to the heart by the great veins which carry also the discharged contents of these absorbent vessels, we have but the one simple knowledge that the body is thus nourished and repaired. Yet there is more mystery attached to this force of absorption than could by possibility be found in the case of the veins, or the venous system generally; for there is no continuous chain of circulation in the lymphatics arising from such a propelling cause as the *columnar force* of the sanguiferous system. All that we know is that some subtle power of attraction, which is in fact the law of assimilation, takes from our food its really nutritive produce, and thus supplies fresh stores to the blood which alone nourishes, and is being each moment of our lives robbed of its essential elements.

Having already given a brief account of the mechanical functions of the intestines, it remains to offer a few facts and suggestions to those who would investigate the subject more closely than an undertaking of this kind will admit of.

The stomach has been described, both by ancient and modern physicians, as the "centre of sympathy." Whether or not this view be substantially correct is of little moment. Most men, in the course of their existence, have been compelled to acknowledge how great are the miseries attendant upon its derangement; few, guided alone by their natural perceptions, fail to ascribe the root of their troubles or maladies to it as to a primary cause. And not only to the stomach, but to the other portions of the alimentary canal do these natural suggestions equally apply. Afflicted persons point to the abdominal region as the seat of their common miseries; they observe the results in this quarter of all the hurts and injuries which happen to the brain by cranial fractures, unaccustomed motions, such as swinging, riding backward in a coach or railway carriage, or experienced on board a vessel at sea. They find that in these and most other cases nausea or vomiting result, and that no amount of ordinary depression is so intense as that which proceeds from the stomach or intestines. To use their own language they are "bowed down with misery," the whole system is powerless, every energy has for a time departed, and not one organic principle seems to triumph over another. Other forms of disease are of course equally distressing, but they are of rare occurrence happily with the

mass of mankind. In truth, this nausea is but a symptom of that natural action which the organism undertakes for its own remedy when here affected. It lowers the action of the entire system, and thereby gives additional power to the absorbents. Hence it is useful in removing obstructions, in congestions of the liver or abdominal viscera, in taking up often purulent deposits, or otherwise allowing time to recover from the effects of a deteriorated blood, whether proceeding from a virus introduced artificially, or some great error of nutrition disturbing the balance of parts. In any event, it is a wise provision in the economy of Nature, that an already disturbed machine shall get rid of its foreign encumbrances before it return to the routine of its healthy functions. It is, moreover, one which man might wisely follow out rather than ignore, as he too frequently does; it is common to the instinctive if not intellectual faculties of what we call the brute creation, for the lower orders of animals, unless they be removed from this scene of trouble by the remedial aid of sympathising man, invariably admit of its control.

How far diseases of the blood may be connected with alimentary absorption we have no distinct knowledge, beyond this, that certain systemic derangements follow errors of diet, and these are as evident to the non-professional as to the professional

man. Therefore, although we have ascribed a clear mechanical force to absorption, in rejecting or receiving the nutritive elements presented in the food, still we do not doubt of its being *subjective*, and this very often to variations in that faculty itself. For example, we know that the human system at large is, for the security of our existence, capable of accommodating itself to circumstances; consequently, if we do not in our diet present such materials for assimilation as are adapted to the purpose, the absorbents will yet take up much of that we do present, and do their best to nourish therewith. Yet, like all other errors, it maintains its position but for a time, and then diseases, essentially of the kind known as "diseases of the blood," are established. If this be not the case, how are we to dispose of the question of diet which even the debauchee acknowledges, and bears upon his person a testimony indelibly written. Our blood may then be certainly and safely affirmed to be "upon our own heads" while in our hands is the remedy, with little of aperients, little of emetics, simply to *prevent*, by limiting the stomach to such food as it will most easily digest.

Again *Costiveness*, the common malady of the bowels, is not a temporary thing but chronic in its nature. It is true that in general constitutional debility it may be productive of serious inconve-

niences, but yet it is as often set up by Nature for the purpose of further nutritive absorption, arising probably from imperfect digestion in the stomach, as it is a result of a morbid condition of the intestines. In the latter case, the practitioner may stimulate these to promote a peristaltic movement with certain success, and in the same way the stomach and abdominal viscera may be excited through stimulus applied to the epigastric region, acting upon the great *solar plexus* of the sympathetic nerve. Much more safely, expeditiously, and effectively can this be done than by prolonged medicinal treatment, which produces that *reaction* which augments the evil, decreasing in effectiveness at each stage of the administering.

With regard to the time when food is to be taken, and concerning matters of diet, the reader is referred to the many excellent Treatises that have from time to time appeared, and are partly heeded by mankind. Liebig's 'Chemistry of Food' is one that all men should study, as it contains sound rules both for selecting and preparing our food,—divested almost entirely of scientific difficulties. The great rule appears to us to consist in advancing the chief part of our labours with the day itself, gathering that electrical strength which travels with the solar light and sinks as it declines. And we cannot add to or take from the precept given by

the late Mr. Wadd, in his very amusing work on 'Corpulency,' which sums up nearly all that can be said, in few words, of the way to maintain health. After mentioning (by no means a solitary instance) the circumstance of some English prisoners in India being cured of liver and other complaints by being kept on bread and water in prison, he adds, that there are four secrets of health, namely,—"early rising, exercise, cleanliness, and leaving the table unoppressed."

Finally, we have embodied all the foregoing general facts, and have placed them under the most important headings, for the especial use of the practitioner of the mechanical treatment of chronic diseases, as well as explanatory to the profession and the public at large of the natural and physiological principles of this almost new branch of therapeutics.

THE END.

APPENDIX.

NOTE.—As a guide both to the practitioner and the ordinary reader it may be stated, that they are left to infer the number and extent of movements and manipulations by the past and present history of each case, as no exact record is kept of these. It may, however, be laid down as a general rule, that all *active* movements are to be used *short of fatigue* to the patient, while the *passive*, and chiefly those of a nature to promote absorption, should not be incautiously prolonged. The *duration* of each *course of treatment* likewise will depend more upon the long-standing than the nature of the affection itself. Where more than usual symptoms of inflammatory action may be present, the "cold compress" composed of rag and oiled-silk may be advantageously applied to the part, together with a moderate use of such antiphlogistic remedies as are generally recommended by the profession at large. But, with reference to the latter suggestion it must be borne in mind that, while the patient is under this treatment, the usual resources of medicine are superseded, patients generally resorting, or being advised to resort to these applications, either when the disease is deemed incurable by medicines or obstinately repels the common efforts of medical art. In the same way we may regard the Dietary Scale of the several patients, who are alone restricted to such rules as may be found suitable to each individual case. The use of *animal food*, however, which is a species of aliment only to be indulged in in proportion to the amount of active bodily and mental

exercise we take, is not indicated as necessary to the patient on account of the muscular exertion he may undergo during his daily course of treatment, for that is indeed so partial in its character as to differ entirely with the active exercises of health In these, and like conditions, the experience of the practitioner should be his sole guide. It is merely necessary that he be made aware of the above fact; for, otherwise, there are cases where animal food might be withheld save that the *treatment* itself might appear to warrant its use, especially as so many persons seem to be impressed with the belief that no form of diet can be really *nutritious* that does not contain at least some portion of animal substances. The same remarks will apply to the prophylactic part of the duties of the medical attendant.

Case I.—*Incipient Pulmonary Consumption.*

Miss H—, aged 19. This young lady was of a complex temperament, whose two brothers and a sister had died of diseases of the chest; she had for a long time complained of languor and a troublesome cough, and the slightest exertion in going up stairs, or ascending a hill, hurried her breathing to a painful extent. The exacerbations were already experienced twice a day, and during sleep she was almost bathed in perspiration; the pulse was more frequent than natural, and the bowels were often very much relaxed. By auscultation it was found that the respiratory murmur was weaker than natural, and accumulated sputa denoted by a strong "mucous râle;" the chest was very flat and narrow, hardly measuring five inches from the sternum to

the corresponding point of the spine, and the right side considerably larger than the left, the arch of the ribs being more of an elliptical than of the parabolic form.

Treatment.—The manipulation began with *friction* on the front and back of the chest and under the axillæ, by the operator rubbing with his hand lightly in a rotatory manner. The next day this motion was increased, with light percussions near the clavicles, under the arms, and round the scapulæ or blade bones, together with lubricatory motions of the ankles and percussions on the soles of the feet. These applications were continued for two weeks, till the nightly perspirations became considerably lessened; then a passive motion was applied by the hand down the muscles of her arms, in a rolling manner as it were, together with a complicated motion of pressure and friction with the back-edge of the hand between the ribs, and a fixed vibration of the epigastrium. These motions were continued daily for some time without any addition, till the nightly perspirations had almost disappeared and the cough was allayed; after this the manipulations became proportionately *active,* so that the patient was allowed to use resistance in some of the motions, which were always performed in *uniform time;* and movements were begun to expand her chest. After having continued the manipulations

for three months, the patient was not only entirely cured but her chest was considerably expanded, and she was able to run up and down stairs without the least difficulty. Instead of being thin and of a pale complexion she was now fast growing stout, and had gained the true colour of health. This patient is now in the country, and it is believed enjoys perfect health.

Case II.—*Phthisis.*

Mrs. S—, aged 26, a married lady, of a delicate constitution, had lost a brother at Madeira, who succumbed to pulmonary disease. She had suffered from great pain in the right side of the chest, combined with hectic fever. A distinguished physician, who had been consulted on her case, pronounced it one of confirmed phthisis, and advised the patient by all means to leave this country for Madeira. Instead of going abroad, however, she resolved to try the mechanical treatment. On the first visit she was found lying on a sofa in a very weakly state, unable even to feed herself, arising chiefly from pain in the right region of the chest, a little below the clavicle; her pulse irregular, with about 130 beats in a minute.

Treatment.—The manipulations in this case began almost with passive motions of an absorbing

nature, chiefly to the chest and back. After a short time she became somewhat stronger. More active motions were then introduced, till she had gained so much strength that powerful arterial applications could be directed towards the lower extremities. She then began rapidly to improve, and soon entirely recovered. It is now some seven or eight years since her recovery, and, although obliged to use some precaution, she is doing exceedingly well.

Case III.—*Consumption.*

Mr. E—, aged 36. This patient was of sanguine temperament with great physical energy. The disease had been gradually acquiring strength during the previous seven years, but the symptoms had varied considerably in that time. It had been moreover checked in its progress by residence abroad during each successive winter. He expectorated daily about half an ounce of muco-purulent matter, mixed with blood.

Treatment.—The muscular system being still moderately firm, the manipulations began with movements of the muscles of the extremities and the abdomen also; with vibrations and percussions on the chest and back, moderate pressure on the great respiratory nerves and muscular branches, vibration and percussion of the trachea, movements

to the extremities repeated, and lastly pressure and friction along the spine. After a short time movements to expand the chest were cautiously introduced, with vibrations over the region of the solar plexus, manipulations to the bowels, pressure along the course of the femoral nerves, and in fact with stronger derivating muscular movements in general. This patient persevered with the treatment for some weeks, when he left, according to previous intention, to spend the ensuing winter in Malaga. His general health had greatly improved, and, prior to departure, he stated that he had received the assurance of an eminent London physician, who had long watched his case, of a healing process having evidently commenced in the left lung.

Case IV.—*Incipient Phthisis.*

Mr. P—, aged 34. This gentleman had lost a brother of consumption, and had himself latterly given evidence of organic mischief going forward in one or both lungs. His well-grounded fears, however, induced him to seek timely advice and assistance, and, having decided upon the mechanical treatment, he commenced without delay the usual course. The chief symptoms in this case were:—a slight cough with hoarseness of voice, frothy expectoration slightly tinged with blood, occasional

hectic fever and flushing towards evening, the usual perspirations coming on towards morning. Appetite good, pulse variable, and emaciation evidently but just commenced; there was no great muscular weakness, but excessive lowness of spirits and despondency as to the issue of the attack. On auscultation it was found that the respiratory murmur was absent in the upper portion of the right lung, and there were other well-known signs of general organic weakness.

Treatment.—This commenced with the usual vibratory movements to hurry on the circulation and promote absorption within the chest, followed by percussions over the front and back of the same region, and derivative movements by means of the muscles of the lower extremities, applied in all instances at first cautiously and gently. After some time pressure was used along the course of the great respiratory nerve, and to the nerve-branches within the intercostal spaces; then strong movements of the *recti* muscles of the abdomen, with smart percussions to the back and chest; and lastly, increased movements of the muscles of the extremities, and combined muscular exercises to give a better development to the chest. The earliest symptoms of improvement were an almost entire cessation of the fever, the expectoration becoming more easy, and the sputa unstreaked with blood as formerly. Suc-

ceeding to this, the bodily strength of the patient was visibly improved, the muscular system appeared more largely developed, and after an unremitting attention to the treatment and regimen for a period of about three months and a half, the old symptoms had totally disappeared. About a twelvemonth after this the patient took occasion to inform the operator that his health continued unimpaired; that his lungs, to all appearance, were perfectly sound, though he found it necessary to exercise due caution against exposure to variations of temperature and the like; nor is there other than a fair expectancy that the cure will, under care and attention to other matters, be a permanent one.

CASE V.—*Hæmoptysis, or Spitting of Blood.*

Miss F—, aged 19. This young lady had latterly been troubled with a slight cough and spitting of blood, together with costiveness of the bowels and derangement of the circulation. The foregoing were the most prominent symptoms. She appeared of a temperament decidedly lymphatic, though her habit was somewhat robust, with a form well-proportioned and developed.

Treatment.—This was obviously a short one, and soon succeeded in removing the causes of her distress, and in materially assisting towards an increased

activity of the respiratory functions. It at first consisted of respiratory motions to the chest with percussions, then vibrations in the epigastric region, with strong movements of the abdominal muscles and the *transversalis* of the right side to affect the "portal" veins; and finally, such as might promote chest expansion. The patient's cure was therefore speedy.

Case VI.—*Indurated Mesenteric Glands.*

Master M—, aged 4. This child suffered from an enlarged abdomen, proceeding from an inactivity and induration of the glands of the mesentery, his bowels being costive and irregular, his system lax, and development evidently checked.

Treatment.—Horizontal epigastric vibrations, and alternately raising the trunk and extremities to a nearly vertical position by strong muscular action. These were followed by exercises to the abdominal muscles, kneading, and pressure of the bowels, with sharp percussions over the abdomen. A permanent favorable result was obtained in this case, and in a short space of time.

Case VII.—*Luxation of the Jaw with Paralysis of the Muscles of the Face, &c.*

Miss H—, aged 39. This lady, of nervous-lymphatic temperament, had been subject to the

above distressing attacks for a considerable period, the usual medical treatment in such cases having failed to remove the cause of her malady, or restore the general tone of the system. She experienced at times violent headaches, with nervous derangement, loss of voice, luxation of the lower jaw combined with paralysis of the temporal and zygomatic muscles, and partial congestion of the facial nerve or of a portion of the brain itself.

Treatment.—As her general health was otherwise unimpaired, and the systemic disturbance of a local character, the manipulations were carefully directed towards the region of the mischief, in order to remove the tendency to congestion, increase the activity of the absorbent vessels of the head, and give tone to the muscles and ligaments of the affected part. These began with active movements of the muscles of the neck and head, combined with nerve-pressure chiefly on the trunk and branches of the seventh pair, and percussion over the neck and occipital region; these were followed by active motions to the muscles of the jaw, pressure on the parotid and sublingual glands, and lastly, strong active diverting movements of the muscles of the abdomen and extremities. The result was, that in a very short time she was perfectly restored, nor has she subsequently experienced any return of the former symptoms. This case is one which demands

particular attention, as it evidences in the most striking manner the efficacy of a mechanical treatment to parts (suffering under the common effect of local fulness or determination of blood), which are accessible to the practitioner; and it is moreover important, as a period of two years had been given, and with a reasonable knowledge of the case, before the diseased part could regain its former vigour.

Case VIII.—*Premonitory Symptoms of Apoplexy, connected with habitual Costiveness.*

Mr. B—, aged 54. This was a mercantile gentleman of almost a pure sanguine temperament; he had for many years experienced a determination of blood to the head, together with symptoms of fulness and giddiness, throbbing of the arteries, shooting pains along the vessels of the brain, dimness of sight, loss of memory, and sometimes a numbness of the hands and fingers. For this complaint he had been frequently cupped, which for a moment relieved him, but the symptoms always returned with more violence. He was also subject to severe costiveness, and stated that for two years he had not been once naturally relieved, but used twice or thrice a week to take aperient medicine, which he sadly denominated his "*baume de vie.*" The diagnosis here could not be very difficult.

Treatment.—The manipulations began, therefore, directly with pressure along the ramifications of the vessels of the forehead, fixed vibrations of the arteries of the temples, frictions with the palm of the hand on the shoulders and back, pressure along the vessels on the top of the head, along those of the neck, and so on, diverting the blood downwards. After this the patient received strong active motions to the extremities, in order to increase, as these motions do, the calibre of the vessels, and make them a receptacle of the blood thus diverted from the head. After some time the abdominal manipulations were introduced, with stimulating motions to the liver; but still strong active motions were applied to the extremities. The bowels were soon brought into a normal state, and the head entirely relieved. After six weeks' daily application, the patient was freed from all those fearful symptoms which generally prognosticate a fit, and his bowels continued to be in an active and healthy state. Twelve months afterwards this gentleman applied for another course of manipulation, not because he really wanted it, but because he found in his diary that he about this time of the year used to be cupped, and he therefore thought it better to have recourse to the therapeutic manipulation. He then received a month's application. Since that time his health has been so good that, but for his grey

hair, he is now more like a man of forty-five than one bordering upon sixty, both with regard to activity and appearance.

Case IX.—*Symptoms of Apoplexy.*

Mr. M—, aged 62. The subject of this case was of sanguine temperament and full habit of body, his mode of living generous, and occupation somewhat sedentary. The premonitory symptoms were—confusion of ideas, occasional drowsiness, horrible thoughts, sense of fulness and giddiness, and in fact of the common run of those which usually forewarn of a coming apoplectic seizure.

Treatment.—This began with manipulations and motions similar to such as were used in the foregoing case. Strong applications were ultimately administered to his bowels and to the abdominal muscles; these, combined with other active movements, produced a powerful degree of absorption in the system, removing a large amount of fat which doubtless impeded the functions of several organs, and existed particularly about the intestines; and he left off cured of all visible tendency to this fatal disease, with a more healthy condition both of body and mind.

CASE X.—*Chronic Determination of Blood to the Head.*

Mr. F—, aged 42. This gentleman was of an active, sanguine temperament, with considerable nervous development. He had resided several years in Portugal, many of which had been passed under distressing symptoms of derangement of the head and nervous system generally. Business requiring occasional visits to this country, he had hoped that each sea voyage would remove the complaint; but these served alone rather to increase it, and he at one time almost despaired of recovery.

Treatment.—The tourniquet was applied firmly at short intervals to the head, with smart percussions with the tips of the fingers after each application to rouse absorption, and then strong active movements to the extremities. After a few visits, in addition to the above, respiratory movements were introduced, vibrations over the epigastrium, and under the false ribs to stimulate the liver, as well as percussions over the region of that organ; the *recti* muscles of the abdomen, and the *transversalis* also, were brought into action, the latter to affect the liver, concluding with manipulations to the head and extremities, repeated as at first. Thus a course of *passive*, and subsequently of *active* applications, rapidly removed the cause of his malady,

and he left to return to Portugal to all appearance entirely cured.

Case XI.—*Chronic Headache.*

Mr. A—, aged 29, had suffered for many years from severe headache, which incapacitated him for all business. The pain was often so great that he became almost insensible, and on one occasion went into a fit.

Treatment.—By continued arterial motions to the upper and lower extremities, together with slight *active* movements of the *oblique* abdominal muscles, this patient soon began to improve. Passive motions were then directed to the vessels of the cranium, and the tourniquet frequently made use of round the head. After six weeks' daily application this patient was cured.

Case XII.—*Same.*

Miss H—, aged 17. This was a young lady who had suffered for many years from severe headache. She was also very much troubled in her bowels, which seldom acted voluntarily, and often resisted the strongest aperient medicines. The course pursued was very similar to the case above, with this difference, that motions were introduced

in her case which affected the viscera of the pelvis, in order to give tone to the organs within this region, and the usual epigastric vibrations and kneading motions were used to make the bowels act naturally. After three weeks the patient got better, and by continuing the manipulations for some weeks longer became entirely well.

CASE XIII.—*Congestion and Stunted Development.*

Master H—, aged 11. This youth exhibited a considerable amount of precocity of intellect, though his form was stunted and partially developed. He suffered also from a slight curvature of the spine, and a small degree of congestion of the liver with feeble circulation. It having been necessary to remove him from school, in consequence of dangerous symptoms the probable result of the excitement of his usual studies, he was placed under the mechanical treatment, which shortly not only removed the irritation in the brain, but restored the circulation to a more healthy tone, and gave similar development to his muscular system.

Treatment.—Vibratory movements to the epigastrium, both in the erect and horizontal postures, with manipulations to the bowels. The applications to the spine in relation to the existing curvature were *three* movements, as usual, to the *trapezius,*

motions to affect the *longissimus dorsi* and others of the *erector spinæ* group of the *weak* side, together with respiratory and other movements in the way of general development of the frame.

Case XIV.—*Paralysis.*

Miss C—, aged 33. This was a lady of nervous-lymphatic temperament, and of a strumous habit. She had, eight years before attendance, began to feel a want of command over the fingers of her right hand, together with a constant feeling of numbness; and the disease had now gradually developed itself in true *hemiplegia.* The arm was hanging motionless at her side, and the leg dragged after her; sensation seemed still to remain somewhat active, but her *will* had little power over the motions of the right side. The blood-vessels of the right arm appeared narrow, and faintly marked from the long-standing of the disease; the pulse was weak and slow. The patient complained of tightness round her abdomen, like a rope drawn tightly; and she was always constipated, so much so, indeed, that she never was relieved but by using an enema or strong aperient medicines. The diagnosis, as in all similar complaints, was very difficult. The patient neither before nor after the beginning of the palsy, felt any pain in the head or spine. There were

two great curvatures of the spinal column, which drew forth the conclusion that these might probably have something to do with her complaint.

Treatment.—This commenced with manipulations of pressure and friction to the dorsal muscles, then rotations of the trunk, the patient being fixed in a sitting position; after which lubricatory motions to all the joints, and lastly, it was endeavoured to rouse the nervous energy of the paralysed side, at the same time directing some stimulating applications to the abdomen. In three weeks she was able to raise her arm, her leg at the same time being considerable improved. Then the *passive* applications were alternately used with more *active* ones; the former were multiplied to the highest potency, and she received now a long daily application. Continuing this for nine weeks, she became very much improved; she was able to run up and down stairs with the greatest ease, and, as a proof of her arm being so much better, it may be mentioned that she was able to dress her own hair, an operation which required some exertion, and considerable command over the muscles of the upper extremities. Notwithstanding this, the finger points continued rather inactive for a long time; and as circumstances obliged her to return to the country, it is not known whether she has been again able to use her needle, although she could use her hand in

cutting and laying hold of various things. She returned restored to health in other respects, her bowels being active, the catamenia regular, and her command of the muscular motions of the arms and legs perfect. After a period of nearly seven years, in a note received from a sister of this lady, we find the gratifying intelligence that she was in excellent health at the time, enjoying the use of her limbs, though one hand was still deformed.

CASE XV.—*Paralysis of one side of the Face.*

Mrs. W—, aged 29. This complaint, accompanied with inactivity of the liver and costiveness, had been of three years' standing. The success of the applications was early manifest, and she soon experienced great relief from them, though from some cause or other her attendance was not sufficiently prolonged.

Treatment.—Muscular movements were first applied to the affected side of the head and neck, with stimulating pressure to the *facial* nerve, then vibrations to the *solar plexus* in the horizontal posture combined with raising of the trunk at intervals by means of the *recti* muscles of the abdomen; after this, twisting movements to the trunk, the patient sitting, to act upon the *portal circulation* by the aid of the *transversalis* and *oblique*

muscles; and lastly, active movements to the extremities.

Case XVI.—*Hypertrophy or Enlargement of the Heart, &c.*

Mr. S—, aged 45. This was a case of very long standing. The subject of it was a gentleman of sanguineous-lymphatic temperament, who had doubtless accelerated the constitutional mischief going forward by indulging in active exercises after a comparatively sedentary occupation. He had suffered for years, with more or less frequency and strength, from the following distressing symptoms; viz.,—extreme anxiety, with occasional lividity of the lips and around the nasal orifices; sleepless nights, awaking often from frightful dreams with a choaking sensation in the throat, which obliged him to leave his bed and walk about the room; coldness of the extremities, and great difficulty at times in maintaining the proper warmth of his body by clothing or otherwise; occasional vomiting, particularly after any slight indulgence at table; pulse uniformly slow and intermittent, pain in the region of the heart, combined with acidity by which he was often much distressed; vertigo and fainting; bowels costive and irregular. On auscultation it was found that there existed considerable hyper-

trophy of the right ventricle, with a diseased condition of the mitral valve.

Treatment.—This was at first adapted so as to promote an improvement of tone in the system generally, to hurry on the circulation from the deeper-seated vessels, and rouse the absorbents to increased activity. The motions began with chest percussion, vibration to the epigastrium in the recumbent posture, with vibrations to the false ribs; then manipulations to the colon and smaller intestines, after which the chest percussions were repeated. The tourniquet was also applied to the arms and legs, active movements to the extremities succeeding, and lastly pressure and percussion with the hands along each side of the spinal column. As the course of treatment advanced, strong active movements were introduced, chiefly to the muscles of the extremities, thus permanently to divert the channel of the blood and relieve the heart, as well as to give force to the powers of absorption within the texture of the diseased organ itself. It is therefore obvious that the treatment here was at first of a *passive* nature, being applied more to the region of the heart, and to increase the circulation in parts remote from the seat of the disease; this was followed by applications to the epigastric and abdominal regions, and lastly by more active movements to confirm the improving tone of the circula-

tion, and promote innervation of the system at large. After a short period of attendance, the most distressing symptoms gradually subsided, the *sounds* of the heart became more audible and natural, the *impulse* less, the pulse firm and without its former intermittent character. His general health being thus gradually restored, nights of calm and undisturbed sleep followed and were maintained; he was no longer troubled with palpitations or vomiting, and to the surprise of himself and friends, became, as it were, a new man. With a more careful attention than formerly to his habits and regimen, he has experienced, except liability to colds, no recurrence of the old symptoms.

Case XVII.—*Same.*

Mr. J. S—, aged 37. This gentleman was of a lymphatic-bilious temperament, of temperate habits and placid temper. He had from childhood suffered from constitutional debility, while his system had latterly exhibited more decided symptoms of internal disease. On several occasions he had been subject to syncope or fainting after unusual bodily exertion; and when travelling abroad had been more than once overtaken by illness, which proved nearly fatal. The more recent symptoms had been languor, anxiety of mind, sudden starts in bed,

accompanied with violent struggles as if against some impending danger, costiveness, palpitations, and the usual signs of deranged circulation.

Treatment.—The operator commenced with vibrations to the epigastrium and chest percussion, in the upright posture, which were succeeded by vibrations of the same nature in the recumbent position, the patient at intervals raising himself by putting in action the *recti* muscles of the abdomen, the operator in this latter instance, as in all those movements which are of an *active* nature, *resisting* the patient moderately. In the last position also rotations of the femur were used, and the tourniquet applied to the arms and legs. The *psoas* and *iliacus* muscles were also put into action. Next came strong exercises both to the *recti* and *transversalis,* the patient being seated with his feet fixed; also vibrations and percussions to the false ribs about the region of the liver, the usual manipulations to the colon and small intestines, and lastly active motions of the *extensors, abductors,* and *adductors,* of either limb. Other prescribed forms followed of a more active kind, not only to derivate the blood and rouse absorption, but to develop the muscles and expand the chest, to which nerve-pressure along the spine and other parts was added. In this case, as in the foregoing, it will be seen that the manipulations were at the early stage of a *passive* nature, *active*

movements being introduced afterwards with due caution. The result proved the perfect success of mechanical treatment in such diseases. After a few days the bowels began to act with greater regularity, the oppression in and about the thorax to cease, and the previous anxiety, together with disturbed rest, which had so long afflicted him at night, to disappear. In a few weeks the recurrent palpitations were no longer felt, the sounds of the heart had become gradually more distinct and healthy, the intermittent character of the pulse gone, and the tone of the circulation so far improved that he deemed it necessary to discontinue the treatment. There is every reason to believe that he has had no return of the symptoms since that time.

Case XVIII.—*Hypertrophy of the Heart, &c.*

Mr. F—, aged 46, with a good and robust constitution, had for some years suffered more or less from pain and uneasiness in the region of the heart, together with pains along the vessels of the left arm. There were evident signs of *hypertrophy* of that organ, and occasionally symptoms as of supervening carditis; but the latter were temporary, and not of sufficient duration to admit of their being confirmed.

Treatment.—After having for some time received

strong *active* motions of the lower extremities, which were applied to the patient in a sitting posture, applications of an absorbing nature, such as elsewhere described, were directed to the heart and chest; and the improvement, which was gradual at first, became very manifest after two months' operation, shortly after which the patient relinquished his attendance, considering himself cured. He some time afterwards acknowledged his recovery in a note, of which the following is an extract:

"*Sept. 4th,* 1845.

"My dear Sir,—I have just received your note, with minute, &c. I beg at the same to thank you for your kind attention on all occasions, and to assure you how very much I feel relieved and benefited by your treatment.

"Very truly yours,

"M. F."

Note.—This letter was addressed to Mr. De Betou, and the case is one of those for which the author stands indebted to the kindness of that gentleman.

Case XIX.—*Hypertrophy, combined with Neuralgia.*

Mr. H—, aged 26. This case was also that of a gentleman of strong constitution. He had a long time suffered from pain in the region of the heart,

accompanied by an uneasy sensation along the false ribs of the left side, pain along the left arm, and frequent sense of fulness in the head, sometimes so much so that it gave him considerable alarm. His bowels were also irregular, and he suffered often from flatulency. Auscultation proved a condition very similar to the foregoing case, save that the symptoms were more subdued, and there was less sign of organic mischief going forward.

Treatment.—Here strong active movements were applied to the lower extremities, bringing all the groups of muscles of the thigh alternately into operation: first, as usual, the *extensors,* after these the *flexors,* then the *adductors,* and lastly the *abductors.* The upper portion of the body of the patient being at perfect rest, and his back reclining against a chair, these motions had always the effect of *lowering his pulse,* which would certainly not have been the case if he had himself brought these muscles into play in a standing or walking posture; on the contrary, the effect would then have been an accelerated motion of the heart and a quickened pulse. These diverting motions were after some time increased to a still higher potency, by combinations of other muscles and change of position; and by these means a visible improvement soon began to show itself. In order then to produce absorption and hasten the cure, *passive* manipula-

tions were performed about the region of the heart, and within three months the patient was perfectly restored.

Case XX.—*Enervation of the Heart.*

Mr. W—, aged 25. This case bore symptoms somewhat similar to those enumerated in Case 16, though they were of a more restricted character and of comparatively recent existence. The chief of these were palpitations, anxiety, disinclination towards active occupation, much distress after the slightest unusual exertion accompanied with dull pains about the region of the heart.

Treatment.—Applications very similar to such as were used in the parallel case, differing only in the circumstance of motions for chest expansion being early introduced, were pursued for a few weeks only, when the whole of the symptoms gave way, and he has since followed the duties of an active profession without any return of them. It is obvious too, in this case, that had not a similar method of treatment been resorted to, the symptoms might, from the habit and constitution of the patient, have gradually led on to a fatal result.

Case XXI.—*Hypertrophy of the Heart, &c.*

Mr. D—, aged 38. Here there were not only manifest signs of diseased heart, but of arterial

weakness, and general impairment of the circulatory powers. The patient was of highly sanguineous temperament, evincing considerable mental energy and an exuberance of what are called "animal spirits." He had been confessedly a "free liver," particularly in his younger days, though latterly he had lived alone to reap the fruits of former unchecked indulgence. The symptoms were many and numerous, and varied from time to time; they combined to prove the existence of constitutional disturbance in a high degree. The heart was enlarged, but no disease of the valves could be detected. He had been subject to vertigo, palpitations, hæmorrhoids, obstinate costiveness, and occasionally large boils would break out in various parts of his body. He had been also long under medicinal treatment applicable to his case, but being at length advised to relinquish his professional duties and retire into the country, he determined to try a course of the mechanical treatment, and the result was that in a few months he was enabled to resume his occupations, though certain restrictions in diet and modes of living were found necessary to maintain health. To dwell upon all the particulars of this highly interesting and valuable case would occupy too much space; yet, as it was one peculiarly trying upon the efficacy of this treament, the author will gladly furnish more ample

details whenever called upon so to do, and even refer the inquirer to the subject of it for his own corroborative testimony.

Treatment.—The early and subsequent part of the course embodied the following principal forms of application, each succeeding the other, viz., chest vibrations in the horizontal posture, epigastric vibrations in the same, raising the body and legs also in the same; movements for the liver and abdomen, by means of the *transversalis* and *recti;* motions of the *oblique* muscles of each side of the abdomen alternately; percussion over the region of the liver and spleen, the patient sitting sideways; then manipulations to the colon and small intestines. After these, percussion over the region of the heart in the standing position, with the left arm raised above the head. Lastly, strong active movements of the various muscles of the extremities, such as the *rectus femoris* and others, then manipulations to the nerves and vessels of the forehead and head, and strong pressure with the knee of the operator down each side of the spinal column, the patient being seated in both instances. Thus, applications in respect of the "unity of the human system" are the marked and successful features of the treatment in this remarkable case.

Case XXII.—*Languid Circulation and Hypochondriasis.*

Mr. —, aged —. This was a gentleman of rather a weak constitution, whose circulation was very languid, bowels torpid, and who suffered from lowness of spirits, fear, and many imaginary complaints. Sometimes the morbid affection was so bad that he was almost afraid of being alone, and his friends entertained great anxiety lest he should commit suicide.

Treatment.—General, to promote functional activity throughout the system, by muscular movements and stimulating vibrations to the region of the solar plexus; and, although a severe example of this species of malady, the mechanical treatment was here quite in its place: he recovered gradually, and became at last quite well.

Case XXIII.—*Morbid Circulation.*

Mr. G—, aged 28. This patient was of a sanguine-lymphatic temperament, of extremely temperate habits, and had resided some years in hot climates. He complained of a constant feeling of languor, difficulty of fixing his attention to matters in which he was engaged, want of confidence, restlessness at night, taste in the mouth on waking in

the morning, fulness about the region of the heart with slight palpitations, at times a difficulty of breathing, eructations yielding momentary relief, acidity of the stomach, slimy dejections, cold extremities, slow pulse, and feeble action of the heart.

Treatment.—This began with chest vibrations in the horizontal posture; percussions over the region of the heart, the patient standing, movements to expand the chest having been previously applied. He was then placed in the sitting posture, when *active* motions were given to the several muscles of the neck and head, backwards, forwards, sideways, and obliquely; after this to the *flexors* and *extensors* of the arm, then to the *recti* and *oblique* muscles of the abdomen, these being followed by moderately strong movements of the *extensors, abductors,* and *adductors* of the legs, and lastly friction and knee-pressure along each side of the spinal column to the lowest vertebræ. It will be seen that, in this course, the main point with the practitioner was to promote as well as equalise the circulation to the natural condition of health; and it is almost needless to say that it was attended with speedy success.

Case XXIV.—*Abscess of the Liver.*

Mr. S—, aged 32. This patient was of a bilious temperament; had suffered for three years from

acute and prolonged pains in the right side, accompanied with a sensation of weight in that region, which he compared to a heavy lump hanging under the false ribs; nausea, and sometimes vomiting after meals; tongue furred, skin dry, complexion dark and sallow, his countenance assuming an expression of despair, urine thick, bowels highly constipated, sleep broken, pulse small and irregular, feet cold. He stated that he had been during the before-mentioned period under medicinal treatment, but without deriving much benefit therefrom; and, prior to his placing himself under the mechanical treatment, had been advised by his medical attendant to relinquish all business, at least for a time. It is therefore highly satisfactory to relate that the new treatment, even from the first, obviated this very common necessity.

Treatment.—As the successful result of this case is of the deepest importance, not only to medical science in general, but to the future practitioner of this branch, the plan of proceeding is here described in the technical language at present in use. The *first course* comprised half-lying chest vibration, standing epigastric vibrations, horizontal epigastric vibrations, horizontal raising of the trunk; sitting, feet fixed, *recti* muscles of the abdomen, *transversalis* of the right side to affect the portal circulation; and lastly, active movements to the *rectus femoris*

of each leg. The *second course,* which commenced as soon as a visible improvement began, was as follows:—Standing, rapid elevating and depressing movements to the arms, also to expand the chest by drawing the patient forward; horizontal epigastric vibration; horizontal, raising of the trunk and drawing it sideways; sitting, *recti ab.;* standing, right foot raised, oblique muscles of right side, active; side-sitting, percussion over the region of the liver; sitting, vibrations of false ribs of right side, with pressure on branches from the *hepatic plexus;* sitting, kneading the colon and small intestines; sitting, extensors of the legs; kneeling, drawing back, (a very powerful arterial movement,) involving the extensor, hamstring and other muscles of the thighs, the *recti* of the abdomen, *psoas* and *iliacus;* stoop, forward-standing, vibration and percussion along the spine and in the region of the kidneys; and lastly, stride-sitting, knee-pressure along each side of the spinal column. The *treatment,* which at the commencement will be seen to have been almost entirely of the usual *passive* nature, was eminently successful. After a few day's attendance he felt as it were revived; his bowels began to act, the nausea and vomiting after meals to disappear, and his appetite became greatly improved. A few weeks subsequently the heaviness in his right side entirely left him, his spirits became

lighter, and he gradually recovered. This cure must be pronounced perfect; and, with the exception of one week about the middle of the treatment, when he did not consider himself quite so well as usual, sleep had returned; whilst his skin, the functions of which had long been dormant, now appeared of a healthy tone and colour.

Case XXV.—*Liver Disease.*

Mr. A—, aged 52. This was a gentleman who had for a long time suffered from various forms of liver affection, the particulars of which it is barely necessary to repeat here. However, before the manipulations were begun, the disease had established itself in a regular case of *jaundice*. The liver was likewise found hard and enlarged, and the patient suffered very much from the great quantity of mercury he had taken from time to time.

Treatment.—The manipulations were directed chiefly to the liver, and in fact to the whole *right* side of the body. He was lying in the horizontal position, and the organ itself was raised by the assistant putting his hand under the last false ribs, whilst the operator applied vibratory motions in this region. Strong frictions were then applied to the right side, and the right extremities received frequently gentle *active* motions. After some few

weeks, the symptoms of jaundice had gradually disappeared, the colour of the evacuations was much changed, and the patient improved in health and spirits. By daily applications for two months he was entirely cured.

Case XXVI.—*Morbid Condition of the Liver.*

Mrs. F—, aged —. This lady had suffered for a long time under symptoms of diseased liver. There was a good deal of enlargement of this organ, together with pain and a feeling of weight in the same region, also acute pain in the shoulder. Her head troubled her constantly, and the bowels were in the most irregular state.

Treatment.—By vibratory motions applied under the false ribs, together with active motions to the *transversalis* and *oblique* muscles of the abdomen, and arterial motions to the lower extremities, as will be found in other cases of diverting movements, she very soon began to mend, and after two months considered herself, so far as feeling was concerned, perfectly restored.

Case XXVII.—*Incipient Tumour of the Liver.*

Mr. M—, jun., aged 26. This patient complained of pain in the region of the liver, and great

tenderness in the epigastric region. A hard tumour could also be felt on the convex side of the left lobe of this organ; and all these symptoms were accompanied with pain in the back, much weakness and debility, so much so that he fainted at the time the diagnosis was being performed.

Treatment.—By the application of pressure at certain intervals the tumour soon became absorbed, at the same time that motions were applied both locally and generally; and subsequently more active movements to rouse the dormant functions of the system. After a comparatively brief course of treatment, he became once more strong and active.

Case XXVIII.—*Congestion of the Liver.*

Mr. M—, aged 28. This patient had just returned from China, and suffered greatly from acute pain in the region of the liver, increased by the slightest pressure. His habits had been somewhat irregular, and the present condition of his system had been superinduced by resorting to the stimulus of alcoholic drinks, a custom but too prevalent among Europeans in the East, and adopted as a temporary relief against the relaxing influences of climate. In this case there were also occasional conditions of *hepatitis*, such as pains resembling pleurisy, yellow tinge of the conjunctiva, want of

appetite, diarrhœa, and more or less fever, with great nervous debility and excitement.

Treatment.—Commenced with gentle respiratory movements in the standing posture; epigastric vibrations, first in the standing and secondly in the lying postures. Then, the patient being seated, vibrations under the false ribs, kneading the colon and small intestines; after these, in the standing and leaning-forward position, vibrations and percussions over the region of the kidneys, particularly on the right side; again sitting, the active movements of the *extensors, abductors,* and *adductors* of the thigh were employed; and lastly, stride-sitting, arms drawing down, a respiratory movement. This course was sufficient in a short time to remove the congestion, and subsequent applications were selected to promote a greater development of the functions of the system generally, and to re-establish the condition of health.

Case XXIX.—*Tic Douloureux, combined with Inactive Liver.*

Mrs. W—, aged 45. This case was one of peculiar interest. The subject of it was of a bilious-lymphatic temperament, of full and active habit of body. She had suffered more or less during a period of eight years from *tic douloureux* in the left

side of her face, as well as from neuralgia in other parts, experiencing the most acute lancinating pains chiefly during the day, and at night an occasional presentiment of suffocation, with loss of voice and capability of rousing those who were near to her; also a feeling of oppression and spasm in the region of the diaphragm. On examination there was found considerable induration of the liver, which produced also an inactive condition of the large and small intestines. She stated, moreover, that she had once been confined to a dark room for a period of six months, in consequence of the severe nature of the neuralgic pains and the existing state of both organs of vision.

Treatment.—After almost the first attendance of this patient, the *tic* was entirely removed by pressure on the nerve, together with light frictions along the left eyebrow and under the eye. These were combined with *active* movements of the muscles of the neck, and secondly with stimulating applications to the liver and stomach, as well as attention being paid to the restoration of the system generally. The result of a persevering attendance at length was an entire restoration to health; the neuralgic pains speedily disappeared, and the absorbing functions both of the liver and alimentary canal gradually assumed a healthy character. The following is the formula of manipulations, divided into two parts

corresponding with the progress of the cure, viz.:— 1st. Chest vibration, half-sitting and half-lying; light friction along the left eyebrow and under the eye, with pressure on the facial ganglion, sitting; active movements of the muscles of the neck forwards, backwards, sideways, and twisting; vibratory motions over the region of the solar plexus, standing; extensors, abductors, and adductors of the thighs, strong active movements, sitting. 2d. The first four movements repeated; sitting, feet fixed, drawing back, *recti* muscles of abdomen, *active;* same position, twisting to the left, obliquus internus and transversalis, passive; left side-sitting, percussion over the region of the liver; forward-standing, percussion on each side of the spinal column with nerve pressure; standing, vibratory motions over the solar plexus; sitting, strong active movements of the extensors, abductors, and adductors of the thighs.

Case XXX.—*Gout.*

Mr. K—, aged —. This was an elderly gentleman, who for many years had suffered from regular fits of the gout. He applied to have a course of therapeutic manipulation, and when first visited, was under the usual course of medicinal treatment, so that it became necessary to suspend the manipulations till the fit should be subsided.

Treatment.—When after some days he became better, the applications were chiefly directed to the abdomen, kidneys, and liver; the patient received thereafter daily rotatory motions of the trunk, for which purpose he sat on a stool, his knees and feet fixed, while the operator moved his body in a rotatory way. After these, lubricatory motions of the wrist, shoulder, and ankle joints were given, together with half-active motions to the upper and lower extremities. After eight weeks' application the gouty symptoms had entirely disappeared, and eighteen months afterwards it was found that there had been no return of them, whilst he lived more sparingly, and in accordance with dietetic rules.

Case XXXI.—*Chronic Diarrhœa.*

Mr. W—, aged 29. This case affords another striking example of the certain efficacy of these applications in diarrhœa or other derangement of the "portal circulation" and its branches. The subject of it had just returned from China, which part of the world he had been compelled to leave in consequence of increasing symptoms of a gradual prostration of his entire system, and fearing a fatal result. The homeward passage had not, as had been expected, removed the danger, or checked but slightly the progress of the complaint. Passive

mechanical applications, however, to the abdominal region, in conjunction with active movements to the muscles of the back, speedily checked the ordinary symptoms of diarrhœa, the bodily emaciation gradually gave place to an increase of flesh, and this patient left perfectly cured to visit his friends in America. Stronger developing movements were subsequently used, as the following outline of the course will show.

Treatment.—This commenced with absorbing and diverting movements combined, to promote the freer circulation of the *vena portæ* and its branches, and to derivate the arterial flow. These movements may be thus described;—the patient stands perfectly upright, with his feet close together; the left arm of the operator is then placed along the spinal column, and the right hand upon the abdomen,—the patient is then bowed as it were forward, and raises his body again to the erect posture, the operator *resisting* and at the same time making use of a rapid vibratory movement with pressure on the walls of the abdomen. Between each application, the patient is allowed to walk once or twice up and down the room. He is then placed in the recumbent posture, and active movements introduced to affect the *psoas magnus* and *iliacus internus*, followed by sharp percussions upon the abdomen; after this, in the kneeling position, he is drawn

backwards,—an active movement for the *rectus femoris* chiefly, with intervals of walking; the first movements for the diarrhœa are here repeated; then, standing, active movements to the *gastrocnemius* and *soleus* muscles, by resisting the patient whilst raising himself from the crouching or stooping posture; vibrations to the epigastrium; movements for the diarrhœa again repeated; and lastly, leaning forward, pressure, and percussion along each side of the spine. The subsequent developing motions were such as are ordinarily practised.

Case XXXII.—*Neuralgia.*

Mr. M—, aged 56. Temperament sanguine-bilious. This patient had suffered for a period of three or four years from neuralgic pains in the back, chiefly across the shoulders, and at the inferior posterior angles of the scapulæ. He was excessively nervous and irritable, suffered from constant pain, such as at first appeared to indicate *myelitis* or inflammation of the cord, disturbed rest, anxiety, habitual costiveness, flatulency, and depression of spirits. He remained only about three weeks under the course, business demanding his return to the country, whence he subsequently wrote to a friend in London testifying to the relief he had experienced from it.

Treatment.—This began with vibrations near the solar plexus, lying; then vibrations of the false ribs, patient sitting, to affect the liver; kneading colon, with raising of the trunk occasionally, exercised in the recumbent posture; sitting, feet fixed, drawing backward (for the bowels) by means of active movements to the recti abdominis; sitting, extensors of the thigh—active; sawing motion to back of the neck with the hand; stoop-standing, finger-pressure and percussion along the spine; lastly, stride-sitting, knee-pressure along the spinal column.

Case XXXIII.—*Lateral Curvature of the Spine.*

Miss P—, aged 19. This condition of the spinal column had existed for a period of eight or ten years, though the curvature was not very considerable. The upper curve, arching to the right, took up about the first four or five dorsal vertebræ, and the lower curve arched, as usual, to the left, in the lumbar region. The integument of the back was found to be in a state of great irritation, and the ankle joint of her left foot swelled occasionally, though her general health was tolerably good.

Treatment.—In the early part frictions and percussions along the spinal column were resorted to, with rotations of the extremities, epigastric vibrations, and other means applicable to the general

health. The movements directed to the antagonist muscles on the weaker side, in a word, to those of the left were as follow; viz., — arm stretched-out, trapezius three movements, and left arm drawing-down; sliding motion with the left arm against upright bar, standing; elbow movement, sitting; also the *complexus* and other muscles of the back of the head; depression of the left arm with rotation; depression of the body forward, resisting chiefly on the left side, exercising the *erector spinæ* group generally; and lastly, friction and percussion over the region of the curves. The improvement began with a removal of the languor and irritation of the integument, and, by perseverance for a considerable period, succeeded in reducing the curvature, and in affecting a decided cure.

Case XXXIV.—*Deformity of the Chest.*

Master M—, aged 8. In this case the sternum or breast-bone was found to project considerably; the seven true ribs, meeting at a very acute angle, formed in a high degree what is commonly known by the term "pigeon breast." This patient was entirely cured in about six weeks, after receiving the usual muscular applications both to develop and expand the chest.

Treatment.—The following manipulations were

used; viz.,—sitting, the operator, standing behind the patient, and resisting the latter in drawing his arms downwards from the elevated posture; standing, chest expansion, thus—the patient was placed in a corner of the room, with his elbows resting against each wall on a level with the shoulders, and in this position the operator, placing his right hand beneath the scapulæ, and his left upon the breast of the other, presses in an oblique direction upwards and forwards, the patient rising on tiptoe, and resisting each movement; standing, hands over the head, supported, and chest drawing forward with resistance; standing also, left-side, hand and arm, resting upon an upright bar, and gliding upwards from the pressure exercised by the operator, while the same was repeated to the right side; lastly, the patient lying bound upon the couch, raises himself up by a powerful effort of the muscles of the back and loins.

Case XXXV.—*Muscular Deformity, combined with Constitutional Debility.*

Mr. L—, aged 50. This patient had long suffered from general debility as well as atrophy of the gluteal muscles of the right leg. The case is only important as shewing how beneficial mechanical applications assuredly are in such instances, as a

judicious treatment succeeded in restoring the failing limb gradually back to nearly its former vigour, as well as imparting a high degree of tone to the functions of the body generally.

Treatment.—This comprises *two courses,* the first of which began with,—full sitting, arms drawing-down, as in the preceding case; standing, epigastric vibrations, the same repeated in the three-quarters'-lying posture; lying, trunk rising by means of the recti; sitting, manipulations to the colon and small intestines; sitting, active movements to the extensor, abductor, and adductor muscles of the leg; and lastly, the first movements repeated. The *second course* consisted of the first five movements above detailed; then, full-sitting, feet fixed, drawing backwards for the *recti abdominis,* followed by side twisting to the left, exercising the transversalis and oblique muscles of the right side; standing, right foot placed on a low couch, right arm elevated, the patient being pressed backward, resisting chiefly with the oblique muscles, this being an *arterial* movement for the liver; half-sitting, the tourniquet applied to the affected thigh; kneeling, back-drawing for the extensors of the thigh; sitting, active movements to the extensor, abductor, and adductor muscles of the thigh; and lastly, the first movement repeated.

Case XXXVI.—*Constitutional Debility.*

Miss K—, aged 22. This patient, of lymphatic temperament, had suffered from debility for more than three years, when she was advised to make use of the mechanical treatment; at that time she was so much reduced in strength that she could hardly sit up, but was obliged to be confined to her sofa. The pulse was slow, small, and contracted, scarcely fifty-four beats in a minute; her tongue was very foul, and the appetite much reduced; her skin was cold, and of a sallow complexion. The state of the blood had long been such that if she happened to prick her finger with a needle, a yellow serum appeared instead of the red-coloured blood. The urine was straw-coloured and cloudy, containing albumen, and its specific gravity 1·016; her bowels were in a state of habitual costiveness. It was a case in fact, in which, the nervous energy being excessively low, the ordinary medicinal treatment fails either to rouse or to restore.

Treatment.—In this miserable condition *passive* motions were applied for ten minutes to the abdominal viscera, beginning with moveable vibrations; after this, the patient was left to rest till the evening, when the same motions were repeated. The next day the same form of treatment was pursued, together with gentle percussions, applied with the

hands of the operator over the region of the liver and the kidneys. The third and fourth day the same treatment; the fifth day the patient's pulse had improved, her tongue was better, and she felt some appetite. The applications were increased; instead of ten minutes' she received half an hour's application morning and evening. Besides the former motions, she now also received motions of pressure along the ramifications of the vessels of the extremities, lubricatory movements of the wrist, shoulder, and ankle joints, together with continued pressure along both sides of the spinal column. At the tenth day the patient was able to walk about, and could sit up for some time, when she also could bear applications of a more active nature. After six weeks' daily attendance she was entirely recovered, and is at this moment a very healthy person.

CASE XXXVII.—*General Debility, Dyspepsia, &c.*

Mr. H—, aged 55. This was a case of unusual interest. The patient was of a nervous-sanguine temperament. The chief symptom was general debility, which had continued to a greater or less degree for some years. He had been afflicted, at intervals of three or four months, with stomach pains, constant eructations, and occasional con-

ditions of hæmatemesis; also faintings at stool, sudden attacks of desire to evacuate but without the power of motion, when he was usually carried thither; had been accustomed to horse exercise, but had latterly denied himself that pleasure in consequence of chronic neuralgia of the knee-cap, from a blow sustained some years previously; his habits were decidedly temperate. The following forms of treatment suitable to his case lasted for about five weeks, when they were discontinued, the patient declaring himself to be perfectly well, the old symptoms being entirely removed, and notified his intention of visiting the Continent with his family for a short period.

Treatment.—This commenced with the respiratory movement, namely, standing, arms elevated and fixed, drawing forward; standing, epigastric vibration, also vibration over the region of the liver; recumbent, epigastric vibration, and raising-up, recti abdominis; sitting, vibration of the trachea, pressure on the pneumogastric nerve above the clavicle, also upon the hypoglossal; sitting, feet fixed, drawing backward and torsion of the trunk, recti and transversalis, with percussion over the seat of the liver; standing, right foot elevated on a couch, arm up, pressure backward, an arterial movement for the liver; standing, leaning-forward, and resting upon the hands, vibration over the

region of the kidneys, and pressure down the spine and over the intercostal muscles. The *second course* consisted of the first three movements in the foregoing, then manipulations to the colon and small intestines; active movements of the legs in the recumbent posture; sitting, vibration of the false ribs, right and left sides; sitting, manipulations and movements to the throat and head, and pressure afterwards along the course of the femoral vessels; stride-sitting, feet fixed, torsion of the trunk to the right and left; stoop-standing and resting on the hands, pressure and percussion along the spine; and lastly, pressure with the knee of the operator down each side of the spine.

CASE XXXVIII.—*Dyspepsia and General Debility.*

Mr. F—, aged 45. This patient was of a sanguine-bilious temperament. The symptoms were a quick and feeble pulse, great general debility, the least exertion painful and producing a cold, clammy prespiration over the entire body. Also, pain in the region of the liver, with tenderness of the epigastrium, bowels very much constipated, and the muscular system relaxed in the highest degree. Had long suffered severely from acidity of the stomach and other distressing accompaniments of derangement of that organ.

Treatment.—The *first course* consisted of the following, viz. :—standing position, rapid elevation and depression of each arm; lying, vibrations to the epigastrium, manipulations along the course of the colon, and rising or active movements of the recti abdominis; lying, rotation of each femur; active movements of the muscles of the head and neck, in three directions, backwards, forwards, and oblique; and lastly, active movements of the extensors of either limb. The *second course* embodied the following, viz. :—sitting, vibrations to the seat of the liver and spleen, and manipulations of the small intestines; sitting, thighs bound to the couch, torsion to the right and left; standing, either foot placed on couch, arm up, movements to the oblique muscles of the abdomen; sitting, percussion over the region of the liver and spleen; supine posture, vibrations to the epigastrium, kneading to the colon, and rising or active motions of the recti abdominis, also raising the extended legs, active; sitting, manipulations to the small intestines; stoop-standing, percussion and vibration over the region of the kidneys, and along the back of the thighs; and lastly, stride-sitting, knee-pressure along each side of the vertebral column. Thus it will be evident that the principal applications were, in the first instance, confined to such as might promote a better circulation of the blood, and lastly to in-

crease the innervation of the entire system. By these means he gradually recovered the tone of his bowels, the clammy perspirations disappeared, the acidity subsided, and in eight weeks he was perfectly restored.

Case XXXIX.—*Deformity of the Foot.*

Miss H—, aged 10. In this case the left foot was distorted by an evident over-strength of the *peroneal* muscles. The *treatment* consisted alone in daily active movements of the antagonist muscles of the weak side, chiefly the *tibialis posticus* and *flexor longus digitorum.* It was perfectly successful without artificial aid of any kind, and the case is merely given as affording proof of the obvious advantage of this system over many others in like examples.

Case XL.—*Spinal Irritation with incipient Lateral Curvature.*

Miss W—, aged 15. This young lady, who appeared to be more than usually developed for her age, had latterly exhibited signs of constitutional debility, such as languor, speedy sense of fatigue, giddiness, depraved appetite, and a condition almost amounting to menorrhagia; this resulted in a slight

degree of *curvature* according to the common form of such complaint.

Treatment.—Active exercises, in proportion to the strength of the patient, were applied to the muscles of the weaker side, including as usual the *Erector spinæ* group, *trapezius, rhomboideus,* and *latissimus dorsi,* combined with friction and stimulating nerve-pressure on the affected side. A shock of cold water was also given to the spinal column every morning, followed by friction for the space of half-an-hour to one hour. In a very short time both the dorsal and lumbar curves entirely disappeared.

Case XLI.—*Congestion of the Brain.*

Mr. F—, aged 30. This patient, of sanguine temperament and plethoric habit, had previously suffered from a violent attack of congestion of the brain, brought on by full diet and sedentary occupations. Previous to this he had suffered from great depression of spirits, want of confidence and imaginary fears, with fulness of the arteries of the neck and head.

Treatment.—The course pursued in this case differed in very slight respects from those mentioned in the foregoing cases of Apoplexy and the like, containing in addition merely strong muscular

motions to affect the *portal circulation.* This patient experienced almost instantaneous relief from the manipulations and movements; he expressed himself as feeling stronger after a few visits, his spirits became lighter, and, on the sensation of fulness in the neck subsiding, his health was perfectly restored.

C. and J. Adlard, Printers, Bartholomew Close.