A TEXT BOOK

OF

The Principles of Osteopathy

BY

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PREFACE.

In presenting this work on the Principles of Osteopathy, the author is aware of many imperfections both in thought and arrangement of subjects; yet he is further cognizant of the fact that, owing to the dearth of satisfactory literature of the nature of which this work is illustrative, there are many in the student ranks as well as in the field who will welcome it in spite of its many faults. It must be understood at the outset that the work is designed primarily for the student who is but beginning to be interested in the new method of healing. Hence to those who are already practitioners of that method the matter contained in the following pages may not seem particularly new or satisfying in the way of suggesting ideas of an immediately practical nature. Yet we are not without hope that even to the latter class there are many points of interest which will help to throw light upon some of the many vexing problems that continually arise in the experience of the busy practitioner.

Neither should it be assumed that the work is intended to treat exhaustively of the numerous questions of theory that are associated with the science. That is entirely beyond the scope of a work that is prepared especially for him who, under the circumstances of a comprehensive curriculum of study crowded into a period of time all too short, must of necessity limit his reading in all subjects to those texts which give but a comparatively brief treatment. This work therefore, is rather but an outline of the various subjects that are most closely related to the fundamentals of the science, with suggestions as to the direction further investigation should take.

The various subjects outlined and the manner of their treatment are the result of the labor of the author which has been especially devoted to the principles of osteopathy during his course as teacher in the American School of Osteopathy for the past three years. In large part the work here presented is a revision of lectures delivered before the classes in Principles of Osteopathy.

The work is divided into Parts I and II, indicating a difference in the nature and arrangement of the matter treated. This difference lies in the more general nature of the substance of Part I, the more specific in Part II. Certain fundamental propositions bearing on the general problems of life, health, and disease are discussed in the former, while the deductions drawn therefrom are applied specifically in the latter to the various regions of the body.

Acknowledgment of indebtedness is hereby made to all those who, either directly or indirectly, have aided in the elaboration of the subject matter, and in the preparation of the volume. To Dr. A. T. Still, the founder of the science, special thanks are due for continued oversight and frequent correction—a fact for which is felt the deepest gratitude. Dr. Charles Hazzard, the pioneer as an author of a text book, and an exponent of osteopathy of wide and enviable reputation, has as teacher and co-laborer, been of very material aid and inspiration in the work. Other members of the faculty of the American School of Osteopathy, as well as numerous practitioners in the field have incidentally or specifically contributed to the material which has been systematized and formulated in this volume. To Dr. C. M. T. Hulett, of Cleveland, Ohio, the author is under obligation for many suggestions, and especially for his patience and care in reading the manuscript.

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PART I.

CHAPTER I.

INTRODUCTORY.

A statement of the principles which underlie the science of osteopathy must, in the nature of things, be a very **incomplete** one. No one recognizes the fact more thoroughly than does the practitioner himself when he is compelled to apply theoretical propositions to actual cases. Nor should he be astonished at the discovery. If, as we continually reiterate, osteopathy is a system built upon the facts of anatomy and physiology, then the foundation must be an absolute and knowable one before we may presume to pronounce the building in any sense complete. Unfortunately for the building, the foundation itself is incomplete, but "ever becoming." It is a perennially recurring surprise to the students of the biological sciences, to learn that in comparison with what is yet to be determined, the total bulk of demonstrable fact relating to these sciences is infinitesmal. When the student, in taking up the study of osteopathy, is told that the osteopath is successful by virtue of his complete knowledge of anatomy and physiology, he glories in the assertion. But when he learns, as he certainly will, that the most expert is equipped with only a meager supply, he is likely to be disappointed. True, in anatomy we are comparatively well grounded, but our knowledge of physiology and its related sciences is extremely unsatisfactory and must remain so for long. Why need we then apologize for an incomplete statement of the principles of osteopathy? But another fact is very apparent. Dr. Still himself has repeatedly asserted that osteopathy is yet in its infancy. Why pretend then that there be any possibility of presenting it in the garb of maturity. Because of its youth, we must be content with a proper modesty of statement. It is unfortunate that in the rapid growth of the system and in the increase in number of its adherents, time has not been given sufficiently to a careful analysis and record of cases which tend to substantiate the fundamental propositions; and since only an infinite number of observed instances will thoroughly satisfy the demands of inexorable logic, sufficient data has not yet been collected to warrant unqualified statement. A careful presentation then of certain very general but unequivocal propositions,supplemented by numerous provisional ones, is the duty of him who would formulate a "plan and specification," upon which the practitioner is to build his superstructure.

It is further necessary to make a fairly clear **distinction** between principles and practice. It is a pecular characteristic of the average beginner to long for the opportunity to observe and experiment upon cases. He has imbibed the idea that osteopathy consists essentially in the performance of certain movements upon the patient, which in one sense is correct. But it is necessary to emphasize that before such movement shall be intelligently applied, certain fundamental facts are essential; and it is in the development of these required facts that the principles of osteopathy consists. Dr. Still has emphasized in his *Philosophy of Osteopathy* and time and again by word of mouth that a "plan and specification" is necessary before intelligent work can be done. There must be in the mind of the student a "living picture," not only of the form and feature but also of the function, the tendencies toward and away from the line marked out by heredity, and every phase and fact that may be known regarding the complete life of the individual. It is true no such picture was held by the pioneer in earlier times. It is true that osteopathy like all other sciences had its beginning as an art. It is no discredit to the science that the art occupies first place in point of time. Musicians and poets are "born" and the art of music and poetry existed long before the laws of harmony and metre were known. But it is significant that there are few great poets or musicians who are ignorant of the laws underlying their art. The farmer may be able to produce a crop with no knowledge whatever of the chemistry of soils or the laws of plant growth; but the present development of agriculture could never have been, had not such laws been discovered and formulated. The school teacher may be able to instill knowledge into the minds of the young and still be ignorant of pedagogics, but he can never occupy first place. In osteopathy we have no exception to this rule. In his *Autobiography* Dr. Still mentions the fact that while yet a boy, a case of headache was aborted incidental to the resting of his sub-occipital region within a rope swing. That was the art of osteopathy. Similiar cases and observation of other facts accumulated until an inkling was obtained of a law underlying the several facts. The recognition of that law and the application of it to still further cases constituted the beginning of the science. The facts continually accumulating with few acceptions that could not be explained, and their systematization, justified the presentation of a **working hypothesis.** It is the discussion of this hypothesis and the facts substantiating it, the taking it as far as may be from the realm of theory into the realm of demonstration, that constitutes the principles of osteopathy. The application of the principles to specific cases of disease constitutes the practice of osteopathy.

A system of healing cannot properly be separated from a **philosophy of life.** This is true by virtue of the involved nature of disease. We may prate of pure science and declare that we will accept nothing not susceptible of demonstration, and that a system of healing must depend for its permanency upon pure facts of observation. We may insist that laboratory knowledge is the only brand that will be permitted to enter the sacred field of science. And yet the fact remains that the details of every branch of learning have been wrought out and established through the application of preconcieved theories based upon comparatively few facts. The beginning of knowledge comes by induction, but its completion is only accomplished by deduction. A theory of life is at the basis of the osteopathic science. The proof that it is a law rather than a theory is the problem of the osteopathic reasoner and practitioner. That proof must of necessity require time, and inasmuch as confirmative evidence is daily accumulated, let no one be discouraged.

An Evolution and a Revolution.

What is that philosophy? It is both an evolution and a revolution. To make our position clear it is necessary to look back into history and trace out so far as may be possible the **evolutionary outcroppings** that have appeared from time to time, culminating finally in a condition that has made possible the revolution inaugurated by Dr. Still. If we turn to antiquity, we find an abundance of philosophy with little of fact. Remedial agencies were employed with little regard to the nature or the manifestations of the disease; which is not to be wondered at, because of the paucity of knowledge regarding the body either in a condition of health or disease. It is true the records would indicate that in the time of the Ptolemies, post-mortems were held; the ancient Brahmins were aware of the variations in the specific gravity of the urine dependent upon diseased conditions, and practiced a crude form of urinalysis. In some respects the remedial measures of that day may be considered a lost art, for the legends have it that measures were known, the use of which would prevent the pitting of smallpox, and antidotes efficient for the most venomous of snake poisons were compounded. The Chinese recognized the diagnostic value of changing conditions of the pulse, though the connection between the condition observed and the remedy employed is unexplained. The Hebrews, while recognizing certain fundamental facts in regard to the ethical relations existing between man and man, and the moral relations between man and his Creator, gave to the world little of value in the way of treatment of individual body conditions. The world is, however, indebted to that race for the most elaborate *system of hygienic matters* that has been devised, some of the provisions of which might well be incorporated in modern sanitary regulations. Until the era of Hippocrates little was given to the world of a permanent nature that would assist in solving the problems of disease and death. In **Hippocrates** (460—377 B.C.) the medical world recognizes its first great figure, not so much by virtue of any great depth of reasoning, but by virtue of his ability to observe, and further, by his recognition of the necessity for recording his observations. Hence, in the Hippocratic collection of writings we find a vast field covered, embracing as it does every branch of the healing art, both of prophylaxis and therapeutics. Hippocrates further deserves the title, "Father of Medicine," because of his work in gathering together not only his own observations, but those which he considered worthy of others of his time and those who preceded him. It must be noted, however, that the value of the observations of Hippocrates lies in their relation to the symptoms rather than to the explanations or the treatment of disease. He added to the knowledge of effects but not to the knowledge of cause or its removal. The philosophers, Aristotle and Plato, with their contemporaries, dealt largely with speculation and little with experimental determination. It is interesting to note that in their time arose the *pneuma* theory, or the theory of the spirits, which in effect was the precursor of Priestley's demonstration a thousand years later, of the presence of oxygen in the air and of the important role that element plays in all life processes. The same era produced Empedocles and Heraclitus, who with their theories of evolution and the struggle for existence, respectively, anticipated Darwin and his followers, and which in the last half century has so profoundly modified every phase of the life question.

While the modern biological investigator has reverence for the name and fame of Hippocrates, he recognizes in the Roman anatomist **Galen**(131—201 A. D.) the first investigator endowed with the so-called scientific spirit. That spirit was manifested in experimental methods of study which were careful for that age of the world. As an anatomist and physiologist, Galen was able to disprove some of the contentions of the Hippocratic school as well as to add a considerable number of important facts to existing knowledge by dissections and vivisections. That Galen's influence was profound and permanent is evidenced from the fact that certain of his classifications are still employed,and that for fourteen centuries his word was law. In spite of his contribution to biological knowledge,Galen added in a direct way not a whit to the understanding of the cause or the treatment of disease.

From the time of Galen throughout the Middle Ages up to the fifteenth century, little advance was made in any of the sciences related to the healing art. Through the schools of France, Italy, and Spain,fact and tradition were preserved unmodified. All knowledge centered in the records of Galen until,with the general **revival of learning** individuals once more began to investigate and reason for themselves. A striking character arose early in the sixteenth century. Disputant, philosopher, mystic and egotist, **Paracelsus** (1493—1541) proclaimed to the world a profound contempt for the learning of the past as recorded in books,insisted that knowledge must be gained subjectively, and formulated a theory of nature. Three of his affirmations we wish to emphasize: first, *all nature is a unit;* second, *nature is never complete, but forever becoming;* third, *nature is a macrocosm, man a microcosm.* That these three ideas have become part and parcel of modern thought, is a proposition requiring little substantiation. The close relation that they bear to the osteopathic doctrine becomes more and more apparent with further study. From this time forward the path of history is marked with the names of individuals who stand out prominently because of added biological facts or demonstrable theorems. **Harvey** (1578—1657) gives to us the proofs of a complete circulation and the dictum never yet refuted, *omne vivum ex ovo*, the former of which had been suggested by Galen and by others less noted. We need hardly dwell upon the importance of both of these facts to the osteopath. Van Helmont(1577—1644) a follower of Paracelsus,emphasized the inter-relations between matter and energy, and suggested the doctrine of ferments as explaining the digestive processes. The philosopher, Descartes (1596—1650),while emphasizing certain and numerous ideas of a general nature regarding matter and mind, gave rise to one concept that is of the utmost significance to the osteopath. The idea that *man is a machine* and the operation of his organism is dependent upon mechanical laws, is a view fundamental to osteopathic reasoning, and to Descartes we are under obligations for that emphatic statement. Growing out of this conception arose the *iatromechanical* school, whose chief advocates, Borelli (1608—1679) and Marey of our time, have made the application chiefly to the systems of animal movement; while a rival school, the *iatrochemical*, founded by Sylvius, insisted on the application of chemical principles as explanatory of various functions. At this stage in the historical development we find an immense impetus given to the investigation of the problems of life through the invention of the compound **microscope** whereby not only the cellular theory of living structure was formulated, but also the discovery was made of microscopic forms of life. This was followed first by the interminable discussion of *spontaneous generation* and later gave birth to the *germ theory of disease*—a theory which has profoundly modified medical thought and practice during the closing years of the nineteenth century. In the latter half of the seventeenth century the English physician **Thomas Sȳdénham**, emphasized another fact which is basic to osteopathic theory.

He made emphatic claims for the *healing power of nature* and thereby anticipated the contentions of all those of later time who insist that it is nature who cures and not the physician. Priestly, in the latter half of the eighteenth century, by his discovery of the element *oxygen* was able to replace in substantial form the *pneuma* of the early philosophers, which, entering the body through the breath gave life to its tissues. **Haller** (1708—1777), following Glisson in the investigation of the property of irritability, enlarged upon the conception of a *vital force* underlying all life phenomena and independent of known chemical and physical laws—a conception which still commands the adherence of a respectable number of scientists, and which is yet perhaps neither susceptible of proof nor disproof. The relation existing between physiological activity and electricity has been the subject of study since Galvani (1737—1798) proved the generation of electric currents by living tissues, and the recent facts of physical chemistry regarding the electrical nature of certain chemical reactions bid fair to throw further light upon the part played by electric energy in the body organism.

During the nineteenth century a few figures stand out strongly in the further development of biology. In special prominence we note the tendency of all modern investigators to an objective study, leaving severely alone, too severely we believe, all matters of a speculative nature. Hahnemann (1755—1843), with his "law of similars" and his insistence on smaller dosages, has most profoundly modified the practice of heroic drugging which had reached an alarming stage. **Virchow** (1821—1902) with his investigation into the pathology of cells, has cleared up many of the mysteries associated with pathologic conditions, incidentally throwing light upon the general *cell doctrine*, although his views and those of his followers can but be regarded as extreme and in some respects impossible. **Ling** (1776—1839), by virtue of his systematization of the various methods of *movement cures*, gave an impetus to the study of the physiological effects of mechanical stimuli, a fact which has led to no little confusion both on the part of the laity and profession, in regard to the distinction between these various methods and that of osteopathic practice. **Hilton**, the English surgeon, has emphasized Sydenham's contention relating to the healing power of nature, in its surgical aspects, and has served to show, innocently enough, the essential identity in the standpoint of osteopathy and conservative surgery. **Pasteur** and **Koch** and **Klebs** and a host of others, through their investigations of the processes of fermentation in and out of the body, together with the demonstration of the close relationship between disease and micro-organisms, have greatly added to our knowledge of the pathological changes taking place in specific diseases, although their explanation of such relationship is not accepted in its entirety by the osteopath. Modern biologists have added a vast amount of data to the sum of knowledge accumulated in the past, and to them the members of all the schools of healing are greatly indebted. In so far as that knowledge has been applied in explaining the cause of disease and suggesting its treatment there is a pitiable poverty. The ground work for a rational system was laid. The inauguration of that system remained for a leader. The use of drugs, which had come to occupy first place among the healing agencies, was found sadly wanting. As early as the first half of the last century, the tendency of the later time was stated by **Krukenberg**, a German physician, in these words as quoted by Park: "Physicians should be filled with a pious reverence toward nature; the organism is a whole and must be contemplated in this sense; medical art is undoubtedly capable of decisive action, but let us not mistake that in many cases its activity is quite superfluous, in very many null and inadequate, and in many injurious." That there has been a remarkable turning away from drugs in the last half century is evidenced from numerous facts. Note the rise of *Christian Science* and the numerous other cults whose systems are based on the relation between mind and body, which number their adherents by the millions, and whose reputed cures emphasize Krukenberg's statement that in many cases medical art is superfluous, and substantiates Syndenham's declaration that the healing power resides in nature; *electrotherapy* for a time flourished and still has its enthusiastic admirers; *hydrotherapy* has become an adjunct of practically all systems, the use of which has been emphasized to the ignoring of its abuse which in reality has been productive of the greater results; the development of *serotherapy* co-existent with the development of a knowledge of toxins produced by pathogenic bacteria has had far reaching results; the known facts relating to internal secretions, together with the observation of pathologic conditions resulting from the absence of some organ, usually a ductless gland, has led to the rise of *organotherapy*, and has served to distinguish between organic food elements and inorganic chemical substances. The rise of these various systems, all indicating the desertion of the drug, has not been dependent upon a realization by the physician alone of the inadequacy of the drug, but equally upon that realization by the thinking laity. The time was ripe for a **revolution** in the conception of cause and treatment of disease.

THE REVOLUTION.

It was stated that in osteopathy not only was there an evolution but there was a revolution. Heretofore the physician had confined his attention to appearances, which in truth was all that he could do, inasmuch as the cause remained unknown. Every system of treatment thus far developed had been one designed primarily to combat effects. It remained for Dr. Still to determine the *fundamental cause* of all disease, and to inaugurate a system of treatment based upon that cause; and in the statement that perverted structural conditions prevent the return to normal functions we have the **essence** of the osteopathic doctrine, and in the application of measures designed to remove these structural conditions, we have the essence of that revolution. Dr. Still's great work then lies in the determination of cause, and through a knowledge of that cause, the application of an effective treatment. The study of the nature of this revolution in its various general and detailed aspects, constitutes the subject matter of the remainder of this volume.

CHAPTER II.

SOME FUNDAMENTAL CONSIDERATIONS.

THE BOUNDARIES OF OSTEOPATHY.

All systems and sciences, whether related to healing or other aspect of human endeavor, are a result of growth. Growth presupposes a beginning less mature than the end. Hence it were presumption at the present time to attempt to set definite limits to the science of osteopathy. Professor Ladd of Yale states a very important fact when he says that the proper definition of a science is one of the latest and most difficult achievements of that science. Recognizing the extreme youth of osteopathy we must be content with only a provisional setting of limitations in any attempt at a statement of its constituent elements. Admitting this to be the case, yet we do not deem it presumption to attempt to formulate in a concise manner the essential ideas in the form of what may be called a **definition.** We protest against the position that is assumed by some that there cannot be a platform upon which we may stand. Our system must have a basis, staunch, unshaken, if it shall stand. We are willing to listen with patience to the presentation of new facts that may cause us to modify our platform, but these must come as fact and not as theory before we shall recede from the principles enunciated in that platform. And so far in the history of the system the original conception still remains unimpaired, even though sometimes hastily considered inadequate to cover the ground. We believe that if care is taken to analyze the facts it will be found that instead of modifying the original concept, they do but confirm and make it the more impregnable. It is needless to say that a single word cannot indicate in any comprehensive way the nature of the system. Hence we have no intention to explain in any apologetic and compromising terms why the word osteopathy came to be used. We do insist, however, as compared to the terminology of other systems it comes much more nearly striking the keynote, and is far superior to any other name that has been suggested.

The **legal** definition given to the system by the statutes refers to it as a "system, method, or science of healing." We must recognize at a glance that it is systematic and methodical. The more pertinent inquiry remains, —is it a science? That it is not a completed science we have already by inference emphasized. That it embraces all the elements of a science we affirm. The definitions that have been given for the word science have been many and various. Succinctly, "systematized truth" may serve the purpose as well as many of a more pretentious character. In so far as the facts that have been gathered when arranged in definite logical order tend to support a definite hypothesis we have a science. In so far as the conditions in disease are shown to depend in definite ways upon certain properties of the structural arrangements, thereby occupying the relation of cause and effect, we have the essentials of a science. Finally, inasmuch as anatomy and physiology are sciences, osteopathy, which is but the application of these two toward the cure of disease, must partake also of the nature of a science. True, there are many things yet to be reconciled, yet to be classified, but that fact does not in any way impair its validity as a science.

Not touching upon the details that remain yet to be worked out a **technical** definition must suggest a concept of the cause and the treatment of disease. In regard to the latter it must not only embrace therapeutics but prophylaxis as well. For medicine in the broad use of that term must include not only measures employed to assist the body in recovering its equilibrium but also those designed to assist the organism in maintaining that equilibrium. Indeed the latter is logically of far greater importance, but because of an unfortunate tendency on the part of human nature to procrastination the former will of necessity demand the most of the physician's labor. In order that our definition shall include essentials and give to us a basis of support the following propositions must be either directly or by inference included:

1. Cure is the prerogative of the organism.

2. Functional disorders will be self-adjusted except where complicated with or dependent on structural disorders which are beyond the limits of self-adjustment.

3. Removal of structural disorders constitutes the treatment.

In accordance with these provisions we have in another publication (Journal of the American Osteopathic Association, May, 1902) suggested the following definition of osteopathy: *A system of therapeutics which, recognizing that the maintenance and restoration of normal function are alike dependent on a force inherent in bioplasm, and that function perverted beyond the limits of self-adjustment, is dependent on a condition of structure perverted beyond those limits, attempts the re-establishment of normal function by manipulative measures designed to render to the organism such aid as will enable it to overcome or adapt itself to the disturbed structure.* The elaboration of the various provisions in the above definition will appear as the subject is further developed in the following chapters.

The science then by virtue of its recognition of the interrelations between structure and function is eminently, as has been so often stated, the application of anatomy and physiology to the cure of disease.

THE VIEWPOINT OF LIFE.

We have spoken of the fact that a system of healing cannot be separated from a philosophy of life. As introductory to a further study of the osteopathic doctrine it is necessary to consider in brief a few aspects of the life problem. Not that it is possible to give an accurate **definition of life**; for it is obvious that no such definition can be given of a thing, the essential nature of which is unknown. For we know not what life is; we are only acquainted in part with the substance with which life is associated and with a few of its manifestations. We know that in one sense life is a *property of a certain kind of molecule* (Wilson), but the explanation of that property and how it is associated with the molecule is not forthcoming. We know that life is inherent in this certain kind of molecule. Dr. Still has stated that life is an *individualized principle of nature*. A part of the universal life has become individualized in an aggregation of protoplasmic molecules. How it became thus individualized, and at death it again becomes merged into the universal life, is yet and in all likelihood will always remain a mystery. The materialist hopes sometime to be able to explain life in terms of physics and chemistry. While it is true a large number of functions formerly considered vital, in the sense of being out of the realm of physics and chemistry, have in more recent years been satisfactorily explained on purely physical or chemical laws, yet a vast number of much more difficult facts of function remain entirely beyond physical or chemical explanation. Until these are explained and life is shown to be but a peculiar arrangement and action of atoms in a peculiar molecule with no hyper-mechanical or hyper-chemical actors, we must assume the presence of an essence which for lack of a better term is called the **vital force.** This conception corresponds with Dr. Still's "matter, motion and mind." We shall not attempt to identify the vital force with mind. The argument for or against that contention is purely a matter of speculation. Suffice it to notice that a force of some kind animates all living matter and is, so far as can be at present determined, outside the realm of matter and motion. This force apparently initiates, controls and co-ordinates function throughout the entire organism. It is a force continuous throughout the entire organism through the medium not alone of blood continuity, nerve or cell-contiguity, but also through the less known but undoubtedly important fact of protoplasmic continuity to which we shall later refer in more detail. Truer words were never spoken than those used by Krukenberg and suggested by others that "the organism is a whole and must be contemplated as such." Recent biologists have called attention to the fact that protoplasmic bridges exist between cells in a remarkably large number of organs and tissues, and Spencer's suggestion is significant that a particle of protoplasm may during the course of time pass to all parts of the body.

While it is not possible to accept the materialist's conception of living matter yet recognition must be made of the fundamental importance of chemical and physical law as **a basis for functioning.** The chemical nature of protoplasm is significant; composed of a dozen or more of the known elements most of which are of low atomic weight, we find a very complex molecule. If paramount importance can be assigned to any single element, nitrogen could reasonably be placed first. That element is characteristic of living material and is fundamental in the way of giving to the complex molecule its own peculiarities. Nitrogen unites with a sufficiently large number of other elements but in comparatively loose combinations, separating readily to form new associations. It is in this respect that nitrogen is fundamental to the living molecule. The most striking characteristic of living tissue is its tendency to continual change—not only of a physical but also of a chemical nature. The response to a stimulus is dependent upon this readiness and since life may be considered in large part a response to stimuli the necessity for the ability to change becomes apparent. In this connection Spencer's classical definition of life is illuminating: "*The continuous adjustment of internal relations to external relations.*" As we shall have occasion to repeatedly refer to the fact of adjustment this conception of life should be borne in mind. Every change in the environment of the organism constitutes a stimulus of greater or less intensity upon that organism. The continuous proper response to these stimuli represents a normal condition of the organism; a failure to respond, or a response too intense or insufficient is evidence of and further cause for a disease condition. In the sense of a continuous response to continuous stimuli the organism constitutes a *moving equilibrium*. When that equilibrium becomes disturbed by too intense or too prolonged stimuli disease results, while in the continuous adjustment to circumstances we have the normal condition of the living organism maintained.

Considering life, then, in certain of its manifestations, we are led to the conviction that the **law of change** is a law of living matter as represented in man. The study of those changes and the determination of methods to assist the organism in its response to stimuli, constitutes the life problem and the problem of the physician.

Structure and Function.

In this continual adjustment dependent on change in the physical and chemical relations of the molecule above referred to, it is to be noted that both structure and function are concerned. Discussions are rife regarding the relative position of structure and function in the development of an individual or of a race. We shall not enter into the argument except to attempt to show that for all practical purposes the two **develop co-ordinately.** That structure changes function must be admitted in countless cases. This fact is fundamental in osteopathic theory, according to which most diseases are either caused or maintained by structural conditions interfering with function. On the other hand it is equally certain that in numerous cases we have evidence of the modifying influence of function on structure.

The cell doctrine as commonly understood is insufficient to explain the phenomena of the complex, organized living being. The cell represents the expression of life which is inherent in the common structural basis, protoplasm. It remains further to state, as Dr. Still himself has emphasized, that protoplasm is the **first product** of the life essence.

There is an organizing force that lies back of all structure. That force is unknown but it represents an action, an energy, a function. In this sense we are justified in insisting that function is a cause of structure. We may follow out this assertion, however, with the equally obvious statement that before that organizing force can express itself in any substantial way it must have a structural basis. That structural basis is protoplasm. In this view of the matter we are justified in claiming that structure governs function. Throughout the growing period of the individual, function is continually changing structure. Marey calls attention to the development of *grooves and depressions* in the growing bone from the continual functional activity of the growing muscle and other soft tissues. As the individual uses to excess one group of muscles, the *prominences* to which the muscles are attached will be correspondingly increased. The muscle itself, as in the case of the *heart* in certain valvular disorders, becomes remarkably hypertrophied. A disorder of the *stomach*, through the increase of nerve impulses that pass from it, initiates changes which result in *perversions of form*, more noticeable in the case of muscle tissue. All of these are instances of the power of function to modify structure. In large part, it will be noted that the functioning energy only modifies the structure in the process of growth, compensation, or any condition where a definite purposeful action seems necessary. As soon as the functional activity or the energizing force has brought forth and builded its own instrument of manifestation, observation of the human body, that of the lower animal, and to an equal extent, plant life, all show that function then becomes subject to the mechanical conditions of the structure and form. Thence on, more markedly than during the previous period of growth or compensation, structure becomes modified only inappreciably and gradually by the function. The structure, through various forces acting upon it, is in considerable part unable to immediately adjust itself, with the result that the function must immediately suffer and continue so to do until the structural condition be overcome. Therein lies the **essence** of the whole argument. Admitting that function can modify the structure, it much more readily can modify itself and hence is perfectly self-adjusting. On the other hand, structure is only passively self-adjustive, and hence will likely remain in its abnormal condition until some external force is brought to bear. During all the time of structural disorder the function will of necessity be disturbed and disease will result. Structure representing the channels through which the life forces manifest themselves becomes comparatively unyielding. The function remaining active, so long as structural conditions are maintained, will be self-regulated.

THE CELL DOCTRINE INSUFFICIENT.

From the middle of the seventeenth century when Schleiden and Schwann discovered in the case of plants and animals respectively that living material was divided into innumerable microscopic parts having a more or less definite shape, up to the present decade, the cell doctrine has been growing in importance as one of the great facts of biology. When the nature of the cell was first determined and the essential elements had been differentiated from the non-essential, it was believed that a long step had been taken toward the solution of many of the life problems. As the investigator learned that each of these individual divisions had a more or less distinct life of its own, the attention of the physiologist was turned from a consideration of the action of the cell groups to that of the individual cell, until in the literature of to-day the statement is constantly reiterated that the problem of physiology is the problem of the cell. Virchow, in his monumental work on the cell structure with special reference to its pathology, has emphasized more than any one man the individuality of the cell and the fundamental necessity for normal cell life in order that body activity as a whole shall be normal. To detract from his reputation is not the part of wisdom or a thing at all possible or desirable, but it must be insisted that *the problem of physiology can never be solved by the rule of the cell*, and that for the simple reason that the cell is not the fundamental element in living tissue. Within later years the extreme views have been modified and modern investigators are searching for the demonstration of what we may provisionally call the **ante-cellular elements.** That such exist there can be little question. That is, more simple elements which have the fundamental life faculties, lie back of the cell and are responsible for the cell. If we were asked to suggest the *simplest possible conception* of life in its manifestation, we would insist that protoplasm, plus an organizing force dwelling within that protoplasm constitutes the simplest conceivable life condition. This conception is not that of the cell doctrine. The strucutral conditions necessary in the cellular arrangement are but one of the expressions of the life. As Wilson puts it, "All parts of the cell are but the local differentiation of a common structural basis." The cytoplasm is one specialization, the nucleoplasm is another, and the cell wall is a third of the specializations of this structural basis. It is not enough to say that there must be the combination of nucleus and cytoplasm in order that life may be manifested. It is a common statement that the nucleus is necessary and hence any protoplasm devoid of a nucleus cannot represent the fundamental unit. We affirm that cytoplasm does live and does manifest life after having been separated from all connection with nucleoplasm. It shows amœboid movement, it is irritable, it flows about nutrient substances and digests them. Hence life is still present, and without question there are present more elementary biological units. To the objection that the cytoplasm very soon dies, and under no circumstances can reproduce itself, we may reply that the same is true of any of the complete cells of multicellular man when they have become separate. It is purely a question of degree and length of life and not one of kind.

With modern methods of research, our knowledge of the actual structural conditions of the human body has been considerably increased and in large part corrected. One of the more striking of the observations which bear directly upon the subject in hand, has reference to the fact that the body is by no means entirely made up of **cellular structure**. It has long been known that in the case of plants numerous of their cells were structurally continuous. The same fact has been shown to be true in the case of animals. In the developing *ova of fishes* it has been found that the cells as they were formed were not separated but still maintained the continuity of their protoplasm. The same is true with reference to the *ovarian cells* of mammals. In the higher animals, including man, many *epithelial cells* on close inspection show the presence of **protoplasmic bridges**, which is significant as bearing on its relation to the secretory activity of epithelium. Cartilaginous and many other forms of *connective tissue* cells are connected through protoplasmic extensions. In the case of the *muscle cells* of the heart we have a typical condition. There the cells are markedly branching and the branches are continuous one with another. This is of fundamental interest, as throwing light upon the peculiar properties of the cardiac muscle. It has long been known that the contraction of the heart takes the form of a wave passing downward from the sinus venosus to the apex. It was formerly assumed that this wave was propagated from auricle to ventricle through the medium of nerve connection. This has been shown to be erroneous, since the nerve tissue can be rendered ineffective while the propagation of the wave remains unaltered. What is the explanation? Older anatomists taught that there was no muscular connection between auricle and ventricle. This, according to Gaskell, has been disproved and it is now known that the propagation of the contraction wave from auricle to ventricle takes place through a continuity of muscle protoplasm. While the continuous nature of cardiac muscle cells has long been known, it is only within more recent years that proof was given for a similar though less marked condition in the case of *all involuntary muscle tissue.* This becomes of special interest because of the long known fact that a contraction wave started at one end of the intestinal canal passes through a greater or less extent of the tract without further stimulus. Therein further lies the suggestion of an explanation of the *Traube–Herring curves* which are produced by the rhythmic action of the arterial walls and which are entirely independent of the pulse. According to one investigator of recent years, up to the time that the *white corpuscle* passes out into the lymph or blood, while it is seemingly perfect in its development it remains still attached by protoplasmic filaments to the mother cells in the lymphoid tissue. It is even suggested that the appearances indicate a power on the part of the white cell of reforming its attachments. If this be true, the already known functions of the leucocyte would be prodigiously increased and the possibilities from that power would appear to be infinite.

From the above considerations it would seem that the conception of the human body as a **syncytium** is not at all inappropriate, and that there is justification for the conclusion stated by Meyer, (Wilson on "The Cell") that "*both the plant and the animal individual are continuous masses of protoplasm in which the cytoplasmic substance forms a morphological unit whether in the form of a single cell, a multi-nucleated cell, or a system of cells.*"

While it is impossible at the present time to prove that this protoplasmic continuity is present to any extreme degree in the human body there is much to be said in favor of it as an abstract proposition. We have continually referred to the necessity of considering the **body as a whole** and not as an aggregation of independent particles. This is fundamental in the osteopathic philosophy and practice. If the body is a syncytium then the *practice of removal of any organ of the body because of its supposed absence of function is fundamentally erroneous.* All organs and all parts of the body will perform to a certain extent all functions of the body. While there is specialization no part of the body will completely lose its original properties. This emphasizes the fact that in the human organism we have *the most complex as well as the most simple functioning capacities*, and as such it can meet all conditions of environment on a common level, whether these conditions themselves be complex or simple. And this is of importance in the organism's struggle for existence. When man is compelled to resist another organism of complex nature such as the mammal he may do so by the use of his own specialized complex nature. He can meet brain with brain and muscle with muscle. Compelled to resist the effects of poisonous substances, whatever the occasion for their presence in his body, he may meet toxin with anti-toxin—a process known to take place. Compelled to withstand invasion of his own body by the unicellular organism, such as a pathogenic bacterium, he may meet cell with cell, for phagocytosis is an accepted physiological fact. The same idea is emphasized in the case of the *internal secretions*. It is known that many of the organs of the body provide certain substances that are essential to the body as a whole. If there is a protoplasmic circulation it is doubtless true that every part of the body gives and receives from every other part.

A further interesting suggestion along this line refers to the relation between this protoplasmic continuity and various reflex disorders and **chains of disorders.** A pathologic condition of a group of cells too slight to affect the nerve connections or the quality of the blood, may still be capable through the added influence of the flow of protoplasm, of changing the metabolism of remote structures. This fact would further emphasize the necessity for *looking to other parts of the body for lesions than merely to the regions commonly involved through a disturbance of the nerve or blood mechanism.* In like manner we may understand the deleterious effects on other and all parts of the body from the **administration of drugs.** It will thus be impossible to limit the action of a drug to the tissue involved in the disease; once having come in contact with the protoplasm of a single cell, unless thrown out by defensive action, it may pass to every part of the body without leaving its protoplasmic medium.

A final interesting suggestion and one that may throw light upon the general problem of the **inheritance** of disease has reference to the protoplasmic continuity as a medium for transmitting through the germ cells of the body, elements from each of the other cells. This might suggest why it is that a child does to all appearance inherit some peculiar quality in his body or mental functioning.

We have thus emphasized the fact that there is in all probability a uniform protoplasmic continuity, in order to draw attention to the necessity of considering the body as *much more than the sum of its parts.* It is true that the cells individually exercise a profound influence over the body as a whole, but it is equally true that the body as a whole exercises an immense influence over the cell and groups of cells. This latter fact must be continually recognized in all cases of diagnosis and treatment of disease.

Cause of Disease Not in the Cell.

But in another sense the cell doctrine as commonly understood is inadequate. Virchow and others have placed biologic science under great obligation for numerous facts with reference to the role of cell metabolism in disease. From the conception that the body is an aggregation of groups of cells, each of which has its own independent function, comes the natural deduction that a disease of any organ is due to a faulty condition in the activity of those cells. By the demonstration that protoplasmic metabolism was able to synthetise various substances that were **auto-toxic**, a key to numerous diseases was believed to have been found. So far as a superficial conception goes, the assumption is correct. But it is manifest that it is a key that unlocks only a single door and one which leads only to further difficulty. It is true that every cell may produce substances which are actively toxic to its own protoplasm and to that of its neighbor if it be *maintained in contact* with such substance. It is not unlikely that any product of normal katabolism may be equally disastrous if permitted to remain. Everyone has experienced the sensation of fatigue. What is the condition present? Undoubtedly it represents an excess of normal waste material collecting in connection with sensory filaments distributed to the muscle cells. Every student of physiology is aware that in fatigue this toxic substance is produced. The blood serum taken from a fatigued animal and injected into the vascular system of one in a rested condition, will produce in the latter every symptom characteristic of the fatigued animal.

La Grippe produces similar symptoms, and Verworn has attempted to identify the two conditions or at least to show their marked similarity. In the La Grippe condition there is present a material toxic to the cell and irritant to the nerve terminal, similar to the effect of the sarcolactic or other acid always present in excess in overworked muscle tissue. The presence of the bacterium is not necessarily a detriment to the organism but in many cases pathological conditions are undoubtedly caused in part from its activity. In these it is not the mere presence but the excretion product that constitutes the deleterious influence. Whether it be a toxalbumin similar in kind to that produced by body activity remains to be demonstrated. Sufficient for present purposes to note the fact that the material is toxic and must of necessity produce cell disorder if present in sufficient amount. Whatever the source of the toxic material, whether it comes from bacteria, over exercise,or perverted cell metabolism, it is immediately a possible cause for harm.

Cell metabolism may be abnormal from changed supply of **blood or nerve influence.** Undoubtedly in the case of most cells of the body, their activity is partly under control and co-ordination of nerve influence. An excess of that influence will be the cause for the accumulation of the katabolic products constituting the cause for fatigue. This means that the nerve initiates a too rapid transformation of potential energy of cell protoplasm into kinetic energy of chemical and vital activity. This additional activity will further initiate new changes immediate and remote and a chain of events be inaugurated. A deficiency of blood and nerve influence, on the other hand, will permit of a lowered resistance to other stimuli, with one or both of two effects, a trophic change in the tissue or a perverted quality of metabolism. In the latter case the complete products of the normal "metabolic cycle" will not be formed and hence various types of degeneration may follow.

These considerations have led many into **error.** The statement is made that the cause of disease resides in the metabolism of the cell. This is true only in a limited sense. A more nearly correct statement would be that the disease *is* the faulty metabolism of the cell. It remains to trace the faulty metabolism to its source. It is obvious that, theoretically, numerous forms of stimuli may come into relation with the cell protoplasm to modify its activity. Mechanical, thermal, chemical, electric, nervous—all are known to affect protoplasm. But in every case these influences must be brought over channels that connect cell with periphery. For the cell, deeply situated, is in an environment of comparative quiet. Mechanical pressure does not act as a serious stimulus because that pressure is constant. Thermal conditions are unfavorable for producing response since it is only a sudden change that is an efficient stimulus. Chemical stimuli only reach it through the medium of channels which transmit fluid capable of performing the office of a vehicle, while nervous influences are similarly carried over definite pathways. We are thus brought face to face with the fundamental fact in the osteopathic concept that a free channel between cell and its source of supply—unobstructed blood and nerve—is the normal condition for protoplasmic functioning. The connection between blood and nerve having been made such that nerve governs blood and blood replenishes nerve, the cell in immediate connection with both is entirely dependent on the normal condition of these for its proper functioning. Over all is exercised that co-ordinating power, seemingly inherent in protoplasm and by which the cell is maintained in balance between its anabolic and katabolic processes. Hence so long as the channels connecting cell with periphery be kept free, no break in the chain of events constituting the metabolic cycle is possible. The cell will thus be able to *select and reject at will.* The normal hydrostatic and osmotic pressures will be maintained at such a level as to necessitate a correct functioning in vital selection. Nutrient materials will be taken in from the blood with ease and rapidity. Waste materials will be discharged with equal facility. *Fatigue* cannot long persist since a growing loss of irritability will necessitate rest and when rest is permitted the protoplasm is rapidly renewed. *Bacterial products* though present in the blood will not aggravate for long, since the function of normal protoplasm is to secrete anti-toxin. An uninterrupted nerve influence will keep up a constantly normal chemical and vital protoplasmic change. Under such circumstances the cell, vital and self-sufficient, cannot easily go wrong in its action.

But **modify the conditions** associated with the channels of interchange and note the result. Changes in blood supply and drainage permit changes in osmotic conditions and hence changes in activity of the cell selection and rejection; lessened cell nutrition and cell regulation will result. Disturb nerve discharge to the cell, and excess or deficiency in metabolism results, with varied abnormal tissue conditions. How will these interferences be produced? Largely by changes in structural arrangements associated with a *tissue which is least subject to vital control*, i. e., connective tissue, bone, ligament and muscle. When these are disturbed a lessened possibility of adjustment must result. Failure to supply the blood with materials from which the cell claims its pabulum, excesses of whatever kind—all will have their influence, but at most it will be but temporary and so soon as the abuse—for such it is—ceases, repair is rapid and usually complete. Bacterial conditions cannot harm the cell since the blood is germicidal, antiseptic and antitoxic.

Altogether, it would seem that the cell representing a definite bit of protoplasm cannot of itself cause a disease in itself or in its neighbor. It is **inherently healthy** and is utterly incapable of harm until the connection between it and its sources of supply and channels for drainage becomes impaired. These connections are represented by blood stream, lymph channel, continuity of protoplasm, and nerve substance. Interference with these by persistent pressure from displaced structures, which are less subject to vital control of position, constitutes the factor which produces or maintains the disturbed cell metabolism.

Man A Machine.

It has been stated that underlying the practice of osteopathy there is the recognition of a close and fundamental relation between structure and function. Reference was made to the fact that the human body in structural aspects partook of the nature of a definite machine, the operation of which followed definite mechanical laws. That man is a machine is an assertion trite enough, yet one that demands some consideration. A **machine** is an instrument by which force is changed in direction or intensity, and usually associated with the transformation of energy. While the mechanic employs a vast number of mechanisms all may be reduced to a few simple machines, viz., the lever, the pully, the wedge. Each of these is represented in the human body. Practically every action of the voluntary muscles is dependent upon the principle of the *lever*. When one extends his fore-arm he does so by the use of a lever of the first class; when he forces his body from a wall by placing his hands against it the lever is of the second class; when he flexes his fore-arm he employs a lever of the third class. Borelli

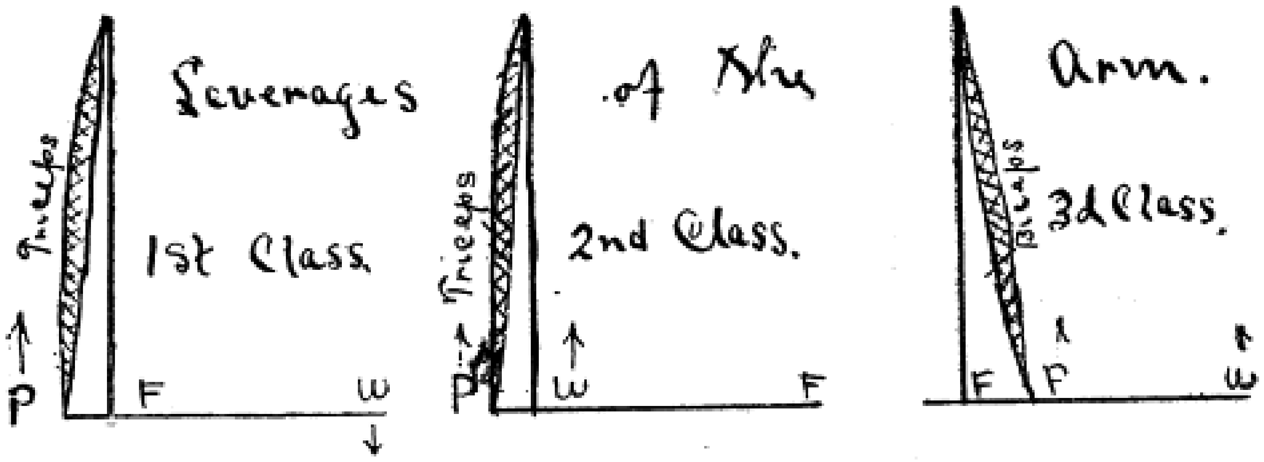
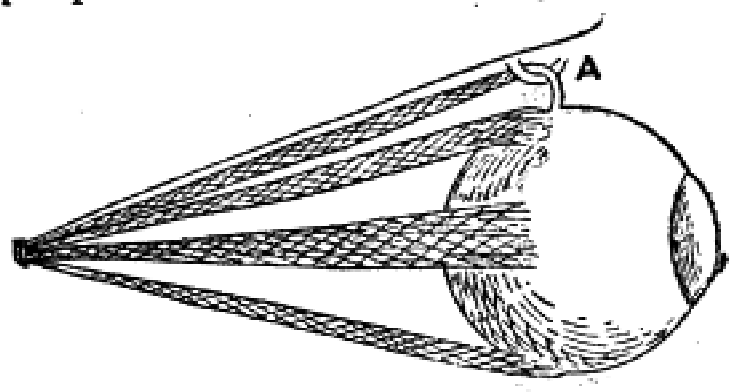


FIG. 1.—Illustrating the mechanics of muscle and bone.

and Marey in their investigations relating to muscular action of the locomotor organs have shown by mathematical and other demonstration the nicety of adjustment of those organs to the work required to be done, emphasizing thereby the purposefulness of the body structure. In the superior oblique muscle of the eyeball, in the peroneus muscle, and in the long head of the biceps, are represented the *pulley* action by which the direction though not the intensity of the force is changed. In the "bag of waters" at parturition, in the middle lobe of the right lung, in peristaltic action, and in certain parts of the process of vomiting we have illustrations of the principle of the *wedge*. The laws of *hydrostatics and hydrodynamics* are made use of in numerous cases. Pascal's law of fluid pressure is at the basis of blood distribution and blood flow; capillary attraction, osmosis, filtration and diffusion play no inconsiderable part in body functioning; the fenestra rotunda of the middle ear with its membranous covering is a provision for the law of fluid incompressibility. The laws of *air pressure* are utilized in the pro-



A.- PULLEY OF SUP. OBLIQUE.

FIG. 2.—Illustrating mechanics of the pulley.

cesses of respiration and circulation, and in giving support to the articulations and the viscera.

While we recognize that man is a machine, the term **mechanism** is one more descriptive of the real condition in that the former carries with it by association the idea of rigidity and unyielding parts. This latter characteristic is obviously not true of the living organism in which continual change is characteristic. Further, mechanism involves the idea of complexity which characteristic is markedly true of the human body. But it must be borne in mind that while the latter term is more descriptive of the actual body condition, it involves largely the same principles as does the former.

The Body a Chemical Laboratory.

The body is not only a machine by reason of which it can produce various changes in the nature of the energy with which it comes into relation; and through the operation of purely physical laws that are possible of expression through the arrangements of its numerous parts it can perform the function of a physical laboratory. It is in addition a **chemical laboratory**, the capacities of which have a reach that is entirely beyond the artifice of man. Substances are formed, torn down and re-formed, which have no counterpart in the world outside of organic life. No man yet has been able to synthetize living proteid from the inorganic or organic materials at his command. We may take the living tissue and analyze it, but when the analysis begins the proteid has lost its life essence. What remains we may analyze and determine in part its constituents. We may take of the products of living proteid and after analysis draw conclusions as to the original living tissue. But we are yet in the dark as to the fundamental quality in the chemical nature of living protoplasm. Even the complete formula for the dead protoplasm defies exact statement. When that is once accomplished we then shall have little reason to hope for an immediate determination of the composition of the living tissue. For within the sacred precincts of the living proteid molecule we may not go, and the discovery of the intimate nature of that substance must continue to be a subject for speculation and not demonstration.

That the **conditions needful** for chemical action are markedly present in the human organism need hardly be emphasized. Suffice it to suggest a few points that call attention to it. The body as a whole is over sixty per cent *water*. The essential living part of the body, i. e., the protoplasm, contains a sufficiently greater amount to render it distinctly fluid. This fact is of fundamental importance from the standpoint of chemical possibilities especially. That it is fluid rather than solid is suggested by the fact that it *flows* as in the case of the streaming process noted in the cells of certain plants; by the tendency which the white blood corpuscle and other typical protoplasm exhibits to assume a *spherical shape*; and the further tendency of *other fluids* to assume that shape when absorbed within an environment of protoplasm such as is noticed in the case of fat droplets. Owing to this fluid nature chemical action may take place more efficiently and more rapidly, which is a fact of considerable value for the purpose of quick response to stimuli so necessary to a complex life. Contained within this fluid material we have a *dozen* or more of the lighter chemical elements held in rather loose chemical combination so that when materials from the outside world have become absorbed into the protoplasmic substance a rapid change of atomic and molecular associations is readily effected. We have before referred to the fact that of the elements found associated with protoplasm a few seem to be of fundamental importance, namely, the oxygen, the nitrogen, and the carbon. A few others seem to be essential but appear to perform a less important role in metabolism, while still others in special forms may be present or absent. The proteid material found in the body is in large part what is spoken of as *combined proteid.* Verworn gives the following formula of one of the most important of the combined proteids, namely, hæmoglobin, which suggests the extreme complexity of the substance and the infinite possibilities of re-arrangement in the processes of vital chemistry: $C_{600}H_{960}N_{154}Fe_1S_3O_{179}$. This represents but one of a large number of the combined proteids. If we permit ourselves to dwell upon the resources from which the body chemist may draw and the numerous products that are continuously formed we cannot be otherwise than astonished at the unerring precision and nicety of adjustment which is maintained throughout the life of the normal individual.

The division point between chemical action in the body and that dependent on other forms of energy is not a definitely determined one. Yet we know that many of the **fundamental facts** of physiology are chemical ones. Proteid foods in the alimentary canal are acted upon by the pepsin and the trypsin and reduced to simpler and more diffusible forms in a manner seemingly entirely identical with that which takes place outside the body. The oxygen entering the blood and later the tissues, forms a combination with carbon which is identical with oxidation processes wherever found. Hydrogen and oxygen unite to form water in a manner similar to its synthesis elsewhere so far as can be determined. Urea, formed by the liver cells from ammonia and CO_2 in the blood, is in all likelihood a process similar to its formation in the chemist's laboratory. We thus emphasize that the body organism is capable of chemical possibilities not only entirely like those outside organized life, but in addition surpasses the known laws and possibilities of laboratory chemistry.

From the above considerations we may draw several important **inferences.** Every substance necessary to the body in normal functioning will be formed by the organism's own chemical processes. Iron compounds have for long been the staple remedies for anæmia. In this disease there is a deficiency in the hæmoglobin of the red corpuscles, together with a deficiency in the number of these bodies themselves. **Iron** is one of the necessary elements for the hæmoglobin. It was assumed that by the administration of the iron compounds the deficiency of that element was provided against. It has been definitely proven that the iron thus administered passes through the body unchanged. But the practice of administering the iron still is prevalent. Note this fact: *the fault is not one of a limited source of iron, but a limited power of assimilation of iron.* The food materials of an ordinary diet contain enough iron as well as all other elements for all normal functioning. Increasing the amount of iron even though it may be assimilable in such form as it is given, which is doubtful, must of necessity fail as a remedial measure. It has been recently contended that **arsenic** in small amounts is a constant constituent of certain of the tissues, and from this was derived the assumption that the giving of arsenic in certain diseases, long a thing of practice had thus found its justification. Reasoning could be no more faulty. The argument against iron in anæmia holds equally against the use of arsenic. In both of these cases, if a deficiency in the assimilation of the substance be the real condition, then the logical consideration would be the determination of the faulty condition of the part which prevented the organism itself from selecting and utilizing those substances which are found in sufficient abundance in the blood.

Another **important deduction** is this: *when unusual conditions arise which demand unusual compounds, the latter will be formed.* Hæmorrhage is self-limited in most cases. Why? **Fibrin**, not found in normal blood conditions, is immediately formed from the interaction between thrombin and fibrinogen which are present either actually or potentially in the blood, on the exposure to air or other foreign substance. Thus the blood clot is formed. Why are individuals *immune* from certain diseases? In some cases by a so-called natural immunity which presents elements in the blood antagonistic to infective agents. In other cases through the excessive activity due to a previous attack whereby an increase in the neutralizing substance was brought about. What is the source of *lactose*? It is a sugar found only in connection with the secretions of the mammary glands, generated from the stimulus associated with the pregnant and lactation periods.

Further instances might be supplied but the point is sufficiently plain. The body organism by virtue of its ability to act upon and be acted upon is continually meeting new conditions as they arise and responding in a manner which insures its continued activity as a separate and self-sufficient organism in a world of contending organisms and inanimate forces. Through its chemical activities, aided by a favorable medium, it is enabled to successfully maintain an identity given to it by a long line of ancestors, but at the same time permitting of sufficient variation in its less important structural and functional details to prevent disintegration that would result were it of a less yielding nature.

CHAPTER III.

SOME FUNDAMENTAL CONSIDERATIONS. (CON.)

THE ENERGY OF THE BODY.

The suggestion that man is a machine gives rise to the problem of the nature and source of the energy that must of necessity be associated with the body. For one of the characteristics of the machine, whether it be animate or inanimate, is its ability to convert one form of energy into another. So far as is at present known no creation or loss of energy is possible. This law of the **conservation of energy** is one of the most fundamental and significant of the laws made emphatic during the last century. It is no less true of the living body than of other mechanisms and other worlds, that the various manifestations of motion are but the different forms into which the one universal energy may be changed from time to time.

What is *energy*? Authorities differ in details, but all are agreed that energy may be most nearly conceived of as motion. Dr. Still has emphasized the triune nature of the body in his discussions of "Matter, Motion and Mind." Matter is inert in so far as it may be independent of motion. But matter can not be independent of motion and manifest itself to the senses. The two are one and inseparable. The motion of an atom is an integral part of the conception of an atom. As soon as matter becomes separate from motion the universe as such must cease to exist. We know that appearances are continually changing. We know that change is a law of nature. And change is only possible through the numerous forms of energy that are associated with the substance of which all natural things are composed. We may conceive of mass motion, and molecular motion, and atomic motion. These are in all likelihood different phases of the same great energizing principle which lies back of the manifestation. All are concerned with the one inherent property of all matter—that which we denominate *energy.*

It has been said that energy remains the same in essence. How is it that it appears so different under different circumstances? We are led thus to a consideration of a corollary to the proposition that energy is never lost or created, and that is, that there is a continual **transformation of energy.** This capacity for transformation depends upon the circumstances of the matter with which the energy is associated. Any mechanism which is able to cause a new appearance in the manifestation of energy is a transformer, not a creator of energy. The human body, as of all living bodies, is such a transformer. The proposition may be illustrated by several instances.

One of the forms which energy assumes is that of **chemical action** which may be considered as an attraction between atoms. It is needless to more than call attention to the fact that body functioning is largely dependent upon the attraction that thus exists. The *source* of such energy is ultimately from the external world, i. e., from the food materials taken into the body and from the potential capacities of the living cells which were transmitted to it from its parentage. Of the latter we are forced to assume an inherent vitality which inaugurates the various changes of a chemical nature with which the embryological processes are associated. Here we undoubtedly have a transformation of *vital into chemical* energy. But that added chemical energy further assists vital activities in which new vital energy is shown, and a retransformation appears. The food materials taken into the alimentary canal represent immense quantities of *stored chemical energy.* As soon as this material comes in contact with certain other substances in the canal which are the product of other vital and chemical factors, the potential energy of the food mass becomes *kinetic* in the liberation of new chemical action and heat. The oxygen taken into the body through the membrane of the air cell passes into the blood, is carried to various parts of the body, unites with the carbon of the food and of the body tissue and in the chemical changes thus initiated, heat is set free. In the finer processes of assimilation and dissimilation the same changes and reverse changes are produced through the continual interaction of chemical and vital activity.

There is a cohesive force characteristic of certain body actions. This may be spoken of as **molecular attraction**. Every molecule has an attraction or a repulsive effect on every other molecule. This is true whether the substance in or of the body be solid, fluid, or gas. The constant intermixing of the fluids of the body in the processes of *diffusion, filtration and osmosis* represents but a difference in the attractions between the molecules of the different substances. By virtue of this action a continual interchange between parts of the body becomes possible, and considering the fact of protoplasmic continuity it becomes doubly significant as a factor in body metabolism. The difference in *gaseous pressures* between the oxygen of the air in the alveoli and that in the blood explains in part the presence of oxygen in the blood. Similarly the excess of the carbon dioxid in the blood with reference to the amount in the lung spaces provides a means for excretion of the noxious gas. In the process of molecular action and interaction new conditions favorable to different atomic affinities arise and we have the molecular energy *transformed* into atomic energy.

The energy of gravitation while not apparent as such in the body is responsible for certain actions that there take place. We may speak of this energy as the **attraction between masses** and while this attraction undoubtedly exists in the case of different masses of the body tissue it is insignificant as compared to the attraction between the body and the earth. In this connection it is interesting to note the fact that the *urinary apparatus* of the human body is so situated as to take advantage of gravitation and by virtue of this fact alone the kidneys are in large part continually drained of their excretions; while in all animals gravitation is made use of in the discharge of excretions from the body. Dr. Still has suggested the important point that in case of fever conditions or other weakening states, the body should be placed in an inclined position in order to assist, through the energy of gravitation, the discharge of the excretions through the ureters. *Transformations* occur in the interaction between gravitation energy and that of other forms. Molecular and chemical movements occur in opposition to the force of gravitation with a consequent production of new forms of energy such as heat and electric action.

The **mechanical energy** of pressure and friction and change of shape associated with the different parts of the same substance are very manifest in the body and in its relations to the external world. By virtue of the continual movement of the body parts and the movements associated with environment pressures and friction occur with the resulting liberation of heat and other forms. The *friction of the blood* upon the vessel walls accounts to some extent for the resistance to the blood flow which is so necessary to a normal blood pressure. This friction invariably produces additional changes in form, and as a result heat and electric and chemical action appear. The mechanical pressures of external matter and internal matter *upon nerve terminals* and less responsive body protoplasm, produces impulses which are nervous or muscular in character, either directly or through an intermediate chemical energy which is in turn converted into a nerve impulse. The latter acting upon the stored materials in the nerve cell body is *rechanged* into chemical and vital energy which will thence further the chain of action. Mechanical energy acting in the nature of a stimulus is of prime importance to the osteopath. For it is largely through the influence of pressures that he is able to explain the various effects from mechanical displacements of tissues constituting the *lesion* which is the most important cause of disease.

In a special kind of molecular movement is seen another form of energy with which the body is associated and which is denominated **thermal energy.** This is spoken of as a *molecular vibration*, the increase of which explains the condition of a rising temperature, the absence of which constitutes the absolute zero point. That a certain *heat level* is necessary to body functioning is evident not only from experimental observation but from the known remarkable apparatus present in man which maintains that level in spite of a fluctuating temperature of the environment. The *sources* of this form are direct from the external world through the medium of radiation from the sun and other warm bodies, or the materials taken in through the alimentary and respiratory tracts in the form of warm food and air; but in large part the heat energy is indirect from a *transformation of chemical energy* the source of which we have already indicated. Practically every chemical action will be associated with the liberation of heat, although in most anabolic processes the consumption of heat will be in excess of its liberation. Of the chemical actions concerned with the liberation of heat *oxidation processes* are by far the most important. The *amount of oxygen* consumed in the course of twenty-four hours amounts to 700 grams or about sixteen quarts per hour. This is suggestive as indicating the immense amount of oxidation that takes place in the body. While it is thus true that the heat is in large part derived from chemical action together with that resulting from mechanical energy of friction and movement, it is also true that a transformation back into chemical and mechanical energy takes place in extreme degree. One chemical change liberates energy in the form of heat. This heat by furnishing a normal medium *initiates new chemical change* and is in other cases perhaps converted directly into muscular and other movement. Throughout the various metabolic processes these continual transformations are manifest.

Photic energy is essential to life processes. Light has been defined for lack of more definite knowledge as *ether vibration*. This vibration is *ultimately essential* for all life processes.

The process of formation of the organic foodstuffs has thus far defied all laboratory attempts and the only source of the synthesis of proteid, carbohydrate, and fat is the cell of the living organism. From the plant the animal gets its food material ready made. But in order that the plant shall be able to effect this synthesis light is necessary. Through some power seemingly associated with the chlorophyll bodies the plant is enabled to utilize the ether vibration in the chemical processes concerned in the food formation from inorganic materials. But it is *not alone* in this indirect way that light is essential to animal life, for observation shows that individuals living in an environment of greater or less deprivation of light become abnormal in their functioning. This fact suggests the necessity for looking to the environment of the individual for the preservation of normal health. From this fact has arisen the *light cure* by which it was hoped to overcome disease conditions through an excess of the energy, a certain amount of which is essential. *An excess of any force or factor is never logical as a method of cure.* That an excess of light is deleterious there is sufficient evidence to show. Ordinary sunburn in fair-skinned individuals is a pathologic condition as also are the burns from X-ray applications. Individuals working in factories where light is generated or in other conditions where an excess of light is present suffer from various forms of cutaneous and other disorders. Light is further a *normal stimulus* for the function of *sight*. In this case the ether vibration coming into relation with the pigmentary layer of the retina is *transformed* into chemical energy which influences nerve terminals and which in turn results in the definite subjective sensation. Whether in the human body light is produced from transformation of other known forms remains to be proven. In the case of certain of the lower and especially the marine animals, chemical action or other energy is quite appreciably transformed into light.

Ether stress or **electric energy** is undoubtedly associated with a large number of body processes. In the experimental laboratory it can be shown that both chemical and mechanical energy may be transformed into electricity. It is probable that similar conditions in the case of the living organism are responsible for the electrical manifestations known to be present. It is known that in conditions of activity and of pathology a *difference of electric potential* exists in muscle such that the active and the resting state are electrically opposite in sign, which is also true of the normal and the injured tissue. Undoubtedly the chemical stress in these various states are different and hence a difference in electric stress is entirely reasonable. This becomes of special interest in view of the recent investigations into electro-chemistry which tend to show a marked similarity between chemical and electric action, if not an actual identity. The investigation into the electric conditions of the body has only begun and the further results are awaited with much interest. Dr. Still continually assumes the presence in *normal* as well as abnormal conditions, of a force of an electric or magnetic nature, and no demonstration to the contrary has yet shown that he is wrong, while what experimental evidence is available suggests that he is correct. The fact that such "currents" exist has given rise to numerous attempts to make use of the fact in a therapeutic way, but thus far electrotherapy has proven as unsatisfactory as has the drug, and for the reason that the form of electricity present in living organisms is a special product of the particular organism.

With reference to **nerve energy** little can be said. Its fundamental importance is obvious and will be continually referred to. What it is we know not. It may be measured in its rapidity, it may be judged by its effect. Whether it be electrical or chemical or neither we can not at present say. Suffice it to note that it results from transformations of all other kinds, and in turn may be converted into numerous forms. Mechanical force, chemical action, light—all may influence its action and assist in co-ordinating its impulses. It is unique among the body forces and to the osteopath represents a most interesting field of study. When its ultimate nature is once known and its manifestations and variations understood, much will be done toward explaining the numerous facts of body functioning and a long stride will have been taken toward the solution of many vexed problems in osteopathic practice.

In connection with the above considerations the following table modified from *Hall's Physiology* is suggestive. Note that the energy of the body finally is given off largely if not entirely in the form of heat. Owing to the fact that the latter is fairly subject to measurement, approximations of energy expenditure can easily be determined:

BALANCE SHEET OF ENERGY FOR MAN AT LIGHT WORK.

	Inc. in Cal.	Exp. in Cal.
Income		
Proteids: 110 grams at 4000 calories	440,000	
Fats: 100 " " 9400 "	940,000	
Carboh: 400 " " 4180 "	1,672,000	
Expenditure		
Mechanical work reduced to calories		500,000
Excreta loss (1900 grams)..........		47,500
Warming of inspired air............		84,500
Evaporating 660 grams perspiration		384,120
" 330 " H_2O from lungs		192,600
Radiation and conduction from skin		1,843,280
	3,052,000	3,052,000

Thus far the fact has been emphasized that energy in various forms is fundamental in the life processes. It should be understood that in any form of energy it may exist either as **potential or kinetic**, i. e., as latent or active, and that these are changeable. The combination of the molecules and atoms in *foodstuffs* represents potential atomic and molecular energy, which, on coming into relation with certain environments furnished by the body, is converted into the kinetic energy of chemical action and heat. The free *molecule of oxygen* in the plasma of the blood, by virtue of its chemical affinities has potentially the power to unite with carbon and other elements and substances with the transformation into the kinetic energy of chemical action and liberation of heat. The *stored protoplasm* in muscle substance represents potentially the activity that becomes manifest as mechanical energy on the application of a stimulus. The stretched condition of the *aortic wall* immediately following the systolic discharge is potential energy which immediately becomes active in a recoil through its elastic property.

Summarizing the foregoing and making a definite application we may make the general proposition that a *normal condition of health is dependent on a proper co-ordination of energies*, and that disease represents a state of living matter such that inco-ordination results. If the condition of *muscle tissue* is such that its potential energy requires an excess of stimuli to be converted into a kinetic manifestation, then abnormality exists. If a *nerve cell body* is in a condition of hyper-excitability, due to disorders of its nutrition, the condition is a too ready response to a stimulus with resulting change to a kinetic form. Further, *these transformations all represent normal stimuli to body action.* Life processes consist largely of response to the stimuli of a continuous stream of impulses that pass by the millions of afferent tracts from periphery to center. If the external or environmental changes are too rapid or intense for a normal response, or the organism is in a condition which prevents a sufficiently rapid assimilation of energy and its proper conversion, disorder must result. In the former the fault lies with the environment and is a cause of disease which we have in another section classified as an *abuse* of function. In the latter the condition will usually be found dependent on a condition of impaired *structure* which modifies the processes necessary to a proper co-ordination of energies. When through lesion to the *digestive apparatus* a deficiency of gastric secretion exists the balance between the potential energy of the food and that of the gastric juices is disturbed. Hence disturbed chemical transformation results. Through a fault of the organic structure the *heat regulating*

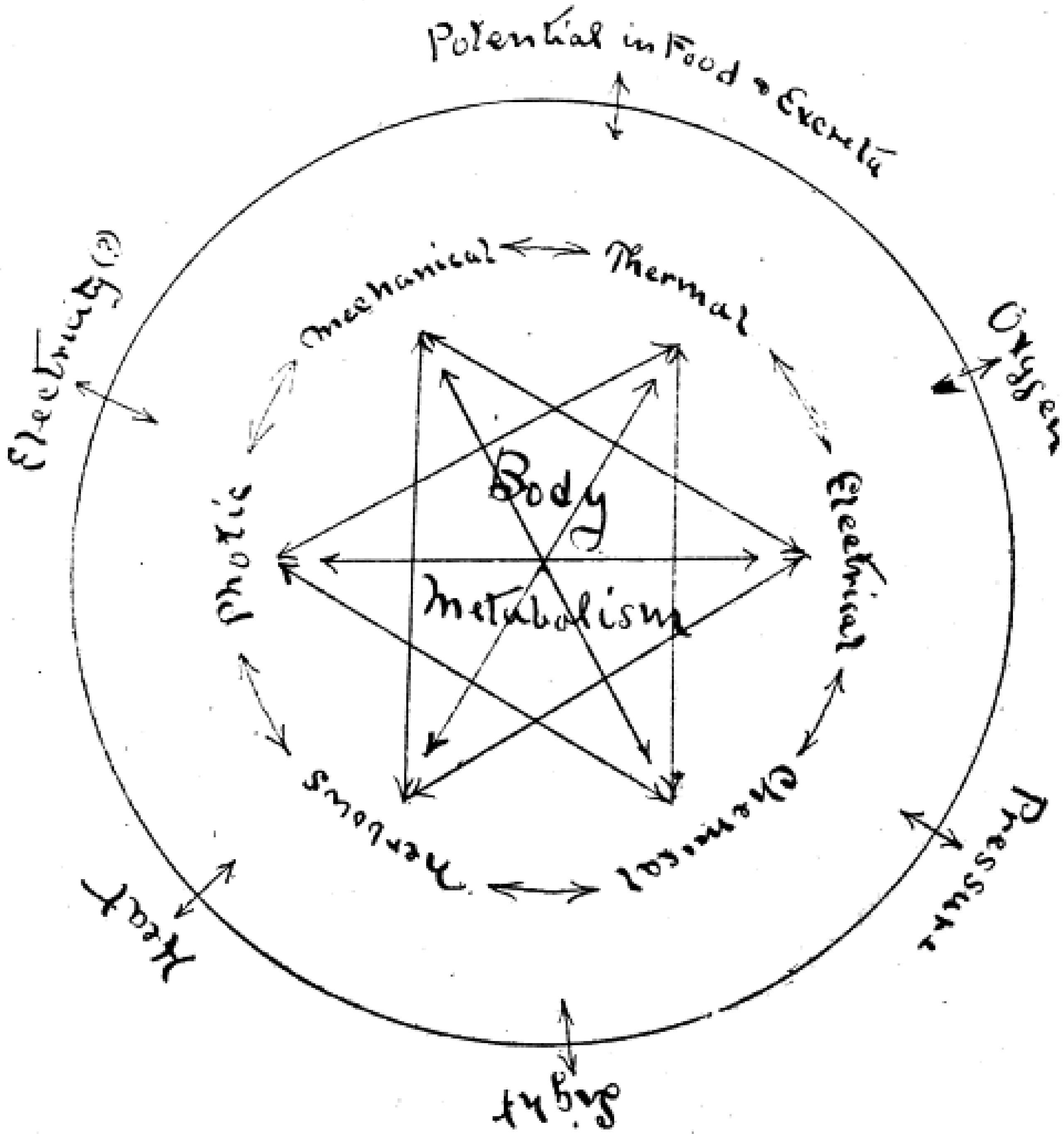


FIG. 3.—Illustrating income, interchange and output of energy of the body.

mechanism becomes deranged and an excessive chemical action with heat liberation results with a consequent rise in body temperature. This rise in temperature furnishes the occasion for further excessive transformations and a chain of effects follow. An *injury to a muscle* initiates chemical changes excessive in kind or degree, and a considerable difference in electric potential is produced. The electric action then is re-converted into chemical and heat energies and inflammatory conditions result. The continued absence of any normal stimulus from environmental change, such as light, results in a loss of energy transformation which is dependent upon such stimulus, and a general weakness is a consequence.

With the action and interaction of matter and motion, then, and all under the superintendency of a guiding force, call it mind, vitality or what not, the normal body metabolism will be maintained in harmony with itself and with its environments. Through long ages the organism has been subjected to certain environmental conditions by which it has become adapted to ordinary and to numerous extraordinary circumstances. In such adaptations of energy we have the most remarkable fact of living tissue.

Body Fuel.

The principal source of the energy of the organism is the food materials. It is manifest that for a proper transformation and utilization of energy there must be a sufficient quantity and quality of the food to be disintegrated to yield the necessary forms. As an engineer insists on a good quality of the fuel as a prerequisite to a full capacity in the performance of his engine, so the human engine must be supplied with materials appropriate to its needs. From analysis of body substance and from experimental observation it has been determined that there are certain organic and inorganic materials which are **essential** to normal body functioning. Among the former we note *proteids*, *carbohydrates* and *fats*; among the latter, *water* and several *salts*, more especially sodium chloride. Numerous other salts are found in body tissues but are present in sufficient abundance in the organic foodstuffs to make it unnecessary to supply additional material. Indeed evidence is accumulating to show that except in the form of these complex organic substances, they will not be assimilated. The *function* of the various inorganic salts is in large part the regulation of the medium in which organic foods may be stored, transported and assimilated. Thus Thompson suggests the following functions: "To regulate the specific gravity of the blood and other fluids of the body; to regulate the chemical reaction of the blood and the various secretions and excretions; to preserve the tissues from disorganization and putrefaction; to control the rate of absorption by osmosis; to enter into the permanent composition of certain structures, especially the bones and teeth; to enable the blood to hold certain materials in solution; to serve special purposes, such, for example, as the influence of sodium chloride on the formation of hydrochloric acid, and that of lime salts in favoring coagulation of the blood." *Water* is an absolute essential and must be taken in greater quantity than is present in the ordinary diet. Its functions are largely secondary to those of the organic foods but none the less essential. The very fact that *sixty percent* of the body is water indicates its great value. We have referred to the fact that the essential life substance—protoplasm—is largely fluid and for specific purposes. This fluidity is dependent on the presence of water. We may enumerate the following as the more important *uses of water* to the body organism: solvent, diluent, medium for transportation, stimulant, and a thermolytic agent. Unquestionably there are individuals who take less water than is essential to a normal functional and structural condition. *Proteids* are the most essential of the organic substances. It has been shown by Pfluger and others that in case of the dog, of the organic foods proteid alone is sufficient to maintain life, while the absence of proteid material in the food is immediately disastrous to normal function and soon results in death. In general the statement is true that proteids are the *tissue builders* while the carbohydrates and fats are *energy producers*, i. e., are oxidized with the liberation of heat. In the absence or deficiency of the latter two proteid may be converted into sugars and fats.

With the finer processes of **metabolism** we are of necessity much in ignorance. What takes place in the transformation from non-living to living proteid we cannot know except in the more gross details. We know this, that only those substances which are concerned with tissue building, secretion, and energy transformation will be permitted to remain in association with the living protoplasm. In this connection Dr. C. M. T. Hulett has emphasized the fundamental fact when he says, "The chain of events in metabolism is a closed chain and into this metabolic cycle no substances but those that serve as food can ever enter. Material not suitable for its upbuilding cannot be imposed upon living substance. It will take in only food elements and only such quantity of those as its needs determine, without regard to the supply which might be available. The only way in which other substances, e. g. drugs, can become incorporated with living substance is by destroying it. Acids and poisons unite with it in that way. The constituent events of the metabolic cycle do not follow each other in a single line but in many lines. Pfluger has emphasized the importance of the polymerization of the proteid molecule in growth—assimilation, in living substance, in which the simple molecule takes in from the materials of the environment atoms of food elements attaching them to itself until it becomes a polymeric molecule. It then breaks down into simple molecules, each of which repeats the process for itself, again and again, forming in that way numbers of chains of many similar links. Dissimilation is the reverse of this process, the end products being principally water, carbon dioxide, and urea. The successive chemical reactions in each chain or line have been compared to explosions on account of the great lability of the compounds." (Journal of the American Osteopathic Association, Nov. 1901). By the *process of selection* which is a characteristic attribute of living protoplasm, every particle of the latter and every cell takes or rejects the materials furnished to it by the blood or lymph. In a similar manner it throws out from its substance into the blood or lymph every material that is of no further use to its functioning. This is true of the substances that are formed from cell katabolism but is equally true of those foreign elements which have temporarily gained access to the protoplasmic substance. In order that the two processes—selection of food materials and rejection of waste—may be *exactly balanced* the medium for transportation must be normal in kind and quantity. The lymph must contain a sufficient available material from which the cell may select and must be in sufficiently normal condition of osmotic pressure and chemical condition as to offer no serious hindrance to the exchange of waste for nutrition. This manifestly will depend on a normal condition of the blood both with reference to quantity and quality. Since the latter is entirely dependent on a proper proportion of organic and inorganic substances the necessity for a proper food supply becomes at once apparent.

It does not follow from the above considerations that every change in the dietary conditions will immediately or remotely produce a disturbance in the protoplasmic exchange. For, note that there are large possibilities of **reserve supplies** between the cell and the digestive tract. The cell itself is capable of carrying on its functioning for an appreciable time even though the blood be totally removed. This is true because it is a function of the cell to store an excess of food not immediately needed. In *every cell* under ordinary conditions there are *fat droplets*, *glycogen*, and other reserves which in addition to its own substance will be drawn upon as the needs require. In the *lymph and blood* and in the intercellular *tissues* there are immense quantities of stored material. This explains the fact that the organism may fast for weeks with little impairment of function though there will be an appreciable loss of substance which is in large part not immediately essential for proper activity.

What are the *essentials* in a diet? The science of dietetics is still in a condition of chaos. Analysis of the body tissues and excretions have thrown some light on the problem.

Note this fact: *the chemical composition of a foodstuff is not a sufficient criterion for judgment as to its value to the organism.* If this were the case the food supply of the world would become a question of *laboratory synthesis.* The various elements must be in a definite condition of combination. *Further,* not all combinations seemingly alike in their various characteristics are equally available to the organism. *Starch and cellulose* are similar in composition but the latter is nearly indigestible. Various of the *prepared foods*, while containing all the elements and compounds in proper proportion, have been found deficient in their nutritive power. The condensed foods, pepsinized and otherwise pre-digested foods, are not suitable for ordinary conditions. The decrying of *white flour* and extolling the whole wheat variety was the fashion among the dietarians a few years back. Chemical analysis showed that the whole wheat contained the essential organic foodstuffs in more nearly a correct proportion than did the white. Yet analysis of the feces shows that the proteids in the husks and outer part is much less available and hence in large part of no use to the organism except as a stimulant to peristalsis.

With the **average diet** available to the ordinary American the organism is amply able to extract sufficient of the nutritive principles to maintain body vigor. *Statistics* with reference to different people and different climates are illuminating more in that they show that what is chemically a very deficient diet is actually and physiologically a very sufficient one. The *Esquimaux* with his tallow and the *Chinaman* with his rice do not show sufficient difference explainable alone from dietetic conditions,to make it a safe rule to rely upon chemical analysis alone for judgment of food values.

In connection with the above Professor Atwater says in "Principles of Nutrition and Nutritive Value of Foods," a bulletin published by the United States Department of Agriculture: "Digestibility is often confused with another very different thing, namely, the agreeing or disagreeing of food with the person who eats it. During the process of digestion and assimilation the food as we have seen, undergoes many chemical changes, some of them in the intestines, some in the liver, muscles, and other organs. In these changes chemical compounds may be formed which are in one way or another unpleasant and injurious, especially if they are not broken down (as normally they are) before they have opportunity thus to act. Some of the compounds produced from the foods in the body may be actually poisonous.

Different persons are differently constituted with respect to the chemical changes which their food undergoes and the effect produced, so that it may be literally true that 'one man's meat is another man's poison.' Milk is for most people a very wholesome, digestible and nutritious food, but there are persons who are made ill by drinking it, and they should avoid milk. The writer knows a boy who is made seriously ill by eating eggs. A small piece of sweet cake in which eggs have been used will cause him serious trouble. The sickness is nature's evidence that eggs are for him an unfit article of food. Some persons have to avoid strawberries. Indeed, cases in which the most wholesome kinds of food are hurtful to individual persons are, unfortunately numerous. Every one must learn from his own experience what food agrees with him and what does not."

The time for **dining** or the frequency do not exercise as great an influence upon body conditions as we are led to think by numerous of the so-called "health" journals. True one may dine so often as to prevent recuperation between the periods of activity of the digestive apparatus. A frequency associated with a small amount at each period is not necessarily bad practice. Overloading under any circumstances is objectionable. An *abrupt change* in dietetic habits is of more importance as a cause of digestive trouble than is the particular habit of the individual.

With **disease conditions** present the viewpoint is somewhat changed. Yet we are largely in the dark with reference to the dietetic principles to be employed in particular cases. In most cases *appetite* is a safe guide in health and within limits it is true in disease. Very few cases present themselves when it is advisable to force an individual to eat against his own desire. "Just a little to keep up strength" is advice and practice which is accountable for numerous prolonged disorders. The body needs house-cleaning. It is not the part of wisdom to bring in new furniture till the old is cleaned and re-arranged. The patient's desire will usually indicate the time. But it is equally faulty logic to withhold nourishment long after the appetite has returned. *Fasting* for ten, twenty, thirty days is advocated by various physicians, osteopaths and others, who rejoice in the reputation of following all methods of treatment that are natural! *Excesses are always unnatural.* The individual, as in other unusual conditions, may get well, but the result is only another of the indications that the organism may regulate its function even under adverse circumstances.

More Than A Machine.

While it is necessary to make emphatic the fact that man is machine-like in his structure and operations it must not be forgotten that he is far **more than a machine** in the usual sense of that word. More, in the fact that the body is a *self-feeding, self-oiling, self-operating and self-regulating machine.* Account for that fact in whatever way we can the fact stands undisputed. Whether it be by virtue of special physical and chemical laws not yet understood or whether it be through the activity of a special *vital force* need not so much concern us at this time since the proof of either contention will not alter the fundamentals of our position. That force, whatever it may be, *initiates, co-ordinates, and controls*, in the most astonishing manner, the various activities of the body mechanism, enabling it to perform the greatest labor with the least loss of energy—being far more efficient in this respect than the most efficient of inanimate machines.

THE SELF-SUFFICIENCY OF THE ORGANISM.

By virtue of the facts emphasized above the body organism is enabled to care for itself to a remarkable degree so long as it is supplied with normal diet. The importance of this idea is such that we shall consider it at some length. If it were asked what fact is most striking and most fundamental in the osteopathic philosophy, we should unhesitatingly affirm, **the self-regulating power** inherent in bioplasm. At the outset it must be noted that the organism's power of self-protection is not unlimited. While from one viewpoint it is preferable to consider all things as co-operating for the ultimate good to each other rather than as a life-and-death *struggle for existence*, yet the latter condition undoubtedly does represent one of the tendencies of all nature. Hence it is presumptuous, in view of known facts, to assume that the body organism will triumph in all its encounters. But the fact that it is sufficient for ordinary conditions of environment and for numerous and extreme emergency conditions may be emphasized by a few illustrations.

1. It is self-sufficient **functionally in health.** Note an illustration in the mechanism of *circulation*: the stomach on the ingestion of food needs an increase of blood. The food materials act as a stimulus to certain nerve terminals in the gastric mucosa; afferent impulses are sent to a nerve center in the sympathetic ganglia or spinal cord where efferent impulses are generated resulting in a dilatation of the gastric arterioles; the general blood pressure remaining unaltered an increased blood flow to the stomach is inevitable. *In respiration*: by reason of an increase in metabolism, an excess of carbon dioxid is generated and modifies the normal condition of the blood; that excess acts as a stimulant to certain nerve cells located in the medulla; these generating efferent impulses over the nerves controlling the respiratory apparatus cause

an increased activity of that mechanism whereby the excess of carbon dioxid is eliminated. In *heat regulation* (thermotaxis): the individual is exposed to a sudden lowered external temperature; by nerve influence and direct effect superficial vaso-constriction and deep vaso-dilatation occur; hence not only a lessened opportunity for heat loss, but through several media an increased metabolism results, which means the maintenance of the average body temperature within narrow limits. In *vomiting* we have an example of *emergency* function exemplifying self-regulation; an irritating substance is taken into the stomach which, acting as an intense stimulus on terminals of the vagus nerve, cause afferent impulses to pass to the so-called vomiting center in the medulla; efferent impulses sent out over the vagus, the lower intercostals, and the phrenic, cause a forcible expulsion of the irritating materials, at the same time through other mechanisms the orifices of the stomach are co-ordinated, the glottis closed and anti-peristalsis of the esophagus occurs. In the *depressor nerve* another emergency function is provided for; under ordinary conditions of blood pressure that nerve is inactive. When by reason of increased peripheral resistance or other cause the pressure becomes excessive terminals of the nerve in the walls of the ventricle are stimulated, afferent impulses are sent to the vaso-motor center and general and special dilatation occurs with a consequent lowering of pressure.

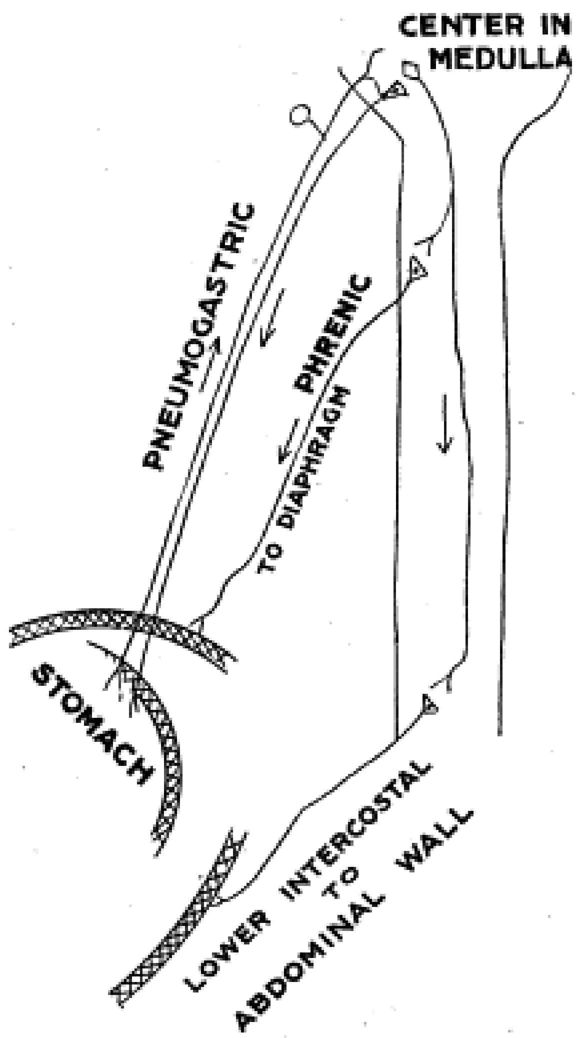


FIG. 4.—Illustrating the mechanism of vomiting.

But also in **disease** conditions we note the regulation.

In the *high temperature* of the body we have a condition unfavorable to the development of micro-organisms which are known to be associated with various fever states; that high temperature is brought about by the disturbed condition of the body, i. e., toxicity, excess of waste, etc., which acts as a stimulus to an excessive metabolism resulting in the overactive oxidation, the heat thus generated acting not only in the manner suggested above but assisting in ridding the body of foreign and waste material by "burning" it. In convulsions, according to Dr. Still (See Philosophy of Osteopathy) is represented an effort to overcome a disturbance in the equilibrium of certain of the vital forces. The *increased activity of the skin* in disturbed renal conditions represents an emergency function as well as an example of the *substitution power* of the body organs. In *infection* the white blood corpuscles are increased in number and efficiency as a result of some stimulus dependent on the presence of pathogenic bacteria; while in addition to this function of *phagocytosis* of the white blood cell an increased *antitoxic* condition of the blood and tissues is produced dependent on the same factors. In *starvation*, the body is preserved in a remarkable manner, for not only are stored foods—glycogen, fat, etc.—first drawn upon, but when this source of supply becomes exhausted the organs least essential suffer first. The following table from *Stewart's Physiology*, giving percentages of total organ weight lost in starvation is extremely suggestive:

Brain	3	Kidneys	26
Heart	3	Blood	27
Bones	14	Muscles	31
Pancreas	17	Testes	40
Intestines	18	Liver	54
Lungs	18	Spleen	67
Skin	21	Fat	97

2. It is self-sufficient **structurally**. Note the *calloused* condition of the palms in the case of an individual who per-

forms much manual labor; or the similar hardening of the gums of those who are without teeth—i. e., structural change because of functional increase. The body is continually meeting with mechanical forces sufficient to temporarily displace parts, e. g., the *ribs*, in which the normal tension of muscle and ligament is usually sufficient to re-adjust. In case of *slight wounds* blood and lymph together are able to approximate the parts and healing results.

But also in **disease** the regulating power over structure is manifested. On the structural change in the semi-lunar valves permitting a regurgitation of blood, the *ventricular muscle hypertrophies* to correspond to the increased work to be done; in which case we have a compensatory structural change. In *dislocation of hip* where tension of ligaments and muscular effort are insufficient to accomplish reduction, compensatory changes occur, such as shortening and lengthening of muscles, formation of new acetabulum with adhesions for ligaments. In *broken bones* where continual motion has prevented the "knitting" process, "false joints" have been formed with all the essential structures, i. e., articular surfaces,ligaments and synovial membranes. In *local dilatation* of the upper intestine in case of absence of the stomach, and in the remarkable case referred to by Spencer where, as a result of partial obstruction at the cardiac orifice of the stomach, food material collecting in the lower part of the esophagus initiated processes resulting in a dilatation of the canal, the development of glands,and a crude form of gastric digestion, we have illuminating instances of the ability of the organism to rise to the occasion.

The above facts have been emphasized for the purpose of impressing the **fundamental proposition** that *all processes of healing are dependent on the inherent power of protoplasm;* that that inherent power to heal *will be exercised so long as structural conditions are normal*, and in the vast majority of cases where the structural conditions are abnormal, adjustment of the latter are not beyond its power; that the *duty of the* *physician* is only to keep external things—things external to function—favorable to the exercising of that power.

THE TENDENCY TO THE NORMAL.

The considerations in the last section are partly explanatory of but more properly lead up to a more definite determination as to the nature of a **normal condition** and the reasons for such a tendency to continually maintain or restore that condition. If the question were asked as to what constitutes a normal condition few there are who would not be able to give a fairly satisfactory answer in general terms. But though the general conception were held by each, to explain the specific elements necessary in a normal condition is a task of some considerable difficulty. If we answer that a normal body is one in which the different parts are working in harmony we have a satisfactory general answer. But if we attempt to give the several elements a mathematical value and then insist in measuring every individual by that standard we will certainly meet with insurmountable difficulty. If by careful estimates we determine that 33 grams of urea is the normal amount excreted in 24 hours, shall we call that individual abnormal who excretes only 28 grams? If we determine that 72 beats per minute shall be the standard for heart action, shall we decide that Napoleon whose heart rate was 40 and that others whose rate was below or above the average figure were not normal? In relation to men *collectively*, then, no standard of normality can be given. But how about the individual? Can we establish a standard for each individual? The difficulties are identical. The individual condition is continually changing in quality and quantity of functioning. The change is no evidence of a departure from the normal. *It is the normal that varies* and hence an absolute value cannot be given to the various elements constituting a normal.

If we shall make **symptoms** the criterion of our judgment we shall certainly fail in numerous cases. Many disease conditions are present for long periods of time though presenting absolutely no noticeable symptoms, subjective or objective. Further, certain changes in appearance ordinarily considered symptomatic of disease are not so in reality; for instance a rapid heart beat is usually apparent following the climbing of a steep hill. The individual is subjectively distressed and the objective symptom of rapid heart beat is present, But the actual condition instead of being abnormal is *normal under the circumstances.* Is *pain* an abnormal condition? Not necessarily nor usually. Subjectively it is a psychic condition and as such is in one sense a product of cerebral activity. In so far as it is a warning it is a normal condition though it is usually if not always evidence of some abnormal condition. This is equally true of other subjective symptoms. We cannot, therefore, rely upon symptoms as a criterion for judgment of a normal condition. The best that can be done under the circumstances is the determination, by *comparisons with the average condition of the average individual* with modifications of judgment dependent upon the presence or absence of symptoms, as to the *degree* of abnormality, the line of demarcation between normal and abnormal being a non-determinable quantity.

While it is true that the details constituting a normal condition are not confined within known and unyielding limits, the general forces back of the "tendency" may be determined. In the first place there are two fundamental forces associated with the life of each organism, the first of which is **heredity**. By the term we mean *that peculiarity derived from the total ancestry that compels a likeness to type.* What is inherited? (a) The *life principle* itself and (b) the *general form and function.* It is to be noted that inheritance does not refer simply to the relation between immediate parent and offspring but between the whole line of ancestors and the individual. An individual may present the special peculiarities of his grandsire rather than those of his sire, in which case we have a special quality of germ plasm handed down through the parents but not becoming manifest in them, to reappear in developed form in the grandson. Such a reversion to ancestral characters is technically referred to as *atavism*.

The second great force is that of **adaptation** by which we mean *the peculiarity that permits an unlikeness to type*—a peculiarity which is dependent on the environment for its manifestation. What varies? The *special features and functions*. No two individuals are alike in their structural or their functional characters; and this individual variation, in so far as it is not a likeness to some ancestor, is dependent on conditions of environment, i. e., dependent on stimuli acting upon the organism during its separate existence.

Both of the two great forces are necessary; the one in order that stability shall be preserved and the identity of the species maintained; the other in order that the individual shall not be disintegrated because of an absolutely unyielding nature. Each one of the two forces tends to counteract the extreme tendencies of the other and hence the happy medium is maintained. Heredity alone would make an absolute condition necessary to a normal one. No adaptation to the continually arising new circumstances could be possible. Because of the adaptation associated with living material variation is possible. Hence the limits, the boundaries of the field of normal action are markedly widened. Recognizing the two forces we may explain in a general way *individual peculiarities* such as difference in heart beat, in bowel activity, and perspiration; and *circumstantial peculiarities* such as increase in respiration dependent on altitude, hypertrophy of the heart in valvular disorders, thickening of tissues in cases of continual wear. These considerations become of special interest and fundamental importance to the osteopath especially in their application to the determination of *lesions*. In a later chapter we shall indicate in detail the points necessary to consider in the diagnosis of a lesion but in this connection we wish to emphasize one case. The tendency of the beginning osteopath is to assume that every variation of structure, especially in the position of the spinous processes, is a lesion. The foregoing considerations would suggest some possible exceptions. And experience demonstrates that there are numerous exceptions. The spinous process may be deviated because of an over-development of muscles on one side—the right in "right-handed" individuals, for example,—or from a faulty condition of nutrition in fœtal life, or from various other forces, which while causing an appreciable variation from the average condition does not cause or predispose to disease, and hence could not be rightly called a lesion. What is true of the position of parts is true of the several other conditions that may be present. In all considerations of diagnosis the *possibility of unusual appearances being normal* must be recognized.

A normal individual, then, is one sufficiently like the species to maintain its identity as a member of that species but pliable enough to change sufficiently to meet the average emergencies of environment. If the incident forces are sufficiently intense or prolonged to produce a modification beyond the limits of adaptive response disease will result. Otherwise, while function and structure may be temporarily modified, disease beyond the limits of self-cure will not occur.

This tendency to the normal results from certain well known **principles** which may be enumerated.

1. First are those of a **physical nature.** Self-reduction of luxations depend to a considerable extent upon the difference in mechanical *tension* on opposing parts of the luxated structure; in the case of the formation of a new acetabulum the mechanical *pressure* operates to produce the cavity. The discharge of irritating particles from the bronchi is effected by an apparatus which utilizes *air pressure.*

2. Or the tendency may depend upon **chemical** conditions. The *carbon dioxid* acts as a chemical stimulus to the nerve cells controlling respiration. The *immunity* to certain diseases through the medium of an increased antitoxic condition of the blood is secured by chemical means. The *coagula-*

tion of the blood thereby preventing its own loss is largely a chemical process.

3. Finally, the tendency is dependent to a considerable degree upon certain **vital** principles. The *protection from loss* in the more essential organs in the case of the deprivation of food above referred to; the *formation of a stomach* and arrangements for gastric digestion in other parts of the alimentary canal when the stomach itself has been obliterated or rendered ineffective; and the chemotactic action exhibited by the white corpuscle in the presence of the pathogenic bacteria are illustrations of this principle.

It is not to be presumed however that these various separate principles act separately in bringing about the adjustment. It is likely that in no case is this true but that **the three are associated** and co-ordinated by the vital force of the organism; and thus continually guarding and restoring, the organism is enabled to pass its alloted existence in a world rife with changes of environment which may at any time be sufficient to inaugurate disease. But by virtue of the tendency exercised both in ordinary and extraordinary circumstances it may usually triumph, and hence it is in a very real sense that the statement is true that "disease is the stimulus to its own cure."

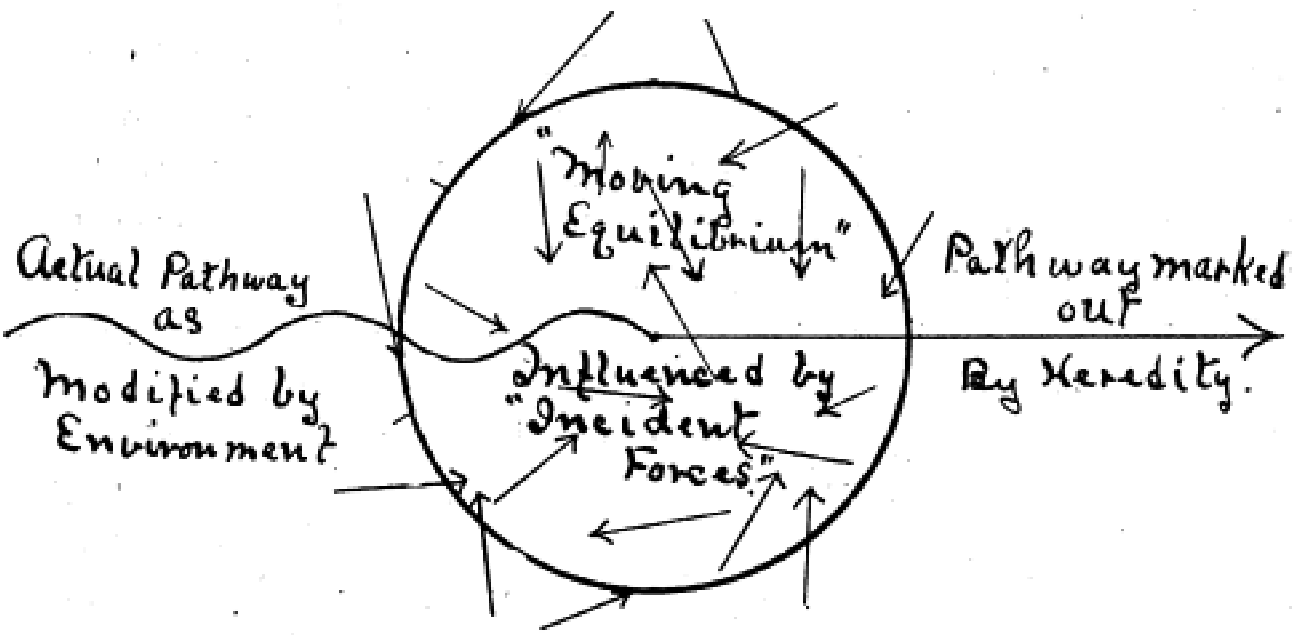


FIG. 5.—Illustrating the action of forces of Heredity and Adaptation.

CHAPTER IV.

THE ETIOLOGY OF DISEASE.

In a previous chapter it was suggested that health represents a condition of body harmony and that disease is body discord. For purposes of convenience we may accept as our definition of disease **perverted function.** While this is not entirely satisfactory in that most diseases are associated with structural changes also, yet the appearances so strongly emphasize the prime importance of functional perverson that we shall make use of the phrase.

Granting that there are limits to the self-regulating power of the organism and that disease does exist, it becomes necessary to inquire into the cause of disease; and first will be mentioned the most important of two general causes.

Abnormal Structural Conditions.

Whatever in addition he may be man is certainly a machine. It is further obvious that the function of a machine i. e., its *action*, is absolutely dependent on its structural integrity and that just as soon as any part of the machine becomes disturbed in relation to other parts disorder of action will result. Is this true of the man-machine? It would seem a simple proposition easily answered. Yet objection is offered. Without at this time entering into a discussion of the relative placing of structure and function, a few facts may be indicated tending to prove indisputably the contention that *abnormal structural conditions* are a fundamental cause of perverted function.

Medical and surgical history teems with records of cases where at least **gross anatomical disturbances** initiate definite and far-reaching physiological disorder. A few of such cases will be specified. A *dislocated hip* will cause sciatica. How does it do so? By direct pressure, not necessarily on the nerve perhaps, but upon structures closely enough associated with it—its blood supply, for example—to result in its disorder. A *dislocated cervical* or even lumbar vertebra will cause paralysis by pressure upon the spinal cord or upon its sources of supply. An occluded artery will cause dry *gangrene* and an occluded vein will cause moist gangrene. Note Nancrede's statement: "Indeed except when the traumatism physically disintegrates tissues as a stone is reduced to powder, heat or strong acids physically destroy structure, or cold suspends cellular nutrition so long that when this nutrition becomes a physical impossibility vital metabolism can not be resumed, gangrene always results from *total deprivation of pabulum*." (Italics mine). He also indicates what most surgeons assert that the moist form depends in part upon interference with the drainage. A *flat chest* vitiates lung tissue and renders it susceptible to invasion by bacteria. *Pregnancy* by pressure on renal vessels produces albuminuria. *Sclerosis*, i. e., overgrowth and hardening of connective tissue structures causes interference with nerve impulses in tabes dorsalis, spastic paraplegia, and similar conditions. A *sprained ankle* causes congestion and infiltration, thereby producing various sensory and motor disturbances directly and reflexly. And finally, as stated by Hill in Schafer's Physiology, "the movements of the *muscles of the neck* by pressing on the jugular vein are sufficient to affect the cerebral circulation."

In all of the cases mentioned above we have illustrations of the fact that function depends on structure. That such cases exist is recognized by all authorities and is disputed by none. In all of these cases the anatomical perversion is a gross one and the functional change is also gross. Why should we **limit the application** of the principle to the gross cases? Let us further analyze some of the above instances. All are agreed that the dislocation of a hip can produce an inflammation of the sciatic nerve. Is it a greater tax on the intellect to conceive of a less severe functional disorder dependent upon a less severe structural perversion? If an intense stimulus will produce the *neuritis* why will not a less intense but long continued stimulus produce, if not a neuritis, at least an appreciable disorder of some other kind, for instance a deadening effect, a numbness, or a change in vaso-motor impulses that are carried by the sciatic nerve? And what is the source of this long continued but less intense stimulus? Among other things, a slightly subluxated innominatum or other of the bony structures which are closely associated through their ligamentous and muscular connection, with the sciatic nerve in its course or at its origin. Is it possible that the innominatum can be subluxated? Undoubtedly. Any bone having a definite articulation can be subluxated. A slight twist of the innominatum at its articulation with the sacrum constitutes a real subluxation and of sufficient degree to produce tension upon its associated structures. Note the case of the *paralysis* dependent on dislocation of a cervical vertebra. Is it an insult to intelligence to assent to the proposition that if a gross dislocation can produce a paralysis a less perversion, for instance a severe torsion or strain, may so impinge not upon the cord directly but upon the innumerable channels that connect the contents of the neural canal with the structures anterior to the spinal column, as to very materially interfere with the exchange between those regions? We think not. If it be possible that *gangrene* of a tissue is dependent on the total obstruction to the arterial supply to that tissue, why is it not reasonable that a partial interference with the flow of blood through an artery may result in a less completely starved condition? That partial interference may easily be produced by direct pressure of structures upon it or by interference with the nerve mechanism which governs its diameter. If the *lungs* are weakened by a depressed condition of the thoracic walls, why is it not true that the heart may suffer from a like crowding? If it be possible that contraction of cervical muscles produces a change in cerebral circulation why may not a *contractured*--ie., chronically contracted--muscle produce a chronic disturbance of that circulation and hence a congestive headache. If a pregnant *uterus* by virture of its size and weight may produce renal disorder by pressure, why may not a tumor, a contractured muscle or a subluxated bone, acting upon a vital structure directly or indirectly connected to the kidney, produce disorder of that organ in a similar manner?

If a *sclerosis* interfere with nerve impulses in the spinal cord, why may not a thickening of tissues connecting vertebra with vertebra produce similar disturbance in the nerve fibers or blood vessels which pass so numerously into and out from the spinal canal, among and between and through those connecting bands? If a *sprained ankle* is a common occurence and if congestion and infiltration are resulting conditions which cause direct and reflex disturbances, why is it such a draft upon credulity to believe that a similar common condition of sprain with similar congestions and infiltrations and similar direct and reflex disorders may occur in the scores of articulations which are presented by the spinal column?

But it is not necessary to rest the case entirely on assumption. **Evidence** has been accumulated and is still accumulating which is most confirmatory in character. Case after case has been found by osteopaths who are careful in observation and logical in judgment, showing that these various structural perversions are present and are associated with functional disorders, the removal of the structural condition uniformly resulting in a disappearance of the disorder. It is at the present time not so much a question as to the fact that a structural disorder produces the disease as to the details of the manner in which the latter is brought about.

Disease Maintained by Structure.

It is not of such moment as to what was the **original stimulus** to a disordered function. We have no quarrel with those who insist that the functional disorder may result from a multitude of forces which act continually upon the organism. It is readily admitted that constant disregard for well known laws of health must of necessity produce disorder, and in another section special attention is called to the fact. A thousand conditions of environment and of individual may initiate or predispose to disorder of function. This fact must be recognized in order that the individual shall understand that he *must reap what he sows.* It must be a part of the work of the physici an as it is only less emphatically the duty of every man to assist in a proper understanding of the ordinary laws of responsibility for one's own health, body, mental and spiritual. Temperance in all things is absolutely a prerequisite for continued well being. Any intemperance will result in at least a temporary impairment of function. With most normal individuals a few experiences will teach wisdom. Hence most individuals pass through life with a fair degree of health so far as disorders dependent on wilful abuse is concerned. When, however, a disorder becomes manifest and persists in spite of removal of the intemperance or abnormal condition or environment we are justified in assuming that some other factor is maintaining the disease, for *function is infinitely self-regulative.* We maintain that the other factor is *perversion of structure* and that structure is a part which is less immediately and less completely subject to vital control—the more inert tissues such as bone, ligament, cartilage and other connecting structures. Hence where a disorder is maintained, we assert from reason and observation,that the structural condition is the factor that *prevents a return to normal functioning* The question, therefore, is not as to the original force that caused the disorder, but *why does not the sick man get well.* It is just as much a normal power of the organism to produce a return to normal functioning as it is to maintain functional equilibrium manifest in the ordinary healthful life. It is in fact impossible to actually differentiate between the two. An excess of carbon dioxid is a normal stimulus to the removal of that excess. This is true in other cases. The organism restores continually its proper function largely through the medium of stimuli furnished by its own katabolic products. The presence of other substances not nutritive in character, e. g., bacterial excreta, produces a similar result. Whether through ages of adaptation and from hereditary transmission or from inherent endowment coequal with life itself, the fact that this self-protective power exists may be affirmed with little probability of error; and that function is absolutely self-regulative while structure is only less responsive to the same forces is equally certain. Hence in the ordinary disorder that seems beyond the limits of self-restoration we must logically look to the structural condition for the factor maintaining the disorder. And experience has shown that little in addition is needed, for with the average individual the average environment constitutes a normal condition. With such an environment to which the individual has long been accustomed the organism is master of the situation and needs only freedom to exercise its restorative powers.

The truth of these considerations is evident in case of chronic disorder. But they are no less true if less evident in **acute conditions.** A certain prominent instructor in a recognized medical college told his students on the occasion of their graduation that 95 per cent of their acute cases would get well whether they were treated or not. We are not sure that the percentage is too high. This does not argue for a policy of non-interference. For osteopathic experience shows unquestionably that the reparative forces may be given greater freedom for action by appropriate treatment. In general the length of time required by the unaided organism to restore normal conditions may be *lessened one-half*. What is the philosophy of the treatment under such circumstances? Under the influence of an excessive stimulus, i. e., a marked disease condition, the organism exerts its full powers of response but very materially at the expense of certain secondary abnormal functioning. That is, the vital forces are all concerned with the state of emergency, which diverts attention from certain functional and structural conditions that under the circumstances are secondary in importance. These together with the added disorganizing factor of an excess of stimuli due to the disease become more or less deranged. As a result we see the varying symptoms which represent in large part evidences of the secondary disorganization. One of the most common of the latter is change in structural relations, e. g., *contractured muscles.* But contractured muscles, directly and through their attachment to bone or other tissue, further disturb structural relations and hence an additional causal factor is presented. This structural perversion which has been produced secondarily is an *added cause* not so much of the disease but of the inability of the organism to immediately recover. Hence by keeping the structural conditions reduced the total time for recovery will be appreciably shortened. If this assistance is *not given* the organism will recover in most cases unaided. But in others the disease will become chronic *not because the function delights in irregularity* nor because the environment or habit of the patient is necessarily an insurmountable hindrance, but because the inert structure which was disturbed has become set in its new relations and the normal tension of surrounding tissues is insufficient to readjust.

It is not necessary to assume that the perverted structure arose as a secondary result. It is enough to note that in countless cases there exists a deranged structural condition which, not of itself capable of producing marked disorder, yet permits of a lessened resistance to the extraordinary stimuli and when the disease results from the latter, prevents a complete response to the new conditions by interfering with normal nerve or blood action. In such cases the structural difficulty is part of the original cause of the disease in that it represents a **predisposition.** It becomes the principal if not entire factor which prevents a ready return to normal.

The Lesion.

By osteopathic usage the word lesion has come to have a special significance. The *surgical conception* of lesion, i. e., any hurt or injury to a part, and the *pathological concept*, i. e., any local or circumscribed area of tissue undergoing abnormal functional changes, must be carefully distinguished from the *osteopathic concept which is any structural perversion which by pressure produces or maintains functional disorder.* Note first that the **definition** includes all tissues. While it is true that the *bony* lesion occupies first place by virtue of history and importance *muscular* and *ligamentous* are rivals of the former for pre-eminence. A *viscus* may act as a lesion, and among the most serious of diseases are those directly dependent upon pressure from prolapsed viscera. In the *second* place note that the structure must be perverted, that is not normal—has departed from the usual or average condition. *Third*, note that the condition of function is included in the conception of lesion. This is of fundamental importance. From what has been said in a previous section it can be understood that a structure may be perverted in the sense of being unusual and still not be a cause of change of function. This variation is still within the limits of normal adaptation. A spine may have its curves markedly exaggerated or completely obliterated and the functional conditions still remain normal. To make of it a lesion in the osteopathic sense there must be included the idea of functional disorder as a consequence of the structural perversion. *Finally*, note that the disorder is produced by pressure. This latter idea is the keynote in disease causes. We believe this conception of the term lesion is the proper one from the standpoint of usage, convenience and simplicity.

The perverted structural condition may be a disturbed **positional relation** of parts. These may be further classified into (a) *dislocations*, which usually refer to bony tissue and represent a condition in which there is a complete separation of the articular surfaces. An example of this class would be a hip dislocation. (b) *Sub-luxation*, also usually referring to bony structures but in which there is an incomplete separation of the articular surfaces. A rib is more commonly subluxated than dislocated. (c) *Displacement* is more commonly applied to yielding structures and especially viscera in which there is no well marked or special articulating surfaces. We can more appropriately speak of a displaced uterus than of a sub-luxated or dislocated one. (d) The lesion may be in the nature of a *contracture*, more especially of muscle tissue. While it is true that all living tissue is more or less susceptible to change in shape through the phenomenon of contraction, muscle tissue because of its specially developed power in this particular must occupy first place. While the contracture is a position change it is also a size change and might appropriately be considered in the next division. For there is undoubtedly in the majority of muscular contractures an increase in the total bulk of the muscle though not necessarily in the amount of muscular fiber.

In the second place the disorder may be a disturbed **size relation** of parts. These may be also further classified into (a) lesions from *overgrowth*. In the case of a hypertrophied heart or a thoracic aneurism direct pressure is exerted upon the lungs and other thoracic structures with resulting disorder of their function. (b) *Arrested growth* and (c) *atrophy* are less common conditions but are occasionally noted. In the case of an atrophied liver the resulting disturbance of associated abdominal viscera may be directly dependent upon this size disturbance. (d) *Perverted growth* as in the case of exostoses and tumors which are special forms of overgrowth conditions. We have referred to the fact fundamental in importance that the lesion produces diseases by a pressure effect. In what way is that pressure applied? The question demands a rather extended discussion but will be briefly outlined in this connection.

MEDIA THROUGH WHICH LESIONS PRODUCE DISEASE.

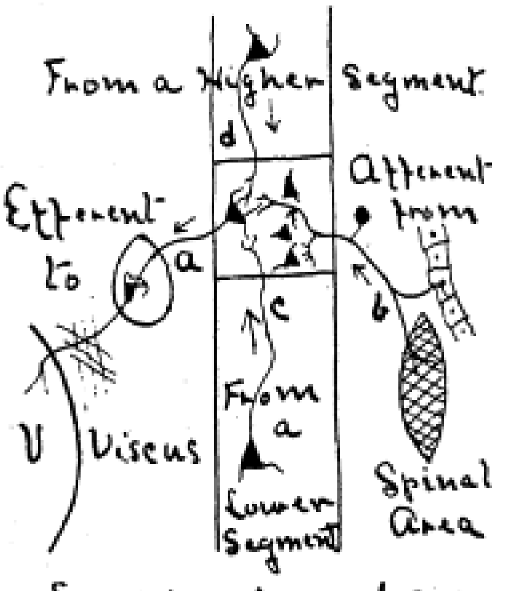
1.—**Direct pressure** may cause the organs to be involved in disease. A *rib* or ribs may be depressed thereby pressing directly upon the lungs, or what is equivalent to that pressure, prevents their normal expansion resulting in an immediate disorder or a lessened resistance to specific infection. A *floating kidney* may press directly upon the bowels thereby inducing constipation or other trouble. The *pyriformous muscle* or others closely associated may in contracture impinge directly upon the sciatic nerve causing a neuritis.

2—Pressure upon the **artery** which supplies it causes an anæmic condition of the organ and a possible secondary hyperæmia of some closely associated part. By virtue of a torsion of the cervical vertebra with a consequent tightening and thickening at intervertebral ligaments the blood flow through the *intervertebral artery* is hindered and the spinal cord suffers. An approximated condition of the upper ribs impairs the arterial supply to the *mammary gland* and the secretion of milk is hindered. An abdominal tumor or a pregnant condition impinges on the *renal arteries* and kidney trouble is experienced.

3.—Pressure upon the **vein** which drains it causes a hyperæmia of the organ with a possible secondary anæmia of closely associated structures. A depressed sternum and anterior ends of clavicle and first rib through pressure upon the *inferior thyroid* veins causes goitre. A tightened muscular and ligamentous condition about the saphenous opening causes *varicose veins.* Muscular contractures in the cervical regions interferes with the drainage from the cephalic structures and a congestive *headache* results. In cirrhosis of the liver an obstruction to the *portal system* occurs with a resulting abdominal dropsy and a secondary anæmia of other parts of the body.

4.—The organ may be disordered by pressure upon the **lymph channels** with which it is associated thereby producing innumerable disordered conditions through the interference with the nutritive and sewerage functions of the lymph, and by a secondary process materially affecting the general vascular system.

5.—Pressure upon a **nerve** directly or reflexly connected with it causes organic disorder. The heart may be interfered with by tightened ligaments causing pressure upon the *cardiac accelerators* which issue from the spinal cord from the first to the fourth thoracic segments, or it may be involved in disorder partly dependent upon an excess of impulses transmitted to it by way of the hypogastric and solar plexuses from a disturbed uterine condition, in which case we have reflex effect. Or the accelerators may carry too many or rapid impulses to the heart dependent on contractured spinal muscles in the upper thoracic area, this being also a case of disturbance dependent upon reflex action. Note the physiological law that *the total activity of a segment of the spinal cord varies directly with the total number of impulses passing to it.* Hence a contracture of a spinal muscle, by increasing the incoming impulses through impingement on sensory nerves, will cause hyper-activity of the cord segment and a resulting increase of accelerator impulses out over the cardiac nerves. This law is uniform and will explain most visceral disturbances dependent on muscle contracture. Note the extreme number and variety of effects possible from nerve disturbance. A sensory impingement will produce *pain*, direct or transferred. Every sensory nerve is a possible pathway for impulses setting in motion a *vaso motor change*; hence anæmic or hyperæmic conditions may result. It will also initiate excessive activity of the sweat glands and hence *perspiration* becomes abnormal. It may carry the impulse which inaugurates the change in any efferent channel and hence motion may be increased or decreased, secretion accelerated or depressed inhibition modified, trophicity lessened. All of these effects, are dependent on interference with *afferent* or



Lesion to a, b, c, or d, may produce disorder of V.

FIG. 6.—Illustrating the numerous sources of disturbance of viscus.

sensory nerves. On the other hand the efferent channels themselves are equally subject to interruption while any change in the nutritive condition of a segment of the spinal cord or a center in the brain will affect to a greater or less degree all nerve pathways in direct or reflex connection with them. *The medium of nerve interference is without doubt the most important with which we deal.*

Through these several media we may explain with greater or less satisfaction the varied results that have been observed to follow the presence of a lesion. The **difficulty** lies in determining in each individual case which of the several explanations is the true one—a difficulty at once apparent and in many cases insurmountable. It must further be noted that a lesion sufficient to produce impingement on one of the channels will be sufficient to affect another, so that in most cases we will have *more than one of the channels interrupted* and hence the greater possibility of extreme effects.

MISCELLANEOUS NOTES.

1. *The extent of the lesion bears no constant rleation to the intensity or extent of the effect.* Note the case of the *hunch-back* whose lesion condition is quite apparent and great in extent. Yet in many cases his health is not markedly impaired. On the other hand a slight strain at the articulation between the eleventh and twelfth vertebra has resulted in immediate *Bright's Disease* of a very serious nature. The strain was barely noticeable on palpation or inspection yet the effect was far-reaching. Several facts suggest an explanation of the condition. The effect will vary directly with the **vitality of the tissue** interfered with. If a lesion brings pressure upon simple connective tissue little result may be looked for. The *connective tissue* is comparatively inert. If the pressure be upon nerve tissue the result is far-reaching. *Nerve* tissue is most vital. It is developed with the special end in view of furnishing a material quick to respond to stimuli and capable of conducting the impulse to other parts of the body. Hence

a lesser intensity of stimulus from pressure will be necessary to cause response than in connective tissue and a much more rapid transmission of the impulse will also result. A *muscle* impinged upon, less vital than nerve in respect to readiness of response and speed of propagation, will be associated with less immediate effect. An *artery* involved is more likely to result in disorder than is some other structures because of a wider influence and a more ready response to pressure.

Again the **adjustment possibilities** of the structure involved in lesion is an important factor in modifying the response; and this is in turn largely dependent on the *abruptness and strength of the stimulus*, i. e., the pressure from the lesion. A lesion produced gradually, as is true in most cases of curvature of the spine, will not constitute a change sufficient to be effective as a stimulus. For, note that *it is an abrupt change of pressures that constitutes a mechanical stimulus*. In the case, then, of the posterior curvature, the extreme kyphosis, the pressure has been so gradually applied that the structures in contact were not stimulated but were able to adapt themselves to the gradually changing conditions. It is a rule recognized by physiology that a change sufficient to produce a response in a tissue if continuously applied will later fail to produce such response. The tissue has adapted itself to the stimulus and is not further affected thereby. In the case of the sudden wrench of an articulation causing *nephritis* the change in pressures was so intense and so abrupt as to constitute a very efficient stimulus so that the extreme result was brought about. It must be noted however that ultimately further adjustment will be impossible and the tissue must respond. Note that finally the hunch-back succumbs to conditions much less severe than would otherwise be the case. The *summation of stimuli* may help in the explanation of such. A stimulus ineffective at first, by repeated operation may cause such an accumulation of effect as to result in a discharge. The spine though gradually impinging upon a nerve or other tissue will finally produce a summation of effects and disorder will result.

2. Another important fact that must be noted is that *the region of apparent disturbance is not necessarily or usually the seat of the lesion.* While this statement applies with more force to the subjective disturbance of pain yet it is noted in others not subjective. With respect to pain, sufficient to refer to a later chapter in which is discussed the condition of **transferred pain**. At present note that the pain caused by an irritation may be felt in any part of the distribution or course of the nerve irritated. In pressure at the elbow upon the *ulna* pain is not only felt at the point of pressure but also and in many cases most markedly in the fingers, i. e., where the nerves are specially developed for receiving stimuli. A lesion in the spine by pressure on fibres forming the *intercostals* may produce pain felt over the anterior surface of chest or abdomen. *Hilton's rule* that pain felt superficially and not accompanied by a local rise in temperature indicates a spinal origin of the pain, is interesting and helpful especially to osteopaths. Especially is this likely to be the origin if the pain be *symmetrical*, i. e., on both sides of the median line at corresponding points. An associated local rise in temperature together with other evidences of local inflammation indicates the latter as the probable immediate irritant.

But the application can be made to **other than pain** conditions. Note that a pelvic lesion primarily affecting the uterus may cause symptoms only with the heart, *palpitation* of that organ being a quite common result. In this case the patient and physician would naturally assume that the heart was primarily at fault. But experience suggests that it is otherwise, the heart being affected through the complicated mechanism of reflex activity. The impulse from a disturbed uterus may be transmitted, for aught we know, through a choice of numerous pathways involving the reflex—the numerous centers and their connecting fibers associated with the pelvic, hypogastric, solar and cardiac plexuses, the sympathetic ganglia and the segment of the spinal cord being involved. But why should the heart be thus involved and not some other organ? In answer it may be said that in other cases and at times in the same case it is another organ. Byron Robinson's suggestion that it is dependent on a condition analogous to an electric arrangement is suggestive but unsatisfactory in that there are too many exceptions. *His suggestion* is that that organ will be involved reflexly which is connected to the primary organ by the greatest number of nerve strands. Unfortunately he does not show that such is the case. Personally the author prefers *another explanation* in which there are noticed few exceptions and those perhaps only apparent. Under the circumstances of a perfectly normal condition of every other organ of the body, little disturbance if any will result when the one is disturbed. The excess of energy will be more or less equally distributed over the entire nervous system, perhaps indeed more to those offering the least resistance, i. e., to those having a greater number of nerve strands. But in most cases some one or more organs will be found in an irritable state quite out of the ordinary. In such a case a nerve impulse coming from the organ primarily involved will be effective in a much less intense form than would be required in case the organ were normal. Hence the statement may be made after this manner: *that organ will be involved reflexly which is in the more irritable condition.* The excess of irritability in one organ over that in another will depend to a slight extent only upon inherent capacity, but in much greater part upon a disturbed nutrition dependent on an associated lesion. In case of a reflex disorder, then, we must look for additional cause in the way of a predisposition. In the majority of cases actual experience will show that predisposition results from a lesion in the region of the source of nutrition for the organ. Hence in case of the palpitation resulting from uterine disorder a lesion should be found in the region of innervation to the heart, or in those structures which may directly affect the heart. And such is the case. If our contention be valid the reflex impulse is but the exciting cause, the lesion, the predisposing; neither alone being sufficient to destroy the cardiac equilibrium but acting conjointly are able so to do.

It is a question whether a large number of so-called reflex disorders should be considered reflex except in the manner suggested above. The occipital headache from uterine displacement will much more likely occur if there be a local lesion deranging the cephalic circulation; the "bilious" headache resulting from gastric disorder will usually present cervical lesion sufficient to cause the disturbance to appear; even the vomiting of pregnancy is often in direct proportion to the abnormal previous condition of the stomach. Hence let none rest content with the diagnosis of a "reflex effect." Prove that the local structural conditions are normal before sentencing the reflex mechanism as the sole cause for the disturbance.

THE CAUSES OF LESIONS.

For purposes of convenience we may classify the causes of lesions into **external** or environmental and *internal*. Among the former the most common is *mechanical violence* such as a blow, a fall, a mechanical shock or jar to the organism produced in whatever way. It will be found on inquiring into the history of a vast number of cases of disease that the onset of the disorder was noticed soon after having suffered the violence, and owing to this fact it is always the part of wisdom to inquire carefully into the history of the case. These mechanical causes act alike in producing bony, muscular, ligamentous, or visceral lesions. A *prolapsed uterus* is often found to have its cause in a sudden mechanical jarring of the body. A *luxated rib* is a common result of direct pressure from without such as might occur in the strenuous periods of a football game or the less intense but more prolonged compression of certain steel braces constituting a part of the wardrobe of the modern woman. A sudden attempt to protect one's self from falling will account for a *strained muscle*, a sprained articulation, or a sub-luxated vertebra. A second important external cause is in that of *temperature change*. In order that a thermal condition shall produce its effect on responsive tissue it must be a *sudden change* and usually a change from a higher to a lower temperature. While experimental physiology indicates the possibility of a contracted muscle dependent on a change from a lower to a higher temperature, little evidence has been produced to show that a similar condition is produced in the normal living human body under those circumstances. Lack of evidence however does not prove that the contraction may not be brought about in the way suggested. With regard to the production of contractured muscles resulting from sudden exposure to cold atmosphere or a cold draught, all osteopaths are agreed in emphatic affirmation. In experimental physiology it can be shown that an isolated muscle so exposed to cold does contract and it would seem altogether reasonable that a similar condition should result in the case of the far more responsive living, attached human muscle. While it is agreed that muscle protoplasm is the typical variety that responds to a stimulus by definite and measurable change of shape it is not at all unlikely that other soft tissues of the body respond in the same way although not to the same degree. The primary effect in point of time and importance, then, will be the production of a *muscular lesion*. But remembering the intimate relation existing between muscles and other tissues it is easily understood how a bony or ligamentous lesion may come about as a consequence of a muscular contracture. A muscle cannot contract without an approximation of the structures to which the muscle is attached. Hence if it be a spinal muscle a vertebral lesion will be produced, or if it attaches to a rib the rib will be depressed or otherwise disturbed.

Of the **internal causes** of lesions *posture* of the body may be mentioned though perhaps with equal propriety it might be classed under external causes. Especially is this operative in the case of children and young people, the most common form of lesion which results being a curvature of the spine. Any cramped or distorted position assumed for long periods at a time will with a fair degree of certainty result in a gradual change in the relation of parts. The continual bending over the desk at school is undoubtedly accountable for numerous spinal disorders. *Professions* and trades which require the assumption of peculiar positions furnish their quota of patients with characteristic lesion. The dorsal inclination of the head in the process of lathing a ceiling, the stooped position in shoveling, the stooping of the compositor at his case, and the anterior lumbar curve assumed in order to acquire the so-called "erect form" are all illustrations of the point. In all of these there is a uniform force continually acting in a definite direction, the inevitable result being in the case of yielding human tissue, definite changes in structure.

Nutritional disturbances are internal causes which comprehend a variety of specific conditions such as congestions, anæmic states, and nerve irritations. These in most cases are further dependent upon an adjacent structure but it becomes necessary to seek for the cause of the congestion. Nerve irritation may initiate changes which produce muscle contracture or ligamentous thickenings but the cause of the irritation must be sought for elsewhere. An *overworked organ* through a resulting hypertrophy of its tissue will become a lesion. Not only will viscera act as lesions from congestive conditions but a muscle will become contracted through impulses transmitted by *reflex pathways from the viscus*. In practically every acute case with which the osteopath comes in contact there will be found muscle contractures, in part primary to the disease, in part secondary to it. Is such a case possible? Observation by competent osteopaths indicate that such secondary contractures do occur. Is there any anatomical and physiological explanation for that condition? Unquestionably. By the known anatomical facts of central association between spinal nerves and visceral nerves and the known physiological facts of the *radiation of impulses* from one part of the spinal cord to another, a reasonable explanation is not difficult. Afferent impulses aroused by a disturbed viscus will be transmitted and given up to the spinal cord and possibly to the sympathetic ganglion, from both of which centers efferent impulses, motor or vaso-motor, pass to the spinal muscles. That such an explanation is reasonable is further suggested by reference to *Head's law* relating to sensory nerves. The law suggests an intimate relation between afferent nerves closely connected centrally; and knowing the peculiarities of reflex action it requires little tax on credulity to assume a similarly close central connection between an afferent visceral nerve and an efferent motor nerve. Congestion or other nutritional disturbances in the muscle tissue will undoubtedly lead to a contracture. Experimental investigation in the laboratory shows that *weak acids* may be efficient stimuli to the contraction and it is to be noted that just such a condition is present in venous congestion or in the fatigued muscle. Venous blood, always less alkaline than arterial, becomes appreciably acid under various circumstances of the organism, due to the presence of carbonic or sarcolactic acid, the latter a common product of excessive katabolism. An excess of arterial blood in a muscle may be an efficient stimulus because of increasing its metabolic processes or because of soon becoming of a venous nature due to stagnation. This latter state may easily follow from a disturbance of the vaso-motor mechanism known to be associated with muscles as with all other parts of the organism. In fatigue of muscle from overwork or other cause we have conditions entirely favorable for the production of the special form of contracture which is so well known to the osteopath. Here the excess of katabolic waste including the sarcolactic acid referred to may easily be sufficient to produce the effect. On the other hand anæmic conditions may easily be responsible for abnormal states of the muscle and the cause of the lesion, though this is perhaps a more debatable proposition.

CHAPTER V.

ETIOLOGY OF DISEASE (CON.)

Abuse of Function.

Osteopaths make no claim that there are no possible disease conditions from other than structural perversions. Any one will recognize the fact that by abuse of any organ or its function departure from normal action may result. Indeed every life is a continual fluctuation between a normal and an abnormal condition so that it becomes evident that disease is but a relative term. If, as we recognize is true, a continued excess of carbon dioxid in the blood constitutes a disease, shall we decide that the amount necessary to arouse increased respiratory activity is a disease? That condition continues for an appreciable length of time and in so far as it does so continue it is normal. But on the other hand it is a normal stimulus to the respiratory activity and for ordinary purposes of discussion would not be considered disease. The organism is able to adjust its functioning immediately. What is true of the case of respiration is true of the body as a whole. The struggle between organism and environment is a ceaseless one in which the organism is usually triumphant, but there are times when the environment temporarily gains the supremacy. In these cases enough of a departure from normal is apparent to be dignified by the term disease. It is this condition that is present in abuse of organ or its function. The excess of food, the overwork of muscle, the contaminated air, all represent what is foreign to the organism, and as such stimulates it to an unusual response. In the vast majority of cases the organism will be victor though no external aid is given. At least 75 per cent of acute cases will be overcome without treatment of any kind. In every case the full responsive power will be exerted in the attempt to overcome. If the stimulus is too intense or prolonged, disintegration of the organ will result. The duty of the physician in such cases is to secure and maintain such a condition of organism and environment as will allow the fullest freedom to the responsive power of the organism. Of prime importance in this connection is the prevention and overcoming of *secondary lesions*. This with the additional attention to ordinary laws of hygiene and sanitation will usually suffice to enable a return to the usual grade of organic action.

The abuse that will cause disease may depend on **overuse** in time relations. That is, the function evidencing itself through too great a proportion of the allotted time to allow for repair, will ultimately be disturbed. This disturbance may be in the nature of a *hypertrophy* of the organ that performs the function. An overused muscle will become enlarged as in case of the heart following aortic stenosis. A liver in an individual who constantly overeats will ultimately be somewhat increased in size. The constant abuse of the stomach may result in a thickened mucosa. In numerous of these cases the fact must be noted that the hypertrophy is in part physiological; for instance the hypertrophied heart is a necessity under the existing circumstances, i. e., the aortic stenosis. At the same time it is secured at the expense of a continual tendency toward the production of disorder in neighboring structures, for instance impaired respiration dependent on lung pressure from the enlarged heart. Secondly, *exhaustion* will be a common result from abuse in point of time. In the case of the enlarged heart so long as "compensation" is maintained, little difficulty may be experienced, but usually the time comes when all reserve forces have been drawn upon, the heart is no longer able to increase its substance to meet the increased demands, and exhaustion of its energy rapidly follows. The gastric glands, continuously called upon to do excessive work, will finally yield to the inevitable and fail to supply the requisite amount of digestive fluids. In any of these cases a third condition is likely to result, i. e., that of *atrophy.* In this connection note the wasting of heart muscle following the period of "broken compensation," the thinning and waste of substance in the walls of the stomach, or the final condition of atrophy in an overworked liver.

Again the abuse may be overuse in *intensity. Apoplexy* resulting from sudden increase in blood pressure from over exercise of body or mind is a case in point. An *aneurism* is similarly caused. The excessive lifting, athletic efforts and the like may produce strains and ruptures in various of the body tissues. This does not include the cases where a *pre-existing* weakened condition makes the sudden strain, but an immediate or exciting cause, as for instance, the usual arterio-sclerosis in those individuals subject to apoplectic attacks.

Instead of overuse constituting the abuse, **underuse** may result in a disorder. It is a well known fact that a muscle kept inactive for a considerable period will gradually waste away. This is true not of muscle only. It seems to be a *fundamental biological law* that a structure unused will become incapable of use and if evolution be accepted as proven we may explain the gradual disappearance of structures in man and other animals on the basis of disuse. Note in the case of the *lungs* of an individual who contracts "lazy habits of breathing", that they are much more susceptible to disorders than are those of him who breathes naturally and deeply. The apices are the regions of lung tissue most commonly involved in tuberculosis and involved first in point of time. The apex is the least exercised of all parts. The two facts may be closely associated. Again, proteid food substances furnish the most efficient stimulus to the secretion of pepsin by the gastric glands. The consumption of *pre-digested*, i. e., pepsinized foods may constitute a definite abuse through furnishing lessened exercise of the peptic glands with a consequent atrophy of those structures.

Finally we may speak of abuse in the form of **perverted use** of a function. The teeth are structures designed to grind the food materials. If that function is given to the *stomach*, through improper mastication, there is a perverted use of the stomach. Life in an environment of impure air, noxious vapors, and dust particles constitutes an abuse of the *respiratory function*. According to the reports of certain witnesses in the recent coal strike investigation one of the causes of the shortened life period of the coal miner was the continued inhalation of coal dust. Numerous postmortems in the case of those who have worked for long periods in an atmosphere charged with metal or other particles, indicate the induration of the lungs from deposit of the material as a factor in the cause of death. *Mouth breathing* is a perversion and is accountable for occasional disorders of the respiratory or upper digestive channel. The introduction into the body through any pathway, of a material foreign to the organism constitutes a perversion. Hence *drugs* taken into the alimentary canal, *pathogenic bacteria* with their toxins and all other forms of poisoning constitute abuse conditions in the nature of perverted use. In a large number of such cases the cause is of an *exciting* character, a predisposition being present which impairs the responsive power of the organism. This is especially true of micro-organisms, a discussion of which is given in a further chapter.

PREDISPOSING AND EXCITING CAUSES.

The causes of disease may further be classified in accordance with their relative capacity to produce disorder without the aid of any other factors, into *predisposing* and *exciting*. This classification is not an absolute one but may be used with advantage for purposes of convenience and better understanding. A **predisposing cause** is any condition of the organism or its environment which, while not producing sufficient disorder to constitute disease, renders the organism more susceptible to other causes. As illustrations of such may be mentioned the following: in *hay fever* two conditions seem to be essential in the production of the characteristic symptom, an irritable condition of the nasal mucosa and a specific irritant, e. g., pollen from some certain plant, dust particles, and the like. The weakness is more or less continuously present, the specific irritant only at special periods. In this case the irritable mucosa with whatever has caused that condition, e. g., a lesion in the cervical region, constitutes the predisposing cause, the pollen or dust particles representing the exciting cause. Neither of these two is capable alone of producing the attack but acting conjointly are sufficient. The small boy is noted for his craving for green apples. If a lesion be present in his splanchnic region and he indulges the craving, an attack of *cholera morbus* is the result. In this case the green apple represents the "last straw" added to a stomach weakened from vasomotor disturbance maintained by the splanchnic lesion. A depressed thoracic region by limiting the amplitude of the respiratory movements renders the lungs less able to resist *tuberculosis infection*, the tubercle bacillus acting as the immediate cause of pulmonary consumption, the former the predisposition to the disorder. Pulmonary troubles tend to run in families. It is not the inheritance of the specific condition but the *peculiarity of lung or chest structure.* Most reflex disorders are satisfactorily explained from this double cause standpoint. For instance a common accompaniment of uterine disorder is palpitation of the heart. Such a disturbed heart rate is much more likely in an individual with a spinal lesion in the cardiac area than in one where heart control is not interfered with. *Age, sex, temperament and race* relating to the organism, and *climate, season, atmospheric and other environmental circumstances* may constitute predisposing causes or occasions. It is common knowledge that children are more susceptible than adults to measles or scarlet fever, while arterio-sclerosis, paralysis agitans, and numerous other disorders only affect the adult or aged. The peculiar condition of the organism at these different periods constitutes a predisposition. The Negro race is more susceptible to tuberculosis and less so to yellow fever and malaria than is the Caucasian; and this by virtue of some inherent difference in the organism which is without satisfactory explanation. Climate is accountable for special disorders. Catarrhal affections of the respiratory tract are common in cold, damp, and changeable localities, while typhoid and other fever conditions are associated with late summer and autumn, in each case predisposing to the onset of the disease through the agency of various exciting stimuli.

A point to be noted in this connection is the fact of what we may conveniently speak of as a **reversibility of causes**. That is, a lesion which in one set of circumstances constitutes a predisposition, may in another be an excitant. Note the case in hay fever. An individual manifests a lesion in the cervical region. Passing to that period of the season when pollen is plentiful the attack is initiated. In this case the lesion is predisposing, the pollen exciting to the disorder. Another individual continuously living in a pollen-laden atmosphere is unaffected thereby. But a lesion is produced when the attack at once supervenes. Thus predisposition and excitant have been reversed. Climatic condition may be the excitant or a predisposing cause. In the first case a lesion is present rendering the nasal tissues susceptible to the influence of sudden changes of temperature the latter being the excitant of the disorder; on the other hand an individual living in a changeable climate is predisposed to catarrhal disorders by virtue of the environment, the catarrhal condition itself being excited on the production of a specific lesion. An individual with a normal splanchnic region may continually abuse his stomach by overeating and still no gastric disturbance result but on the production of a lesion disorder soon becomes manifest; on the other hand an individual with a lesion in his splanchnic region may show no marked evidence of stomach trouble but on abuse of his stomach by dietetic errors disease occurs.

It is to be noted further that while a predisposing cause of disease usually will not be sufficient to produce the disease, an excitant may produce it *with or without the addition* of the other factor. While it is much more likely that disease will result from the eating of green apples in the case of a child who shows specific splanchnic lesion experience would indicate that the green apples alone is an efficient cause.

Finally it is to be noted that in a large number of disease conditions of any permanency in time they are dependent not on a single cause but upon numerous factors in which numerous lesions and numerous forms of abuse may be concerned in the various relations of predisposition, predisposing occasions, and exciting causes. (For an excellent discussion of "Summation of Causes in Disease and Death" see October, 1902 issue of the Journal of the American Osteopathic Association, by E. R. Booth, Ph. D., D. O.)

The Germ Theory of Disease.

It seems proper at this time to discuss a problem in relation to disease which has in recent years assumed extreme importance. The germ theory of disease is not at all a new explanation of disease conditions, for ever since the invention of the compound microscope in the middle of the seventeenth century the fact that small forms of life were associated with certain diseases has been known; and not only was this association known but shortly following the discovery of the micro-organisms the doctrine of a causal relation between such micro-organisms and the disease was promulgated and, as suggested by Abbot, amounted almost to a germ-mania. But like numerous other facts and theories based upon those facts this was practically lost sight of until late in the nineteenth century when it was again revived by numerous investigators of world-renown among whom the names of Pasteur, Klebs, and Koch stand pre-eminent. These, with others, placed the theory upon fairly sure ground in showing by methods to which no objections could be raised that in certain cases there is such a **definite relation** between the pathologic condition and the presence of the micro-organism. The question is not yet entirely settled as to the nature of that relation. *Is the disease as it exists responsible for the presence of the micro-organism or do the bacteria produce the pathologic condition?* In accordance with these two ideas the micro-organisms have been classified into the *saprophytic*, or those which live only upon refuse matter and are hence beneficial to the organism; and *pathogenic*, or those which by virtue of some deleterious action definitely produce the disease condition. Doctor Still has insisted that all are of the former class and compares them to **buzzards** whose function in the larger world than man is to render dead and decaying material incapable of further harm. In this assumption we are personally convinced that he is essentially correct, and that this view is not foreign to that of a large number of the best thinkers and closest investigators of today is becoming more and more evident.

Admitting for the time that certain forms of bacteria to produce disease the question arises as to the **manner** in which it is effected. It has been explained on the theory little supported by fact, that the micro-organism abstracted the nutritive material and thus *robbed* the tissues of their source of supply; another explanation is that by their rapid multiplication a direct *mechanical blocking* of the channels and spaces of the body was produced with the resulting abnormal tissue changes; a further suggestion of some value is that the bacterium directly *attacks* and destroys the body cells including but not limited to the white corpuscles; the explanation at present given and one that more nearly meets the requirements of all cases is based on the fact that in the rapid propagation of the organism *toxins* are formed which act in a definitely destructive way upon the tissue cells. In so far as the bacterium is responsible for disease or complicates the condition already present any one or more of these several explanations may be correct but the last is undoubtedly of paramount importance.

Admitting, then, that inasmuch as the micro-organisms are present in disease and the toxins are produced which are destructive to living tissue, it is yet sufficient to say that the micro-organism is the essential cause of the disorder. While the germ theory was being pressed into service there were individuals who insisted that bacteria were already present in the tissue of normal individuals. *The germ theorists themselves in attempting to show the fallacv of this position have established a firm foundation for the claim that the micro-organism is not of itself sufficient cause.* Note the significance of the following statement from Abbot's *Principles of Bacteriology:* "Under careful precautions against which no objections could be raised the experiments of Billroth and Tiegel were repeated by Pasteur, Burdon, Sanderson, and Klebs, but with failure in every instance to demonstrate the presence of bacteria in the healthy, living tissue". *Why are they not present in healthy, living tissue?* We believe the only answer possible s that absolutely healthy tissue is incompatible with the propagation of the bacterium. The following facts are also significant: in any epidemic of *diphtheria* there is little difficulty in demonstrating the presence of the pharyngeal mucous membrane of normal individuals, the Klebs-Loffler bacillus; the micro-coccus lanceolatus is present in the sputum of many individuals not affected with *pneumonia;* even in *cholera asiatica* unaffected individuals may show the presence of the comma bacillus of Koch in the mucous of the intestinal canal. Why are not these affected? Why is not every individual stricken with the disease that passes through the community as an epidemic? The only possible answer is that they are immune *and immunity proves nothing less than that the bacterium cannot be a sufficient cause of disorder.*

A few suggestions regarding the nature of **immunity** may not be out of place. It is spoken of as being *natural* or *acquired*. For instance in the case of the *Negro* comparative immunity to yellow fever and malaria is noted; many individuals are never attacked with the *small pox* virus although they are continually exposed. These have a natural immunity. But it is further noticed that in many of the infectious diseases one attack renders the individual immune to a second, in which case the immunity has been acquired. There are three principle factors which secure to the individual such immunity. The first is the *phagocytic action* first emphasized by Sternberg and later by Metchnikoff. This consists in the independent action of the white blood corpuscles by virtue of which it is enabled to flow around and digest the bacterium, in which case there is a germicidal action; a second factor is the *antitoxic* conditions secured by cell secretions which render the micro-organism incapable of poisoning the organism; and last the blood and tissues are *aseptic* partly because of their alkalinity which is sufficient to render conditions unfavorable for the development of most of the pathogenic micro-organisms and partly because of the presence of nucleinic acid which is also unfavorable. These three factors are obviously dependent upon normal blood and hence it is that the blood is said to be *aseptic*, *germicidal*, and *antitoxic*. In case these several factors are not present in their full efficiency and the individual succumbs to a first attack, this of itself usually is a sufficient stimulus for producing the full efficiency of each factor and hence no second attack is probable.

Meltzer, quoted by Vaughan and Novy in their work on "Cellular Toxins", sums up the organism's defense against bacteria in these words: "I maintain in the first place that in the struggle against bacteria the defense of the body is not carried on exclusively or chiefly by a single element. It is neither the body fluids nor the leucocytes nor the other cells alone which can claim the exclusive merit of maintaining the health of the body, but each and every one of them has its variable share in attaining the desired end...........Let us take as an illustration the protection of the conjunctival sac.

It is nearly in direct contact with the air and we might expect to find there an extensive bacterial settlement. Nevertheless Lachowitz and Bujwid found that in 69 per cent of cases the conjunctiva was perfectly sterile. The factors which accomplish this sterility, or at least comparative sterility, of bacteria are: The reflex which causes the closure of the lids at the approach of dust (the carrier of bacteria); the blinking which occurs regularly a few times in a minute, which in conjunction with the lachrymal moisture throws out again mechanically the already landed bacteria; and finally, the bactericidal effects of the tears destroys the balance of the invaders. Or let us take the respiratory organ from the larynx down to the respiratory tissues including the corresponding lymph glands .... Through this path the outside world stands in an intimate relation to the interior of the body, inasmuch as the air column is separated from the lymphatics and capillaries of the lungs merely by a single layer of the very thin epithelium of air cells. Even the serous cavities are separated from the lymph spaces by thicker layers. This arrangement is of course indispensable for the proper exchange of the blood gases with the air. But what prevents the bacterial invasion of the interior of the body by this open and direct way? Moreover, most of the writers agree that trachea, bronchi, and lung tissue of healthy animals are entirely sterile. In a number of rabbits under morphine anæsthesia I found all these parts to be sterile. If one vagus or a laryngeal branch was cut then the upper part of the trachea contained bacteria but not the lung. When both vagi were cut, then of course the lungs, too, were invaded. Jundell reported recently that by means of a special device he was able to test the human trachea and found that in the majority of healthy cases the region below the glottis proved to be sterile. What protects this path? In my opinion the result is accomplished by the cooperation of the following factors: The tortuous part of the respiratory path lying above the glottis removes perhaps the greatest part of the bacteria contained in the inspired air column and the remaining number is, under normal conditions, just small enough to be disposed of by the factors present below the larynx. Bacteria which pass the glottis are either carried back outside of the glottis from the trachea and the bronchi by the steady movements of the cilia of the epithelium, or, if the germs are carried in the center of the air column down to the air cells, they quickly penetrate the thin epithelial layer and are immediately in the reach of the lymph glands, which take good care of them..........In connection with the respiratory path, I would like to recall here the interesting fact that both canals which lead farthest to the innermost of the body, that is, the respiratory and the female genital canal (which latter terminates in the peritoneum) have ciliated epithelium, the movements of the cilia being outward and are as far as the epithelium extends, entirely or nearly sterile."

In general, then, we arrive at the **conclusion** to which the old school physicians must come and in goodly number are already coming, that first, assuming that the bacteria may be able to gain access to the body substance, *vitiated tissue is a necessary prerequisite* before the bacterium may excite the specific disorder, and that second, the treatment must be directed to *overcome the cause of this vitiated tissue*, which is usually a lesion or abuse, and to assist the organism in keeping up its strength to overcome the bacterium or its products which constitute the exciting cause.

It would seem therefore that the anathemas hurled at the germ theory advocates by certain osteopaths are entirely uncalled for. The position of osteopathy is impregnable regardless of the ultimate demonstration of the exact relation between bacteria and disease. If it be shown that all such micro-organisms are simply associated and not causal factors, well and good. If the causal relation be established, it is no more true of them than of numerous other elements of environment that they may promote disease. Continued life in an atmosphere of dust certainly will cause disorder through abuse of the organs of respiration. An environment of excessive microscopic life constitutes an abusing factor in the same way. The organism will be successful, so far as success is at all possible, as long as the machinery through which life manifests itself is kept in its structural integrity.

CHAPTER VI.

THE DIAGNOSIS OF DISEASE.

THE SYMPTOM.

Diagnosis consists in the determination of the location and nature of disturbed conditions. The osteopath recognizes the value of symptoms in that diagnosis. A symptom or group of symptoms does not constitute disease but is only the evidence that disease exists. That rule of practice is a confession of failure to trace the symptom to its cause, to treat the symptoms as they arise. It is only in occasional cases that it is necessary or advisable to treat symptoms and even then it is but incidental. The *symptom is an effect* and a logical, a legitimate, and under the circumstances a physiological effect. It is as much a matter of physiology that the **heart rate** should be increased when peripheral resistance is at fault as that the heart should maintain a normal rate under normal conditions of peripheral resistance. **Pain** is a physiological condition under the circumstances of pressure or other cause of sensory irritation, and it is markedly true of pain, that by its presence protection to the organism is secured. In the first place pain is a *warning* to the consciousness of the individual that something is wrong; second, the *location* of the pain together with the transference of the sensation gives fairly accurate location of the disturbance; third, pain in numerous cases enforces *rest*, thereby securing better opportunity for organic repair; and fourth the pain condition by causing directly or indirectly or reflexly *increased activity* of other parts of the body may further aid in processes of repair.

In the case of **high temperature** we have a condition that is directly advantageous to the organism in many instances. We know that in numerous fever conditions certain pathogenic micro-organisms play an important role, not necessarily in acting as the original cause for the disorder, but at least in complicating the condition. By laboratory experiment and clinical observation it is found that with many forms of bacteria a high temperature is directly antagonistic to their development. Hence, the high temperature, while a definite symptom of a disorder is in addition a definite protection to the individual. In an equal degree the profuse sweat which is often associated with fever cases is an arrangement whereby a temporary respite is given to the patient from the great discomfort due to the temperature. In the evaporation of the perspiration, the patient is temporarily relieved. In some cases, as in acute articular rheumatism the sweat is distinctly acid, and as such represents an excretion material. This suggests that the profuse perspiration is an aid to body purification. The *chill*, also often found in connection with various acute cases represents a physiological principle. If a case of malarial fever be examined just at the beginning of the period of the chill, it will be found that the temperature of the body is below the normal. If observation be made shortly after the chill period, or even before that period ceases, a considerable increase in the temperature will be noted. Hence, the chill is a method for increased heat production—a thing necessary under the circumstances. We know that most of the body heat results from oxidation processes taking place in active muscle tissue. In the chill we have a rapid contraction and relaxation of the muscle tissues of the body with the consequent elaboration of heat. According to Lowy, (Schafer's Physiology) the simple process of shivering may increase the metabolism of the tissue 100 per cent. Since the chill is but an exaggeration of the shiver, the explanation of the increase in temperature becomes obvious. In the *convulsion* we have still another condition where it is probably true that a physiological purpose is fulfilled. Dr. Still has repeatedly emphasized the fact that the muscular spasm is but nature's effort to produce a re-distribution of the forces and fluids. Note the extreme quiet that follows the epileptic spasm. For several hours there is deep sleep during which, recuperation is in progress.

Vomiting and diarrhoea are symptoms indicating that there is disturbance to the nerve terminals in the digestive tract. But both are physiological. By the vomiting process the organism rids itself of material which if allowed to pass into the intestinal canal would create further disorder; while the rapid peristalsis associated with the diarrhoea carries onward material, which, having gained entrance to the canal is directly irritant. By this increased motion absorption of the irritating material is naturally lessened, and hence, a definite protection is provided. The *anorexia* which is likely to be associated with both these conditions, is a distinct protection in that it militates against taking into the alimentary canal additional material before the canal has cleansed itself of the irritant and before the assimilative processes are again in condition to function properly. In such a case, the absence of desire for food should be sufficient warning to refrain from partaking. The warning is often increased by a definite nausea which is produced by the mere sight or thought of food. Needless to say, the warning should be heeded, and yet, as a result of years of false teaching, there are many who utterly ignore the warning and insist on forcing food materials upon a proper rebellious stomach.

The **rapid respiration** in pneumonia is another typical symptom. It undoubtedly is a favorable condition under the circumstances. For in this disorder one lobe of the lung becomes incapacitated because of an infiltration into the air sacs and bronchioles of a material through which air cannot pass. As a result the lobe becomes solidified and comparatively little movement is possible. But the demand for oxygen is just as great as before, hence, in order to keep up a proper supply other parts of the lung must be over active. Hence, by this hyper-activity the organism is protected against a deficiency of oxygen that would otherwise result. In a similar manner increased activity of the heart muscle is called for when a *valvular deficiency* occurs. In order to keep up a normal circulation with deficient valves, there must be an exaggerated heart action. Clinical experience shows this to be the case. And not only does the heart increase its rapidity but it also increases its substance, purely a matter of accommodation resulting from the excess of action. Hence hypertrophy of the heart, while a symptom of organic cardiac disorder, is also a definite protection against failure of the circulation—an evil much greater than an enlarged heart.

Glycosuria, as it is found in diabetes is a definite symptom of liver or pancreatic disorder. It ought to be present in such a case. In fact the rather abrupt cessation of this symptom in a serious case of disease is a cause for alarm. For, if the sugar is present in excess in the blood, various fermentation processes will be inaugurated with the production of acetone and other substances favorable to the development of diabetic coma. When the sugar begins to accumulate in the blood it is the function of the kidney to throw it out, and so long as this is kept up the disorder may not be a serious one. The failure of the kidney to excrete is the cause for alarm. Associated with the excess of sugar in the urine there is an increased quantity of the latter excreted, as much as twenty pints or more has been noted. Under the circumstances this is necessary. In order to keep the excess of sugar in solution, fluid must be supplied. The greater the amount of sugar present, the greater will be the amount of water excreted with it to hold it in solution. In this case, the symptom is an undoubted protection.

In many **inflammatory conditions** there are certain appearances which suggest a definite protective action. It has been asserted with a good degree of evidence that the serous exudate in an inflamed area is a factor that tends to reduce the pain condition and assist in the healing process. In the case of an inflammation of a mucous surface, as in all *catarrhal conditions*, there is an excess of mucous secreted. This is unquestionably in most cases a decided protection. The excessive blowing of the nose in an ordinary acute nasal catarrh is a detriment from this very fact. If the material is permitted to remain in contact with the mucosa, the healing process will be hastened. In *croupous inflammations* such as diphtheria, the removal of the membrane is decidedly contraindicated, unless it forms so rapidly and in such amount as to offer serious obstruction to respiration. It is undoubtedly, as indicated by clinical experience and by abstract reason, a real protection to the raw surface which is exposed on removing the membrane.

Cases might be multiplied indefinitely where a peculiar appearance usually mentioned as a symptom, is not only the latter, but also is a protective means employed by nature. Not that every symptom is necessarily a benefit to the organism or that it is evidence that the latter is making the attempt to overcome the disorder. In fact we know that to all appearances there are certain secondary changes that arise which are a disadvantage to the organism. But there are certainly enough cases where a real benefit is derived to warrant the greatest of care in determining whether a symptom should be combatted. Certain it is that the rule of practice to "treat the symptoms as they arise" has no place in the philosophy or practice of the osteopath.

While it is thus true that in many cases the symptom has a definite value aside from the fact that it is a key to the nature and location of the disease, it is with reference to this latter consideration that the physician finds it of decided practical value. Disease in large part is determined by symptoms, and we may define a symptom as any unusual manifestation in structure or function that suggests disease. The symptom, in case it is one noted only in the sensations of the patient, may be *subjective*, or where noted by physician or other observer, is *objective*. As an instance of the former, pain is typical; of the latter the coated tongue in digestive disturbances, the contractured muscle in spinal lesions, or albuminuria in case of nephritis.

Of the classes of symptoms, subjective and objective, the latter is the one relied upon for determining the details; the former, although customarily first used in point of time, is unsatisfactory. This is true because the subjective symptoms are subjective. *Feelings are unreliable signs*. The location of the disorder may be far remote from that which is apparently indicated by the sensation. The further fact that in numerous cases patients are unable to locate the sensation or are unable to give an accurate description of its ntaure, increases the difficulty in the way of a satisfactory diagnosis from subjective symptoms. On the other hand the conditions that can be seen and felt objectively by the physician constitute fairly accurate indications of the disorder, while the *tenderness on pressure* which is manifest on physical examination gives quite accurate data for legitimate conclusions.

Methods of Examination.

The methods of examination objectively are those in use by physicians of all schools although the osteopath emphasizes one, palpation, above all the others. First in point of time is the method by **inspection,** which consists in observing various changes in the appearance of the body, its functions and its products, by the sense of sight; for instance a *coated tongue*, a sallow *complexion*, and a high colored *urine* are seen; by inspection lesions are determined, at least in general, as in the case of the carriage of the head in *torticollis*, the *inversion* of the toe in a dorsum dislocation of the hip, or a *contractured muscle* and deviated *spinous process* in a spinal disorder.

Palpation is the second method in point of time but *first in point of importance* and consists in determining conditions by the sense of touch. For instance by palpation we may note an increased *cardiac impulse*, a difference in the *respiratory movement* of the two sides of the chest, a *tumor* of the abdomen, a high *temperature* in fever conditions, a *contractured* muscle, a luxated *rib*, or a limited *movement* in articular structures, and by pressure upon a part, though not by the sense of touch of the diagnostician, differences in *sensory* conditions of the patient may be determined. Osteopaths pride themselves upon the delicacy of their sense of touch and it is well they should, because by no method can the lesion be determined so satisfactorily or certainly as by palpation. If one of the various methods should be developed at the expense of others that one is palpation. It is characteristic of the founder of osteopathy that he makes use of palpation almost to the exclusion of other methods, and his ability to detect structural changes with little difficulty by his sense of touch is common knowledge. That there is large possibility of developing that sense will be admitted by all, but to the osteopathic practitioner the fact becomes more and more striking as his experience and observation extend over a larger period and a wider field.

A third method of objective diagnosis is **percussion.** This consists in the comparison between the sounds produced by a series of light blows over the normal organ. Every organ or structure will have its specific *percussion note* which is determined by its density and its relation to adjacent structures or cavities which act as sounding boards or resonance chambers. Various names are given to different grades and tones of the percussion note; thus we speak of the *resonant* note of the normal lung, the *dull* note of the liver, the *flat* note of abdominal dropsy or the *tympanitic* note of the stomach distended with gas. The methods of percussion are *immediate* (direct), or *mediate* (indirect), in the former of which light blows with the fingers or small mallet are delivered directly on or over the tissue; in the latter which is most commonly used a pleximeter is interposed between the structures percussed and the fingers or mallet.

By **auscultation** the sense of hearing enables us to determine disordered conditions of various of the organs, though by this method the sounds produced by the organs in their functioning furnish the evidence. A change from the usual nature of the sounds of the *heart* is indicative of cardiac disorder; the *respiratory murmur* gives evidence of a normal or abnormal condition; the rumbling sounds produced in the intestines technically spoken of as *borborygmus* suggests over-active fermentation; or the *friction sounds* produced by the approximated pleural layers denotes the dry form of pleuritis.

Mensuration is a method much employed by osteopaths not so much perhaps in the way of definite tape-line measurement which is often helpful and occasionally essential, but by comparison in size and shape of paired or symmetrical structures. The difference in size between the sides of the *chest* is often noticed; the difference in the width of the *ilio-costal spaces* is valuable in numerous cases; the *shortening* of a lower limb through lesion at the hip or pelvis will be noted by measurement or comparison; or the increased *circumference of the shoulder joint* will be diagnostic of a dislocated shoulder.

These five methods *modified and aided by pressure and rotation* of parts will either singly or collectively yield sufficient data to indicate the essential nature of most of the disordered conditions with which the osteopath meets. All of them have their uses and their special value and the osteopath who entirely neglects any will certainly find occasion to regret his inability to make satisfactory use of that method.

We shall not further discuss the question of symptoms in the diagnosis of special diseases, for that is not within the province of this work. It will, however, be entirely within the province to take up for discussion the diagnosis of lesions. A consideration of this question is distinctly and peculiarly osteopathic since it is only the osteopath who has recognized the existence of the lesion, at least in the special use of that term which has been indicated in another chapter.

THE DIAGNOSIS OF LESIONS.

The special and limited meaning of lesion is an osteopathic creation and hence it will be necessary to go quite into detail in the discussion of the factors entering into the determination of the presence of a lesion in any specific case. The fact has been emphasized that not every mal-position of bony or other structures constitutes a lesion. In a few cases such a condition may be the only evidence of lesion and still be a real lesion in the two-fold idea assigned to that word, i. e., *structural change producing functional disorder*, but in the majority of cases with which the osteopath deals there will be other evidences which substantiate the diagnosis. Further, in this discussion we shall not take up in detail the different forms of lesion as they may exist separately—bony, muscular, ligamentous, visceral—but shall limit the consideration to a *typical case* where there is a combination of the first three named. For it cannot be too strongly emphasized that in most conditions of skeletal disorder the three will be associated in the causation of the functional perversion. In the discussion the presence of such an association is assumed, and the points essential in the diagnosis of that condition will be indicated. There are two fundamental principles to be noted in the method of making an examination of any part of the body, the one of which will tend to prevent possible error arising from the other. The part should be examined in its **functional activity.** A perverted function will be manifest in the appearance of the action of the organ which performs the function. In *torticollis* or wryneck the sterno-mastoid muscle presents an appearance when in action entirely different from that while at rest. Comparison of the muscle in the horizontal position with it in the erect position of the body will suggest facts that otherwise would escape attention. In the horizontal posture the neck muscles will be in **functional rest.** In the examination of a *hip* the action of it should be noted, but in addition the position of its various parts should be determined by palpation during its rest. The movement of the *chest* should be noted and compared with that of a normal action, in addition to noting the position of the ribs while in expiration and pause. The movement of the *inferior maxillary* may suggest the nature of the lesion more markedly than will an examination of it in the quiet state.

Passing to the details in diagnosis it will be noted that the first evidence that a lesion exists is the **perversion of function** of some organ or structure, which is likely to be first discerned by the patient or some one other than the physician. The patient gives the information that he has functional disorder of some special organ. That fact indicates in general the part of the organism where lesion is most likely to be found; if it be gastric disturbance the splanchnic or the vagal region will be suspicioned; if a uterine trouble, the lower thoracic, the lumbar or sacral structures will first be examined; if the eye be impaired, the atlas and the upper thoracic is more likely disturbed.

The **general attitude** is a factor in the determination of the approximate location of the lesion. Dr. Still has emphasized the fact that *the position that a patient assumes is normal to the existing structural condition*, which is but a special application of the doctrine that function is normal to structure. To make a concrete case, suppose a lesion of considerable magnitude exists in the *cervical muscles* of the patient. The manner in which he carries the head suggests a cervical lesion. If a *rib* be luxated the patient will sit in such a position as will secure him the least irritation. The careful way in which an individual afflicted with *Pott's disease* carries his body immediately suggests a spinal lesion. In all of these cases the position or the attitude is normal to the lesion, that is, it is such because the lesion or its effects compels it to be such. Hence the value, when a patient presents himself for examination, of making a preliminary survey of the individual as a whole.

The **position** of landmarks is a second point to be considered. Having determined the probable region of the lesion by the method above described, a peculiarity in the positional relation between certain parts used as points for comparison may be noticed. If in the case of a *vertebra*, the relation of its spinous process to those adjacent may be altered; the intercostal space, in case of a *rib*, may be found to vary in regularity throughout its extent, or may be narrowed or widened in comparison with those above or below; the lower margin of the *liver*, in a lesion condition of that organ, will be displaced. It seems necessary to emphasize the fact in this connection, that *no greater mistake can be or has been made than that of assuming the existence of a lesion whenever it is found that there is a variation in position of a structure.* Reference has been made to the fact that structure as well as function can vary from the average within wide limits and still the condition be a normal one. While it is convenient to compare the body to a machine and insist that in both cases a variation of the slightest degree in structural parts will cause disorder in the one as in the other, the comparison is not illuminating if carried to extremes. The machine is an unyielding structure and has no power of adjustment, which makes the necessity for perfect structural alignment an absolute one. The living machine, on the other hand, is made up of yielding parts and has immense possibilities of adjustment to an abnormal structural change. The universal tendency on the part of the beginning student seems to be to make the assumption, unfortunate as that fact may be. In some cases it would seem that the apparant structural change is, of all the several evidences of lesion, the most unreliable.

A further evidence of the presence of the lesion is the **sensory change.** While this usually takes the form of definite pain, in many cases it is of the nature of such peculiar sensations as anæsthesia, hyperæsthesia, or paræsthesia; under the latter term is included the burning sensations, tightness of tissue, or of formication, i. e., sensation as of a small insect creeping over a part. Any of these may be present either at the local area of the lesion or may be remotely situated and partake of the nature of *transferred sensation.*

Pain is of such importance that we shall enter into detail showing its relation to lesion and disease. It has been **defined** as the "prayer of a nerve for pure blood", and this conception is apt in many cases. It is a sensation, perceived by the cerebral cells concerned with consciousness, produced by an irritation of some form to a sensory nerve. Without entering into the argument for or against the contention that there exist special pain nerves or special pain-receiving end organs, suffice it to hazard the opinion that any afferent nerve if sufficiently irritated will give the sensation of pain. Note the fact that the sensation is a brain sensation though it is usually projected to the part irritated. For instance the sensation from a burned finger is felt in the sensorium but the individual is entirely aware that the irritation is at the finger. With reference to this fact, note the *want of logic* in the reasoning of the individual who is content with giving a drug which renders the sensorium less capable of receiving or responding to the transmitted impulse. The pain is still present in so far as the nerve disturbance constitutes the pain. The drug has simply rendered the patient unaware of the existence of irritation. Pain, then, is a distinct advantage to the organism, and it is in relation to its advantage in the way of assistance in the diagnosis of the lesion that it will further be discussed.

It is to be noted that pain may be **direct** as when caused by irritation produced directly upon the part to which the sensation is referred. For instance, an irritant taken into the stomach may cause the sensation referred to that region; or the pressure upon the ulnar nerve causes pain at the point of pressure; a contractured muscle—e. g., the pyriformis—may irritate directly the sciatic nerve and the whole nerve will suffer. In this case the pain is felt not only at the point of pressure but throughout the entire neuron; for note that in the pressure on the ulnar, while the pain may be felt at the pressure, it will likely be more noticed in the finger, i. e., at the peripheral end organs. In this case it is not necessarily simply a reference by consciousness, but an actual disturbance of molecular vibration throughout the entire nerve element, with a consequent arousing of impulses from all parts suffering the disturbed vibration, and the greatest intensity of impulse will come from those parts which are especially developed for the purpose, i. e., the sensory endings in the periphery. But the pain may be indirect or **referred.** In this case a peculiar fact is to be noted, a fact that has been put in definite formulation by Head and which is spoken of as *Head's Law.* This law states that, "*When a painful stimulus is applied to a part of low sensibility in close central connection with a part of much greater sensibility, the pain produced is felt in the part of higher sensibility rather than in the part of lower sensibility to which the stimulus was actually applied.*" While this is a fairly correct statement of the real condition it should not be dignified by the name of "law," since in the above wording it cannot apply to all cases by any means. Head based the law on observations with especial reference to visceral versus spinal pain. It is known that many of the viscera are comparatively insentient under ordinary conditions. That is, the nerves capable of conducting an impulse producing the sensation of pain are comparatively few and inefficient, and hence the irritation sufficient to give pain must be correspondingly intense. But every one is aware that pain may be produced in a viscus, and in order to show that Head's

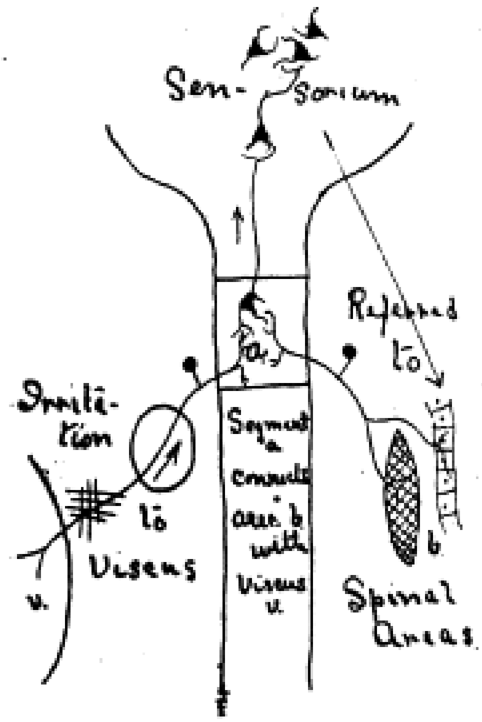


Fig. 7.—Illustrating mechanism in referred pain.

law holds, it must be proven that the part of higher sensibility is the part most noticed by consciousness on the application of the stimulus to the more insentient organ. That such is the case in numerous instances may readily be admitted but that it is true in all is disproved. Were it stated that the pain *may* be felt in the part of higher sensibility the objection to the statement would cease. In this latter interpretation the question will be considered. Note that the law provides for a condition where there is a "*close central connection.*" It is to be remembered that though little evidence of an anatomical nature can be adduced, there is much from physiological and embryological investigation to show that the spinal cord and less noticeably the brain are **segmental structures**. We may arbitrarily divide the cord into segments corresponding with the paired arrangement of the spinal nerves and assume with little possibility of error that this division represents a physiological segmentation. Each part of a segment acts more with reference to its other parts than with parts from an adjacent segment is a statement that is true in general. Hence, two nerve fibres having their central endings in the same segment will be in more intimate relation than fibres from different segments. This fact is indicated from various evidences derived from experiment, especially in reference to reflex action. For instance Pfluger has shown that a stimulus applied to a limb of a "spinal frog" produces its first response in motion of that limb, but the next effect, produced by a stronger stimulus will be upon the limb of the *opposite side*, showing the radiation of the impulse to parts in the same segment. An additional stimulus will cause effect on nerves from the immediately *adjacent segments*. But according to Head and others who have investigated the same problem, the phenomenon is not limited to a reflex mechanism such as is present in the above cases. A sensory nerve in connection with the same segment may be involved, or at least the pain may be referred to the area of distribution of that sensory nerve. Head calls attention to the fact that with a few possible exceptions, each viscus is related in this way to a definite area of cutaneous tissue. For instance, irritation of the *stomach* is likely to be associated with pain in the skin areas supplied by afferent fibres from the sixth, seventh, eighth and ninth thoracic nerves. It is significant that the pain is not necessarily of a simple "referred" or "transferred" character. It is noted that in numerous cases there will not only be a referred pain, but what is a different thing, **referred tenderness,** in which case it is suggestive of distinct nerve disturbance rather than a reference on the part of consciousness. But the reference of pain is not necessarily from a diseased viscus. Osteopaths continually have this fact called to their attention by numerous cases. *Hip trouble* gives rise to pain in the knee. This may be due to direct pressure by the luxated structures upon the nerve supplying the articulation, or it may be due to impingement upon the terminals of branches distributed to the hip joint, referred back to the segment, and thence out over the branch to the knee. For we know that the same nerve trunks which supply the articular structures of the hip also supply those of the knee. Similarly Hilton calls attention to the fact that *the same nerve trunk that supplies a joint, also supplies the skin which overlies it and the muscles that move it*, and a further usual circumstance of interest, that *the bowel wall, the peritoneal structures associated with it, and the skin overlying these*, are all supplied from the same segmental source. Attention is further called to the fact that ear-ache may be associated with disturbances in the nutrition of the teeth, both of these structures being supplied by the fifth cranial. In all of these cases we have a principle that is similar if not identical. Further facts suggested by Hilton in relation to referred pain may be of some value. He notes first that pain in the cutaneous structure *not associated with a high temperature* of the part is suggestive of a distant origin of the pain, and usually that origin is in the spine. He instances in this connection what osteopaths have been able to corroborate in many cases, that a sensory disturbance in the anterior terminals of the thoracic spinal nerves is often due to a spinal lesion, no local disorder being manifest. A further rule is that when the pain is *symmetrical* it is almost certainly caused by a central, i. e., spinal disorder. The application of the foregoing facts is apparent. By means of the pain or tenderness we may trace the situation of the segment of the cord which is involved. That involvement may be or may not be dependent on a lesion at the corresponding vertebra, but in the vast majority of cases such a lesion will be found. Even though the definite structural change be absent from this part, the organ involved will be indicated and indirect aid be given in the diagnosis.

The **tender spots,** for the discovery of which the osteopath is famous, are always significant. In most cases these points of increased sensitiveness are quite *limited in extent* and suggest in most cases not a referred but a direct condition of irritation. For instance in the examination for a lesion of the spine, just at the region between the spinous and transverse processes the tissues are tender on pressure. This is always suggestive of local disturbance, i. e., congestion, inflammation, or contracture of tissues sufficient to irritate the sensory nerve terminals in the part. In palpation for such tender areas care must always be exercised or *a tender spot may be produced* where none before existed. Bear in mind that sufficient pressure in any part, whether normal or abnormal, will produce pain or some other sensory change. The sensory condition of the part under examination must always be *compared* with similar adjacent areas, and with the average condition. This last must be a question of experience,—the average normal condition must be learned before there can be much possibility of detecting slight changes—a statement true not only with reference to pain, but to all of the several factors enumerated.

Emphasis has been laid upon the subject of pain as evidence of lesion, not only because of the complexity of the subject, but because of its primary value as a first evidence of disorder. Of the numerous changes that may be associated with a lesion, the sensory one of local tender areas is among the most important and least associated with a possibility of error.

Another valuable factor in determination of the presence of a lesion is the condition of the **associated muscle tissue.** This is usually spoken of as a contracture, the causes of which have been referred to in the section on causes of lesions. It becomes necessary to distinguish between the meaning of contraction and contracture in order that confusion may not arise. The term *contraction* refers to the state of a muscle in the physiological process or condition of shortening and thickening of the muscle not associated with appreciable change otherwise. The term *contracture*, on the other hand, has by usage become involved with the idea of a pathological condition in which the contraction is not identical with the normal state, and though it is contracted it has in addition certain other characteristics. True enough, a contraction long continued will usually result in a fairly typical contracture but that the ordinary contractured muscle with which the osteopath is so familiar is not identical with a prolonged contraction will hardly be denied by any one who has carefully compared the two. Physiologists recognize that there exist conditions of change of shape in muscle not similar to the usual contraction, and to which have been given the name of *idiomuscular* contraction. Specific instances of such are noticed in case of fatigued muscles, which on the application of a stimulus—e. g., a mechanical blow—responds not by a wave of contraction passing to all parts of the muscle, but by a local swelling of the tissue to which the stimulus was applied. This change persists for some considerable time after the withdrawal of the stimulus and in this respect, therefore, also differs from a normal contraction. If the actual condition of the muscle could be accurately analyzed, it would likely be found that the contracture with which the osteopath is peculiarly acquainted and the idiomuscular contraction referred to by the physiologist, would more nearly be identical than would the former with normal physiological contraction. If a muscle is contractured it presents certain peculiar characteristics to the examiner. In the first place it will give evidence of a *shortening and thickening*, in which statement nothing is indicated showing any difference from the ordinary contraction. But in reality if care be exercised in palpation a distinct difference will be noted. Instead of a homogeneity of the contraction there will be an *irregularity*, some of the fibres apparently in a normal tonic condition, while others are distinctly knotted. A further noticeable fact will be the peculiar "*ropy*" feeling as the fingers are passed over the muscle at right angles to the course of the fibers. In other cases the term "welted" would be more descriptive. A further characteristic of the tissue is a peculiarity in the *denseness*,—a sensation transmitted to the fingers difficult of description, and due in all likelihood to a change in the nature, amount, and disposition of the various fluid materials associated with the muscle, i.e., the blood, lymph, and muscle plasma. Another condition of the contractured tissue is the *sensory change* noted in it and to which sufficient reference has been made. Emphasis should be laid upon the fact that a persistent contraction or contracture will invariably result in a sensory disorder of some kind. Finally, material aid may be given in the determination between a muscle physiologically contracted and one in contracture by causing the individual or part to *assume a position in which the necessity for physiological contraction ceases to exist.* For instance so long as the individual is in the sitting posture the deep cervical muscles will be functionally active. On assuming the horizontal position the necessity for their contraction ceases to exist and they will normally relax. If, however, the muscles be contractured, the relaxation on changing position will not be so apparent. Note that it is a condition of degree, for the abnormal muscle will undergo partial relaxation when its contraction is no longer needed.

The degree of **amplitude of movement** is a factor of much value in diagnosis of the lesion, and one which is closely associated with the condition of all the structures. We have noted that in most typical lesion conditions, bony, ligamentous, and muscular changes are associated and interdependent. All three are concerned in producing the change in the freedom with which the part moves. A bony luxation usually will lessen the extent of movement, and so will ligamentous strain and muscle contracture. On the other hand a lax ligamentous and muscular condition will permit of excessive rotation. The condition of the spine spoken of as a "rigid", or "smooth" spinal column (Hazzard) is a case in point. The rigidity may be due to "locked" *vertebræ*—rare—thickened and hardened *connective structures*, *deposits* in or *absorption* of intevertebral and articular cartilages as in articular rheumatism, or to simple but general *muscle contracture*, in the latter case usually yielding on application of measures designed to relax the muscles. Bony *ankylosis* is a condition occasionally met with and will manifest itself by absolute immobility.

Temperature changes in the local part are often found and usually are indicative of local lesion. The existence of a lesion means local irritation. Irritation calls for or at least results in hyperæmia, and hyperæmia may pass into inflammation. In either of the last two conditions there will be increased heat because of increased blood, the latter being the principal medium by which heat is distributed. But the increased temperature may be locally produced. Especially is this likely where local inflammation is present, the increased metabolic changes being responsible for an increased oxidation with liberation of heat. Attention is often called to a *rib* lesion through the difference in temperature along the course of the rib as compared to that above or below. It is not necessarily an increase, but may be a decreased temperarure that is noticed. A cold state of the *posterior cervical structures* is a common accompaniment of the lesion in that region. Dr.

Still calls attention to the lowered temperature of the skin in the gluteal and lower spinal regions in case of *croup*, while the ventral structures may show an increased temperature. The numerous cases noted and the equally numerous possible causes of changed temperature suggest the importance of a careful training of the fingers in the temperature sense.

Finally, the **color** of the part under suspicion may be an indication of a lesion. In most cases the difference in color will be dependent on the amount of blood present, congestion causing redness, ischæmia producing pallor. *Pigmentary* deposits may occasionally be noted in the region of a lesion, from the blood or other change associated.

In all the examination for the nature and location of a lesion the several factors mentioned should be borne in mind. In the vast majority of cases only a few of them will be appreciably present. The greater the number the more certain the diagnosis. *The absence of one or all does not disprove the presence of a real lesion and a serious one*, but renders its presence much less likely. Note the fact that numerous osteopaths are quoted in the expression "There was no lesion in the case." The want of logic evidenced by such assertion is quite apparent. It is not necessary in order that there be a real lesion that the condition can be determined with the eyes closed and gloves on the hands. To assume that every lesion can be detected is to assume the impossible. Lesions may be microscopic and still be lesions as judged by our definition, and he who thinks it necessary, in the case of impreceptible lesion, to assume the existence of some other cause for the disorder than that of the lesion, or that the manipulation of a part which produced a cure of this disorder did so other than by removal of lesion, is making use of extremely faulty logic.

CHAPTER VII.

THE TREATMENT OF DISEASE.

Prophylaxis and Therapeutics.

The ultimate end which we have in view in the determination of the etiology and diagnosis of disease is but to prepare a rational basis for the treatment of disease. By the treatment of disease is meant *any method or measure which will assist the organism in re-establishing its normal function.* More appropriately, it is the treatment of the diseased organism rather than the treatment of disease, for the disease will be disposed of by the organism itself if freedom is given to the healing agencies inherent in the organism. Broadly speaking there are two grand divisions comprehended in the word treatment, one of which is concerned with all of those measures designed to prevent the onset of disturbed functioning. Technically this is spoken of as prophylaxis.

The term **prophylaxis** is a comprehensive one and has rather indefinite limits. In the first place it is concerned with the conditions of the *environment* of the individual. Sanitary measures employed by a municipality, including regulations governing sewerage systems, tenement house requirements, and the like,constitute definite prophylactic treatment applied collectively. Hygiene in the nature of cleanliness, normal exercise and the breathing of pure air or the eating of proper food in proper amounts, constitutes prophylaxis of the individual with regard to his environment. On the other hand prophylaxis is applied directly to the *organism* itself either by the *removal of the predisposing cause*, as for instance the increasing of the chest capacity by lifting and adjusting the ribs in order to avoid furnishing suitable soil for the propagation of the tubercle baccillus; overcoming the irritable mucous membrane of the nasal passages to prevent an attack of hay fever brought on by the presence of dust particles in the air; or insistence on abstaining from further abuse of an organ which otherwise would ultimately result in exhaustion and hence disease, for example, where there is a tendency to writer's cramp; or prophylaxis is applied in the *avoidance of the exciting cause*, or the direct destruction of that exciting cause. As illustration of this second method, the patient may be directed to remove to a climate more favorable to his health, as in the case of the hay fever victim who passes his summers in an atmosphere less laden with irritating particles; or the use of antiseptic washes in the case of contagious diseases.

But measures may be applied in the treatment of the organism after the disease is present, and this constitutes what is technically spoken of as **therapeutics.** It is necessary to observe as a precaution that many writers make use of this term to embrace both preventive and curative treatment. As a matter of convenience the two terms should be kept within their proper limitations. In the application of therapeutic treatment one or both of *two policies* may be pursued, the removal of the lesion condition or the abstinence from any use of the organ that under the circumstances would constitute an abuse. In the case of an individual afflicted with *stomach trouble* dependent upon a splanchnic lesion the proper treatment for such disorder would consist in the removal of the specific lesion. So long as the lesion exists some care may be necessary to avoid any overwork or other abuse of that organ. If on the other hand the primary cause of the gastric unrest is abuse by errors in diet, therapeutics would consist—granting there were no lesion present—in the regulation of the dietetic habits of the patient.

Of the two ideas associated with treatment, that of prophylaxis occupies the **higher plane,** for prevention is always better than cure though not necessarily in the ratio of the ounce to the pound. It is the dream of the idealist that a time may sometime come when there will be a greater demand on the part of the people for prophylactic than for therapeutic treatment; when individuals will pay greater attention to laws of health and will go at frequent intervals to a qualified physician for the purpose of physical examination to detect any predisposing lesions that may have arisen since the last examination or treatment. But the dream of the idealist will hardly be realized in this generation and hence comparatively little prophylaxis of that nature will be used. The average osteopath will only be called upon to treat a case after the evidence of disorder is markedly present. Hence relatively greater stress must at present be laid upon the therapeutic side, except in that the physcian may make himself a distinct force for the dissemination of knowledge regarding the body and the laws of its health, together with a hearty co-operation with all legitimate efforts to enforce sanitary measures applied collectively to a city or community.

The relation that the removal of lesion bears to prophylaxis, even in case of a therapeutic treatment, we have discussed in a former article ("The Ounce of Prevention", Nov. 1902 issue of the *Journal of Osteopathy*,) a part of which is reproduced in this connection: "But after all that may be said of the curative treatment, is not every osteopathic treatment a prophylactic one? The use of the term curative is essentially incorrect. The physician does not cure. We object to the definition of osteopathy which affirms that the physician "directs" the inherent recuperative forces of the body. The direction of those forces abides in a higher and more subtle power than can be exercised by the hand of another individual even though it may be guided by a high order of intelligence. Neither does he "regulate functioning", except in a very secondary sense; and herein lies one weakness in the philosophy of the "vital lesion" osteopath. Functions are controlled by an inherent force which we denominate "vital". That force itself cannot go permanently wrong. It will not cause permanent disorder of structure except it be hindered by blocked channels of interchange. And herein also lies the fallacy of the Christian Scientist and all other mental healers. The "tendency to the normal" operates in psychic as well as in material substance, and the normal in mind and emotion will be assumed if the organization of cell life be intact. If then the physician does not regulate functions or direct forces, what does he do? Fundamentally, he clears the way. Does that cure? The disease as it existed before the lesion was removed was caused by perverted function resulting from the lesion. On the removal of the lesion the disease as it exists will be overcome by the restored normal functioning. The physician in removing the lesion has prevented the further progress of the disease. He has applied preventive treatment."

"Is it the assertion of an extremist to say further that even in the removal of a lesion the physician is not *overcoming* a structural condition? In the vast majority of cases with which the osteopath meets, the treatment does not consist in "setting" a bone, if we use the term in the sense in which it is commonly used. In a case of a recently luxated hip the osteopath may be successful in one treatment. In such a case he perhaps is not simply aiding nature. But in the countless other lesions met with, chronic changes are present which do not admit of immediate replacement. In such cases the prime importance of the physician is as an assistant to the organism. When a lesion is produced by whatever cause one of several things takes place. Nature first attempts to overcome the structural disturbance and is usually successful. Every football player and every one who has watched the game will readily believe that numerous structural conditions are produced during the strenuous periods. Do every one of these need a treatment? Hardly. *Tension of tissue* supplies sufficient treatment. But occasionally a structural disorder is sufficient in degree to pass the limits of self-adjustment. Failing in drawing the part back to normal the tissues on one side gradually yield, on the other gradually shorten, and with other changes a partial adjustment to the new circumstances takes place. What must the osteopath do? In the case where nature is still making the attempt to re-align, he can assist by releasing the hindering structures and in the average case "nature will do the rest." In this case he is not curing, he is preventing. Where complete adjustment to the changed condition has taken place he is perhaps more surely applying a curative measure in the breaking up of adhesions and stretching permanently shortened muscles and ligaments."

"Hence after all we are using the ounce rather than the pound, though for various reasons some of which are indicated above, we are rather late in making the application. But time will remedy the difficulty to a large extent, and then we shall be able not only to prevent the progress but also the beginning of the pathological condition."

Curative versus Palliative Treatment.

A further classification of treatment is made having reference to the immediate purpose and effect, as to whether it be curative by virtue of aiding in the removal of the cause of disease, or whether it be palliative, in which case it is directed to a symptom rather than a cause. If the physician overcomes or assists the organism in overcoming a lesion of the spine which is causing heart disorder, or if the patient himself abstains from the abuse of his heart by over exercise where such has been the cause, a *curative* treatment has been applied. If on the other hand he exerts pressure in the upper thoracic region and relieves a temporary palpitation or sensory distress, a *palliative* treatment has been employed. No definite dividing line can often be made between the two, for a curative treatment will in a large number of cases be palliative also. The adjusting of the ribs by the treatment in the thoracic region thereby taking off the pressure will give relief to the distressed cardiac structures. On the other hand in numerous cases a palliative treatment while given explicitly for the purpose of temporarily overcoming a symptom may in the long run be curative as well. A treatment applied for the purpose of lessening the intensity of pain will in occasional cases give to the organism a better opportunity for repair, which was wanting so long as the nerve disturbance continued. Further, it may become necessary that a palliative treatment be given *in order that the primary cause may be reached.* For instance, an obstruction to the bowel from impaction may cause such a tension of the abdominal wall as to make impossible any direct manipulation of the impacted area. In such a case treatment would be given for the purpose of relaxing the abdominal muscles which would be preparatory to the primary or curative treatment. Or in the case of a wrenched spine the resulting congestion and contracture of the superficial spinal muscles may be such as to hinder treatment to the deeper structures, making it advisable if not essential to quiet the sensory disturbance and overcome the contractured condition before attempting the deeper work. Again, a palliative treatment may be essential as a *preliminary to further diagnosis.* In appendicitis the bowel wall is so irritable and tense as to prohibit palpation deep enough to determine the condition of the cæcum and appendix; or the superficial cervical tissues may be so contractured as to prevent the detection of a deep cervical lesion. In both of these cases the palliative or temporary treatment will be necessary before a satisfactory diagnosis is possible.

Adjustment of the Osseous Lesion.

The statement has been made that the three common forms of lesion, bony, muscular and ligamentous, were usually associated in the production of the same disorder. In the treatment of the condition a movement which will affect one will affect the others. In the case of the bony and the muscular lesion at least, special and peculiar methods must be used. The ligamentous lesion will be affected only by work upon the others. Since we do find bony and muscular lesions associated the question arises as to which should have precedence in point of time. It must be confessed that there is a difference of opinion regarding the matter. If the bony disorder is secondary to the muscular tension and is maintained in its position primarily by that muscular tension, manifestly the muscles should first be relaxed, and if no other cause of bony displacement be present that may be sufficient. Such a condition is a common occurrence among acute cases and hence the general rule that muscle contracture should have *first attention in acute cases* may be safe enough to follow. In chronic conditions, however, the vast majority of cases will present bony disorder not primarily maintained by muscular contracture; and in most cases the muscle contracture will be secondary to the bony disorder though in the beginning muscle contracture may have been primary. In such cases as these we are personally convinced that direct treatment to the muscles is secondary in point of time and importance, and so far as actual results are concerned the direct pressure and massage so often employed is entirely superfluous. We shall begin the discussion therefore with a consideration of a few general principles underlying the adjustment of the osseous lesion.

The first of these principles may be spoken of by the phrase which osteopathic usage has authorized, **exaggeration of the lesion.** By this is meant a manipulation designed to make the structure more prominent in the direction toward which it is displaced. For instance if there be a right lateral luxation of a *cervical vertebra* the head should be flexed to the left and pressure applied to the cervical tissues on the left of the displaced bone; if a *rib* is sub-luxated upward on the transverse process of the vertebra pressure is exerted upward at the angle of the rib and downward on the anterior extremity; if the *innominatum* be luxated through a rotation upward and forward pressure will be exerted in an upward and forward direction on the iliac portion of the bone, upward and backward on the ischium. In the exaggeration of the lesion several objects may be had in view. In the first place the measure tends to *free the articular structures*, just as the driving in a trifle will free the articulation of a nail with wood in which it is imbedded and permit it to be withdrawn more easily. In the second place the movement effects a *stretching and relaxation* of the deeper structures which in numerous cases is all the relaxation that is called for. Finally, there is secured the *benefit of recoil* which results from the stretching of the tissues and aids in initiating the movement backward towards the normal position.

A second general principle is that of **rotation**. The value of rotation can hardly be over-estimated although the rotation itself may easily be too extreme. In effecting rotatian of the part luxated, at some point during the circuit each of the fibres in each of the ligamentous and other connective structures will have been stretched and relaxed and the articular surfaces kept sufficiently free to allow the progress of the part back to its original position. The comparison may be crude but the conditions in the case are similar to the movement of a trunk or box along a platform by rocking it back and forth with some rotation. The advantage of this method over that of dragging the box bodily is obvious.

A final general principle in the adjustment is the simple one of **pressure** applied to the luxated structure in the direction toward its normal situation. In point of time the exaggeration of the lesion is first, rotation and pressure follow and are co-extensive and co-ordinate in time. In all but a comparatively few cases these three principles can be applied with advantage, and are applied although the physician himself may not have been aware of their application. In a few cases little direct pressure can be satisfactorily made, as in the case of an anterior lumbar vertebra, in which it is necessary to rely principally upon the pull of tissues in and following the process of rotation. In other cases the exaggeration of the lesion may not be feasible; but in no case is it impossible to apply rotation and in numerous conditions where the lesion is slight, that of itself will be sufficient aid to the organism in effecting a normal adjustment.

Adjustment of Muscular Lesions.

In most cases of a chronic nature and in practically all acute cases muscular lesion will be quite manifest. It is not necessary at this time to discuss the question as to whether that lesion will be primary or secondary; the fact that it exists calls for discussion as to the methods of producing relaxation. For whether the lesion be primary or secondary its removal is seldom if ever contra-indicated. Note first that one or more of several purposes may be had in view in the relaxation.

One of the objects in such relaxation is that of **diagnosis.** In a large number of cases the muscular lesion will be the most apparent one, which fact has given rise to much hasty reasoning with the conclusion that no additional factors were present. The writer was once told when he was a student in school that when he "got into the field" he would find little beside muscular lesions. We are compelled to testify that the informant has proved himself a false prophet; if care be taken in analysis of conditions few chronic cases will be present unassociated with deeper than muscular lesions, while it is almost equally true of the acute forms. Indeed we believe it not unsafe to assert that in most cases the muscular contraction is direct evidence of a deeper lesion. The difficulty of detection may be much more marked than the realness of the lesion. The fact that deeper lesion is usually associated makes it necessary, or at least in many instances helpful, to effect a superficial relaxation in order to detect the deeper condition. Note the case of a *contractured cervical region.* In numerous of such the ordinary osteopath will not be able to determine the condition of the cervical vertebræ until the obscuring muscle contracture is removed. It is often difficult, further, to detect the relative position of the posterior part of a *rib* at its junction with the transverse process of the vertebra until the associated contracture is overcome. A floating kidney acting as a lesion will often be obscured by contracture of the quadratus lumborum and abdominal muscles. But not only for diagnosis of further lesion is removal of contracture necessary but also for determination of the organ involved and the nature of the involvement—i. e., for *diagnosis of the disease itself*. Note the fact that in hepatic colic from the passage of a gall stone muscle contracture is so intense and painful that a palliative relaxation becomes imperative for definite diagnosis of the gall stone condition; similarly an obstruction to the bowel will produce secondary abnormal tenseness sufficient to prohibit palpation of the impacted or otherwise occluded condition; the rectal and vaginal *sphincters* may be so constricted as to hinder local examination of the position and condition of the uterus. In all such cases the beginning osteopath—i.e., the inexpert—finds it necessary to resort to the removal of the secondary obscuring lesions before he is able to make a satisfactory diagnosis of the disease.

A second object is as a **preliminary to further treatment**, the further treatment often though not necessarily being the primary one. The "Old Doctor" invariably allows his fingers or palms to "sink in" the tissues for a moment previous to the movement for adjustment of a *cervical vertebra*. In this "sinking in" relaxation occurs which reduces the amount of force necessary to produce movement by rotation and pressure; in long standing cases of *hip* dislocation, where a crude new articulation has been formed with a consequent adjustment—shortening and lengthening—of muscle and ligament, it is impracticable and in most cases with the osteopath of average skill, impossible to immediately reduce the dislocation and recourse must be had to a series of treatments designed to relax and otherwise change structural conditions which are secondary to the original dislocation; in *bowel occlusion* from impaction of feces relaxation of the abdominal wall is essential to a further direct manipulation of the impacted area.

Finally, relaxation is used as a treatment **primary in itself.** A muscle contracture whether primarily or secondarily produced will exert pressure on tissues within itself, e. g., sensory nerve terminals, or disturb structures to which it is attached. As instance of the former note the conditions of congestion produced in the *respiratory canal* by virtue of contractures irritating afferent nerves which carry impulses to the segment of the spinal cord governing the vaso-motor mechanism to the part involved: relaxation of the muscle tissue in such a case removes the primary cause of the congestion. But by the tension upon the associated vertebra or rib displacement of the latter will further add to the difficulty and hence be additional cause; in this case the relaxation will permit of a return of the displaced structures to their natural relationship. Further instances are relaxation of *supra-hyoid muscles* which interfere with venous return from certain cephalic structures, thus relieving congestion; pressure on the bowel wall in a spasmodic contraction of the muscular coats which relaxes the tissue and overcomes the cramp which so distresses.

With regard to the *methods employed* in producing relaxation several are in vogue by different osteopaths. Among them we may specify the most important. The **removal of the cause** constitutes in all cases the fundamental method. Owing to the tendency on the part of students to apparently overlook the fact it seems necessary to emphasize that *a contractured muscle remains in that state only by virtue cf a continuously acting stimulus.* One of the inherent properties of muscle tissue is its ability to respond to a stimulus by a contraction. It is no less an inherent property of that tissue to relax as soon as the stimulus is removed. In both cases there is some evidence to show that the process is an active one. With a certain proportion of students and inexperienced osteopaths their first consideration on meeting with a case presenting contracture is the application of methods direct to the muscle designed to produce a relaxation. *This is fundamentally erro-*

neous. The first consideration should be the determination of the nature and source of the constantly acting stimulus. The second consideration should be the application of measures to remove that stimulus. If a muscle is contractured through simple exposure to a change of temperature the primary treatment is the negative one of removing the patient from the influence of the changing temperature. If the contracture is caused by a direct irritation to the motor nerve through pressure from a deep bony or ligamentous lesion the essential treatment consists in opening up the space which transmits the nerve. A contractured condition of the anterior *muscles of the thigh* caused by impingement upon the anterior crural will be logically and surely overcome by the adjustment of the luxated hip, pelvic, or lumbar structures causing the impingement. Note that the direct work upon the muscle in any of these cases will be getting at the difficulty from the wrong side and can only indirectly and in most cases temporarily reduce the contracture.

Admitting the logic of the above considerations it yet remains a fact that specific methods other than those directly concerned in the way indicated above may be employed as a matter of expediency. **Pressure** with quiet and slight rotation of the tissues, usually more in a direction at right angles to that of the fibers than otherwise, is employed in numerous cases. In what way this pressure produces the relaxation is not definitely known. It is suggested that relaxation results because of an inhibitory effect upon the nerve terminals associated directly with the muscle. Objection must be made to this as an entirely satisfactory explanation because of the known physiological fact that *it is much more easy to produce a stimulation of a nerve than to produce a lessening of its activity.* In fact it is with the utmost difficulty that a nerve can be inhibited by pressure upon it when experimented upon in the laboratory. On the other hand stimulation is almost sure to result unless the most extreme care is exercised. It is not denied that gradually applied deep pressure is effective in producing relaxation and it is true that the more gradual the application the more satisfactorily does it yield. And there is good reason for the latter fact. Note that a stimulus causing response of any kind in any tissue *will be effective in proportion not to the total intensity or amount but to the abruptness of its application.* It can be shown that the change from a higher to a lower potential in case of the electric stimulus, if the change be sudden, will be an effective cause of response. The same is undoubtedly true with regard to the several forms of stimuli; it can be shown in the case of heat very nicely. A "spinal" frog's limb may be literally cooked without causing a reflex response if the heat be applied gradually, whereas a change of a degree or two in temperature if produced abruptly will elicit a marked reflex. Hence if the explanation were entirely one having reference to an inhibitory action on the nerve terminals, none but the most gradually applied pressure would be effective. We know, however, that in many cases relaxation does occur where the pressure is applied in anything else than a gradual way. The fact that the latter method is less efficacious is no argument for the explanation based on inhibition of nerve force. It is simply evidence that rough treatment is associated with greater possibility of stimulation of the nerve terminals,

Some other explanation then seems necessary. One such that has been suggested has reference to the fact already mentioned, that in a typical contracture there is a condition that is *markedly different from a simple prolonged contraction.* The condition is one in which a part or all of the muscle is changed in the nature and amount of the fluids present. Hence, when relaxation is effected by direct pressure and manipulation it may result from the expressing from within and between the muscle fibers the products of abnormal metabolism. Owing to its congested state the muscle is enlarged bodily and is contractured, in part by stimuli of nerve terminals by chemical alteration or pressure from distension of its vascular system. These will be partially overcome by compression of the body of the muscle. Further, the pressure upon the fibre directly may very materially assist in its relaxation by more or less forcibly *re-arranging the particles of the muscle protoplasm.* For we know that the essential mechanical difference between a fibre contracted and one at rest is the relative number of protoplasmic molecules in a definite cross-section of the fibre, i. e., in contraction the molecules come abreast while in relaxation they assume "single file." In the process of relaxation, then, there is forcibly produced a tendency to the single file arrangement.

As examples of cases in which the pressure and manipulation method is efficacious are the following: in *headaches* we often find the sub-occipital region markedly tense in which case the gradual but deep pressure, a "sinking in" as Dr. Still calls it, forces the tissue to relax and often yields immediate relief; in case of the passage of a *gall stone* along the duct the irritation is so intense as to cause direct contracture along the duct, the abdominal wall overlying it, and the spinal region from which it is innervated, in which case pressure is used both along the spine and the course of the duct; in *croup* and diphtheria the rapid inflammation and associated toxic condition cause rapid and intense contracture and congestion of the supra-hyoid muscles, which will in most cases rapidly, though perhaps temporarily, yield to the pressure and manipulation.

Stretching a muscle is a method that is employed by many osteopaths for the purpose of producing relaxation. It is doubtful whether such a method will usually result satisfactorily. Theoretically there is much to be said against the process. The process of stretching a muscle is one method of increasing the irritability of that muscle. Lombard is authority for the statement that "the irritability of muscles is likewise increased by moderate stretching and destroyed if it be excessive." Hence it would certainly seem illogical to attempt relaxation by increasing its irritability. Neither would it be the part of wisdom to destroy the irritability by excessive stretching. A muscle in the condition of contracture will be stimulated to still greater contraction by throwing it on a tension, and yet there seems to be no question that in a large percentage of cases the process does result favorably and the explanation is sought. The stretching of a muscle, thus increasing its tension, corresponds in a way to the "exaggeration" in case of an osseous lesion, and in that case there is secured the "benefit of recoil." In addition reference is again made to the fact that muscle contracture is not identical with muscle contraction, and in the process of stretching, the congested material and waste products are more or less forcibly expressed from the contractured tissue though no relaxing effect might be gotten on a simple contraction. In all cases when attempting relaxation by this method a simple rule of guidance is usually sufficient. *Separate the origin and insertion of the muscle.* In case the *scaleni* muscles are found contractured on the left side, bending the head to the right with the shoulders a fixed point will separate the attachments and hence produce stretching; the hyper-extension of the thigh will stretch the *anterior femoral muscles* while extreme flexion of the thigh on the abdomen will put tension on the *posterior muscles* of the limb; the pulling of the middle portion of a muscle in a direction transverse to the course of its fibres will produce tension of the muscle although the absolute distance between the two attachments of the muscle actually may have been lessened, as in the case of an upward and outward manipulation of the *spinal muscles* in the region of the lower thoracic.

Another method less subject to abuse is that of **approximation of the origin and insertion.** In this method the attached structures are forced to yield to the continued tension of the muscle. That this method is efficacious as a temporary expedient few will deny. Just as the tension can be removed from a rope attached to posts by bending the posts toward each other so to an appreciable extent can the tension be taken from a muscle by forcing nearer together the points of attachment. Further, this method seems to be a most natural one and one resorted to involuntarily in many cases. Note the characteristic position assumed by a victim of *peritonitis* in which the superficial abdominal tissues are intensely tightened. The patient will lie supine with the limbs flexed at the hip and the head and shoulders raised, the total effect on the musculature of the abdomen being an approximation of the origin and insertion of most of the muscles concerned; a further instance indicating the value of this method is the flexing of the head dorsally upon the neck in a case of *sub-occipital* contraction; or the flexion of the arm at the elbow for the pupose of relaxing the *biceps* preliminary to the reduction of a dislocated shoulder.

It is seldom that any of these several methods will be used alone and it is in comparatively few cases that it is possible or advisable to avoid using two or more of them. For instance in the case of a contractured *scalenus* muscle a common method is first to bend the head away from the side of the contracture which stretches the muscle, then rotate it back which approximates the origin and insertion, and at the same time pressure is exerted directly upon the muscle fibres. In this case three of the methods were employed and it is altogether likely that during the course of the movement the deeper structures were opened up, impingement taken off the nerve which supplied the muscle, and hence the irritation was removed and the fourth of the methods made use of. The point was emphasized in the case of the method by pressure that the application should be gradual. It is equally true of the other methods and not only with reference to the application but the *removal of contact* should also be gradual for if the removal be sudden there results an abrupt change, and abrupt change whether from a lower to a higher or from a higher to a lower level constitutes a stimulus, and a stimulus means further contracture. Another caution of some considerable value has reference to the relative *temperature* of the hand of the physician. If the manipulation is made direct upon the tissues it is necessary for best results that the temperature of the part and of the physician's hand should be approximately the same. Especially it is advisable if the physician has cold hands to warm them before beginning the treatment, otherwise the shock produced by the difference in temperature will be a distinct added stimulus for further contraction, a result not at all to be desired.

Treatment of Other Lesions.

Thus far there has been discussed certain general principles underlying the treatment of bony luxations and muscular contractures. It becomes necessary to suggest a few points of practical value in regard to the other forms of lesions which the osteopath must occasionally meet. In all of those cases of **perverted size relations** of parts we have to deal with some nutritive disorder which was responsible for the perverted growth lesion, and hence in such cases it is necessary to seek the further lesion or other cause of the nutritive condition and give attention to its reduction; or in a second class of cases the lesion of perverted growth has resulted from direct violence producing a bruise or other enlargement in which the same considerations of treatment apply. The reduction of these is largely accomplished through dependence on normalizing all of the associated structures and relying on normal processes of absorption to remove the surplus material. In some cases it will be necessary to resort to surgical removal but only as a final resort. A *tumor* of the abdomen is a perverted structure which by pressure upon the hypogastric plexus or other vital structure may produce disorder of various forms. The treatment of such a lesion would be the removal of the original structural condition which permitted the deposit of the morbid material, together with the frequent movement and lifting up of the tumor itself in order to keep all channels as free as possible. *Overgrown muscles and exostoses* have been known to cause disorder and hence are considered as lesions; the removal of such will depend upon the same factors which were suggested in reference to the tumor.

The overcoming of **connective tissue** lesions is a matter of no little difficulty and is a condition quite often met with. A typical lesion of this type is found in the *rigid spine* more or less normal to the aged individual and often met with in younger people who have suffered from some spinal violence. This rigid spine condition, where it is not of a temporary nature such as would be produced by simple muscle contracture,is caused by a thickening, contracting, or lessening of the fibrous and other ligamentous structures associated with the vertebræ; or to a deposit in the articular structures of various salts, as in the case of chronic articular rheumatism; or finally, a condition of bony ankylosis. In all of these cases it is a serious question whether a complete cure can be effected or very great benefit given, owing to the difficulty of removing such lesion by any known methods. In most cases it will largely be a "breaking up process" designed to open up the deep structures thereby overcoming tension on nerve and blood vessel and permitting a free opportunity for absorptive processes to be maintained. A further type of connective tissue lesion is found in the case of *cirrhosis* of the liver where the connective tissue frame-work has been formed in excess and has subsequently contracted thereby reducing quite appreciably the total volume of that organ and very considerably obstructing the portal circulation and the metabolic activities of the liver. In the case of *sclerosis* of the spinal cord we have also a connective tissue lesion of a serious nature In this case the neuroglia of the cord is thickened and contracted producing or following a degeneration of the nerve elements. In both cirrhosis and sclerosis the prognosis for removal is rather unfavorable especially in case of the latter. For we know that while a regeneration of nerves will take place in peripheral structures there are as yet no authentic cases of regeneration of the nerve fibre in the spinal cord when that degeneration had been experimentally produced.

All that can be reasonably expected in such conditions will be the limiting of the further progress of the disease and a partial absorption of the morbid deposit by *establishing and maintianing* a normal spinal circulation.

CHAPTER VIII.

THE TREATMENT OF DISEASE.—CON.

Stimulation and Inhibition.

Like all systems of healing, osteopathy has been presented by various classes of its advocates in various disguises, and as a result has been at times entirely misrepresented. While it is a matter of course that its professed enemies should attempt to mislead, it is quite unfortunate that there are a few of its professed followers who, in attempting to uphold the system, have unwittingly placed it on a par with other systems by intimating or definitely asserting that osteopathy is a method of treatment by **mechanical stimulation and inhibition** of nerve impulses. It cannot be too strongly emphasized that such a position places the osteopath *on the same plane wth all other schools of healng*, the underlying principle being the same in kind, and differing only in degree. He who assumes that this definition of osteopathy is a new conception in therapeutics and one which embraces the essentials of the osteopathic philosophy has not only failed entirely to grasp that philosophy, but has shown an ignorance of medical history quite unjustified. For such history is replete with evidences that mechanical stimulation and inhibition applied by definite manipulations has long been known and used—centuries before osteopathy had been brought into the world. But with the rise and development of osteopathy and the newly awakened interest in drugless systems which in part resulted from that development, these various methods have been subjected to investigation as never before through the study of literature bearing on the subject, and the application of mechanical measures to disease conditions. Hence, by a hasty though not unnatural inference was deduced the conclusion that the new method was but a special modification and extension of the old. It is sufficient in this connection to affirm that stimulation and inhibition as definite osteopathic procedures are measures that have been super-added to the original and primary conception, and in so far as they may be used at all are insignificant in importance.

The last statement suggests that there is a possible use for these methods and *under the circumstances of an undeveloped and incomplete science and a lack of knowledge and skill on the part of the practitioner*, the statement may be true. Under certain circumstances it may be impossible or impracticable for the osteopath to apply specific osteopathic treatment and in such cases it will be necessary for him to place himself upon the same plane with the practitioner of other schools and use the least objectionable of the methods of the latter. In order to understand the nature and possible value of these methods it seems advisable to speak of them somewhat in detail.

By **stimulation** of a nerve or an organ is meant the process of accelleration of the function of that nerve or organ. By **inhibition** is meant the process of retarding of the function of a nerve or organ. Both of these processes are attributes of normal living tissue, more especially of the nervous system. We may speak of the *voluntary contraction* of a muscle as a normal or physiological stimulation of that muscle; the effect of *food* on the gastric mucosa as that of a normal stimulation of the function of secretion; the *excess of carbon dioxid* in the blood as a physiological stimulus to the respiratory center. On the other hand a *voluntary impulse* sent to the spinal cord center which cuts off the reflex movement that would otherwise occur is an instance of a physiological inhibition; the *vagus* nerve carries inhibitory fibres to the heart muscle which retards the activity of that tissue; impulses passing by way of the sympathetic filaments to the muscles within the wall of the intestinal tract causing a slower peristalsis are spoken of as *viscero-inhibitory*. These are all examples of the physiological or natural inhibition. By an osteopathic stimulation or inhibition reference is made to the artificial process which causes or is supposed to cause by pressure a similar effect. Note that the process is artificial. A mechanical stimulus applied by the hand of the practitioner is emphatically not a natural but an artificial stimulus. It is said that the *liver* is stimulated by producing pressure directly on it or by otherwise compressing it; the *pneumogastric nerve* is stimulated by pressure along its course for the purpose of increasing its function in lessening the cardiac activity; in prolapsus of the rectum the *atonic walls* are stimulated by local treatment. On the other hand the osteopath inhibits the *phrenic nerve* for controlling hiccoughs; pressure exerted along the *splanchnic region* inhibits the cramping in various forms of colic; pressure exerted in the lumbar and sacral regions and along the course of the *sciatic nerve* will often temporarily relieve sciatica.

These treatments are referred to as stimulating or inhibitory and the assumption made that it is in truth the increasing or the lessening of nerve action by a direct process. Is such a **control** possible? We have heard the human body compared to the piano upon which the practitioner plays, bringing out the harmony of action as the musician produces the harmony of tone. We have heard it compared to an electric system upon which the intelligent osteopath may send messages and shunt the currents and connect the circuits. We have heard the statement that the vital fluids and forces of the body are absolutely under the control of the skillful operator. The essential thing lacking in these comparisons and statements is the element of truth. The human body is not at all like a piano, neither does the osteopath play upon it as would the musician. It is not an electric system that can be operated upon to any degree as the electrician manipulates his batteries or his keys. The forces and fluids of the body are fortunately beyond the control of the physician, skillful though he be. A few facts with reference to anatomy and physiology may not be out of place as indicating the *insur-*

mountable difficulties in the way of securing the absolute control suggested above. It seems advisable to again repeat that *function is self-regulative and structure nearly so*, and it is the business of the osteopath to deal with structure, not function, and to deal with structure only as that structure is in an abnormal condition. But can the nerve be stimulated and satisfactory results follow?

DIFFICULTIES IN DIRECT CONTROL.

In the first place we are just beginning to **learn the functions** of nerves. There are a few hundred million nerve fibres in the human body the function of most of which are not known. It was thought that the function of the pneumogastric in reference to the heart was known to be inhibitory, yet Schiff insists that the nerve has also an accellerator function. It was assumed that the efferent nerve that passes to the muscle carries only an impulse resulting in contraction, but evidence is accumulating to show that it carries also an inhibitory impulse. It was believed that the sacral nerves carried motor impulses to one layer of muscle tissue in the rectal wall and inhibitory impulses to the other layer, but Langley, Anderson and others have exploded the "crossed innervation" theory. In the light of these facts as to the function of the nerves it is presumption to assume that any such marked control over functions as suggested above can be gained.

Greater difficulty in securing a very complete control of nerve action by direct means is obvious when the fact is noted that the same nerve may have **different functions.** Bear in mind that the nerve is not a separate structure but is made up of an indefinite number of nerve fibres each one of which may be associated with a distinct and different action. The *vagus*, for instance, has efferent fibres controlling motion and vaso-motion, secretion, inhibition and trophicity (?) and afferent fibres associated with pain sensation, vomiting, vasodilatation and perhaps a host of others. All these are bound up in the same nerve sheath. Imagine the nicety of control possible to the practitioner under such an anatomical arrangement! Any afferent nerve may, on being stimulated by mechanical means, modify any of the numerous functions of a spinal segment. Who will direct the excess of impulse into the right channel? Nearly every nerve that carries vaso-constrictor fibres carries also those of a dilator function. The presumption in claiming an arbitrary choice of effects in vaso-motor stimulation is evident.

A third factor is noted in that the nerve it is desirable to affect may not be in its **usual situation.** The inhibition of the *phrenc nerve* is often impossible because of the simple fact that it is not in the location where pressure is applied. Any one who has had occasion to do much work in the dissecting room will be impressed with the numerous exceptions to the rules of location of structures. Attention was recently called to a case showing the *spinal acceessory* nerve passing across the end of the transverse process of the atlas and to all appearances it was an entirely normal condition.

In close connection with the above the fact should be noted that the vast majority of nerves are beyond the possibility of **direct manipulation,** a very wise provision of nature. Stimulating the splanchnic nerves is spoken of as though those structures were laid bare to the touch. Perhaps in reality there is produced accelleration of function in many cases. But it certainly must be done through a very indirect route, and that through the complex arrangement of a reflex mechanism.

The latter suggests a fifth very real difficulty in the way. Most stimulating and inhibiting treatments are explained on such a **reflex basis,** an explanation which in some, perhaps most cases seems rather strained. Note that the stimulation of the nerves associated with the spinal region, for purposes of affecting the splanchnic nerves must pass by the afferent spinal fibres—fibres which have a choice of many neurons to which their charge may be delivered. It is but a remote possibility rather than a likely probability that sufficient of the excess of stimuli shall reach those cell bodies whose axons pass to form the splanchnic pathways. The argument that use is made of that explanation for the visceral disorders resulting from spinal muscle contracture, does not particularly enhance the proposition that the osteopath can cause the effect that is produced by the lesion. Note that the lesion is either a much more *intense* stimulus or is prolonged over a *greater period of time.* Should the osteopath keep up continuous stimulation of such nerves for some hours sufficient excess of stimuli might be discharged into the splanchnic channels to amount to a real stimulation. But no such length of stimulation period is indulged in by the average practitioner. Further, to argue that the excess will all be poured into the channels needing it because nature "tends to the normal" hardly meets the demands. It is true that nature tends to normal, but it is further true that so far as function is concerned *the tendency is in part toward that condition which is normal to the existing structure*—i. e., to that condition which is permitted by the existing structure. So long as structural conditions are at fault the function must remain so. When that condition is overcome no additional stimulus would be necessary.

A further difficulty presents itself in cases where the stimulus may be applied either directly or reflexly. The intensity of the stimulus cannot be gauged in **proportion to the need** in the particular case. In laboratory work in physiology the mechanical stimulus is seldom made use of for this simple reason. It is effective but cannot be regulated in intensity, hence the use of the electric stimulus which is susceptible of nicety of control. How much pressure shall be employed in order that the exact amount of increase of function shall be produced? There can be no answer to the question. Why not employ the electric stimulus, then, instead of the mechanical in osteopathic practice? For the very good reason that electrotherapists themselves have tried it and found it wanting. And not because of any particularly harmful effect on the tissues produced by the current as such but because the positive results were unsatisfactory. That it will be found equally true of the mechanical stimulation we are thoroughly convinced.

We have finally to mention a fact that is of first importance and that is, that in all cases where function is artificially changed by increase or decrease there will be a **recoil** in the opposite direction. This is notably true with respect to experimental stimulation in the laboratory. *Goltz's experiment* on the inhibitory action of the cardiac nerves of the frog is a case in point. The following is the description of the experiment as given in the *American Text-book of Physiology*: "In a medium sized frog the pericardium was exposed by carefully cutting a small window in the chest wall. The pulsations of the heart could be seen through the thin pericardial membrane. Goltz now began to beat upon the abdomen about 140 times a minute with the handle of a scalpel. The heart gradually slowed and at length stood still in diastole. Goltz now ceased the rain of little blows. The heart remained quiet for a time and then began to beat again, at first slowly, and then more rapidly. *Some time after the experiment the heart beat about five strokes in a minute faster than before the experiment was begun.* The effect cannot be obtained after section of the vagi." The italics are used to call attention to the fact that the final effect was not an inhibition, but a stimulation. Some experimentation has been and is being done at the present time by osteopathic investigators to show that a direct effect can be produced in case of man and lower animals (rabbit) by stimulation and inhibition in connection with the cardiac nerves and the splanchnics,a proposition to which assent has already been given. While these experiments seem to substantiate the proposition that such a direct action is possible it remains to be shown that the effect is at all permanent or advisable, and more especially to prove that a recoil is not inevitable or probable. Further observation of such experimentation is awaited with interest. What is true in those cases in which accurate experimentation is possible is reasonably true of all others. Any swing of the pendulum past the position which is normal under the existing circumstances will be compensated for by a recoil of opposite sign. Note the fact that *the organism brooks no interference with its function* and will return to its normal activity when it has by sudden force been disturbed in that activity.

Thus far reference has been made to some of the difficulties which beset him who would attempt by nerve stimulation or inhibition to secure a definite control over the functions of the organism. Admitting that notwithstanding these difficulties there is still possible a limited and temporary control, it is necessary to consider certain objections to the use of those measures, and also the conditions where such treatment might be necessary or helpful.

Objections Against Attempt at Direct Control.

By stimulating or inhibiting a nerve or other structure we **interfere with normal function.** It has before been suggested that function is normal to structure. Making simply a general statement, *every function, be it usual or unusual, is what it should be under the circumstances of existing structure.* An increased peripheral resistance to the blood flow will cause an *over-active heart.* This latter condition is normal under the circumstances. It must increase its activity in order to keep up normal circulation. The attempt to limit the heart's action by inhibiting it is a distinct hindrance and an illogical treatment. Suppose that the peripheral resistance was maintained so long as to exhaust the heart's action. The lessened force resulting is still normal to the structural conditions. The *stomach* in discharging its contents through the esophagus is performing a normal function and so long as it can by that method rid itself of irritant material vomiting should be unhindered.

Note further that a stimulus applied to a failing function is in many cases **crowding** an already overworked organ. Notice one of the foregoing illustrations. When the *heart* by reason of an imperfect blood supply through lesion or otherwise is weakened, the work it is performing represents its capacity at the time. If a stimulus is applied to the accellerator nerves to hasten its action, only an earlier exhaustion will be the result. Attention is called to the fact that the accellerators like other motor nerves cause an increased muscle activity, i. e., increase its tone, its excitability, and its conductivity, which in turn depends on a more rapid katabolism. Hence in causing this increase only a more rapid exhaustion of the reserve force stored in the heart muscle or in its other centers of supply is produced. The same principle is applicable to each organ in the body. *Its function is not decreased because of an inherent laziness, but because its force has been lessened through exhaustion of nutritive material.*

The **reaction** may be as great as the original action. Leaving the structural conditions as they are, a temporary accellerated peristalsis of the intestine will be followed by a period of more lessened bowel activity. Just as in the use of a *cathartic* a constantly increasing dose is necessary to produce an action till finally it becomes ineffective, so a mechanical stimulus will be followed by a lessening response. A stimulation of the *vaso-constrictors* will be followed by a greater vascular dilatation. An inhibitory treatment for *pain* is occasionally followed by a return of the sensory disorder in greater intensity.

In many cases the palliative treatment serves only to **conceal** a serious condition. Osteopaths condemn the old-school practice of giving morphine for lessening pain and yet in numerous instances make use of *exactly the same reasoning and practice* with barely a thought of the consequences. The concealment of a pain condition from the patient by any treatment without the removal of its cause *is a crime against the patient, if the pain is necessary for diagnosis of the case.* The plea that the patient insists on it or that it gives nature a chance for repair is seldom a sufficient justification. The lessening of a rapid *heart beat* gives often a sense of security entirely unwarranted by the real state of that organ. The "tonic" treatment gives a temporary sense of exhilaration similar in kind if not in degree to that following moderate doses of morphine or alcohol. This form of deception is little more justifiable than any other and as often results disastrously.

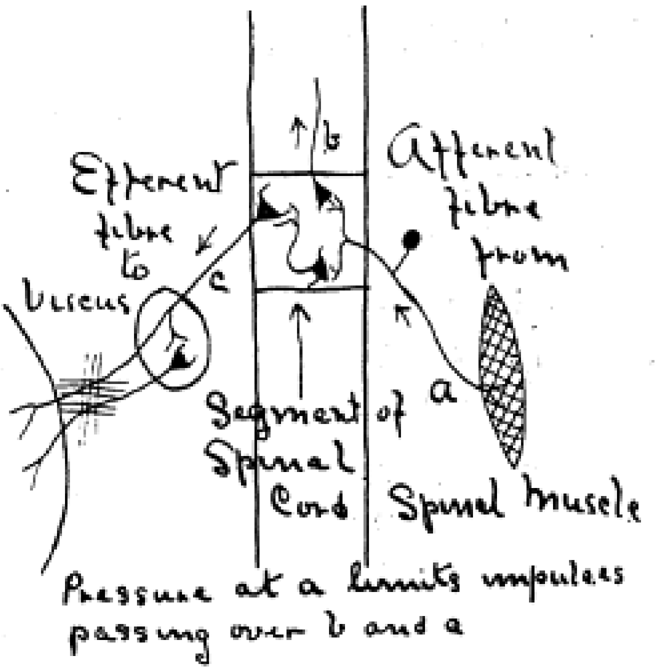


FIG. 8.—Theory of Inhibition.

A final objection that is exemplified occasionally is the fact that a **treatment habit** may just as really be formed as will a drug habit. In both cases the organism eventually tends to rely on the artificial stimulus instead of the natural one for its proper functioning. That individual who requires frequent treatment to be kept in normal "tone" is as much a *treatment habitue* as is he who requires the daily application of the needle, a morphine fiend. And yet many osteopaths pander to the temptation by advertising the value and pleasure to be derived from a "tonic" treatment.

But it would be incorrect to leave the impression that such attempt at direct control is never justified. Experience seems to suggest that while there are numerous possibilities of ineffectiveness or of real harm in such purely palliative treatment, there are occasions where such procedures may be a **choice of evils**. For it cannot be denied that in many cases stimulating and inhibitory *treatments* have been and will continue to be given with marked benefit. *Note that it is not insisted that the good results gotten are necessarily dependent on nerve stimulation or inhibition.* To this phase of the question reference will later be made. At present we shall speak of those cases in which such treatment is theoretically or practically demanded.

INDICATIONS FOR ATTEMPTS AT DIRECT CONTROL.

In those cases where a **lesion is not apparent**, and no other known cause is noticed a treatment in the region of innervation is often seemingly helpful. In occasional cases the ordinary practitioner will not be able to detect splanchnic or other lesion affecting the *stomach* and yet stomach trouble exists. Treatment applied in the lesion region for such disorders will often be effective. A lax condition of the general *circulatory mechanism* is sometimes apparent where no definite lesion can be assigned for the disorder. A general spinal "toning up" is resorted to with at least temporary benefit. An over active *peristalsis* is often checked by strong pressure in the lumbar or lower thoracic region. *Pain* is lessened by treatment over the structures associated with the sensory nerve involved.

It would seem to be helpful to apply a stimulus **after removal of lesion** or other cause. The analogy is drawn between the cases of a stalled horse whose progress is hindered by a stone in front of the wheel of a vehicle, and an organ working against a hindering lesion. In each case the pulling force has become discouraged. After removal of the stone it may be helpful to "touch up" the horse with a whip, and likewise to "touch up" the organ through its nerve mechanism. The *liver* is often directly manipulated by pressure after the spinal lesion is removed. The sluggish *kidney* will seemingly respond to a treatment after the lumbar lesion is removed. A *uterine headache* will be sooner overcome if a cervical treatment is given following the adjustment of the uterus than would otherwise be the case.

In rare cases where **removal of the cause may be impossible** or impracticable. In such case it will be a choice of risks whether to leave all to nature or to attempt to bring out any latent power of nature that the condition itself fails to arouse. In an *ankylosis* of the spine the lesion is a bony union and as such is practically impossible of removal. The functions interfered with thereby may be aided by occasional treatment of the spinal regions and of the involved organs directly; *flooding* from the uterus following parturition may be lessened by a stimulus to the mons veneris; intense nervous or mental *excitement* interfering with direct treatment to the primary lesion may be lessened by pressure applied in the sub-occipital region; it may be necessary to lessen *pain*, in case of such intensity as to prevent use of the various methods of diagnosis, or the application of treatment measures.

In some cases direct stimulation may **force an obstruction** and hence be a factor in the removal of a lesion as well as overcoming an effect. Increasing the *heart's* force may overcome a congested venous or capillary condition. Direct work over the *liver* may increase bile secretion and thereby assist in removing obstruction to the gall duct. Direct treatment to *muscle* tissues may assist in adjusting the structures to which those tissues are attached.

In occasional instances it may be necessary to resort to heroic measures in order to **tide over the crisis**. In case of a sudden *heart failure* direct pressure over the solar plexus or manipulation in the accellerator region may assist in preventing collapse; in case of *hemorrhage* an extreme stimulus applied to the part may temporarily check the flow; spasmodic laryngitis or *croup* may be prevented from terminating fatally through strangulation, by treatment of the laryngeal and other structures.

In some cases it may be advisable for the osteopath to place himself on the same plane with the old school physician and **treat the symytoms** as they arise, for it is to be noted that a symptom may in some cases be a distinct hindrance to normal processes of repair. With reference to *pain*, while it is of value to the organism in numerous ways its great intensity in some cases renders it a distinct disadvantage and inhibition may become helpful by lessening the nerve disturbance thereby giving the organism a better opportunity for repair; an excessively *high temperature* becomes a menace to the life of the individual and direct treatment for purposes of lowering that temperature may be called for; the rapid waste of the fluids of the body in certain *diarrhœic conditions* contributes to an undue weakness and may be prevented by inhibitory treatment; in case of *excessive vomiting* where no longer irritant material is ejected the nervous disorder permitting it may be adjusted by inhibitory treatment.

It will be noticed that in most of the foregoing cases the treatment partakes largely of the nature of a choice of evils and suggests what it is necessary to continually emphasize, that these measures are only to be employed where, in the judgment of the physician, the primary and logical treatment, i. e., removal of cause, is not immediately possible or practicable.

Do we Stimluate or Inhibit?

But if further analysis is made of the above cases it will be found that the words stimulation and inhibition **are deceptive** in many cases. In the ordinary acceptation of those terms it would be understood that the function of the part disordered was increased or decreased directly or through its connecting nerve. But let us see. In the first set of conditions referred to stimulation was employed where no apparent lesion was present. Emphatically that *does not mean that no lesion was present.* In the application of a "stimulating" treatment to the region of innervation we are persuaded that instead of pure stimulation of those nerves by a quick pressure alternating with relaxation, there results in reality a removal of distinct impingement upon nerve or other structures which rendered their activity sub-normal. Note a typical case. In occasional instances of *constipation* no very distinct spinal lesion is apparent; all experience indicates that a "stimulating" treatment through the lower thoracic and lumbar regions is more effective than is a quiet pressure treatment; if the results were dependent upon direct effects produced on the splanchnic nerves the latter form of treatment should be the more effective, for the physiological result of stimulation of the splanchnic nerves is a lessened peristalsis. In such a case as this there is undoubtedly produced an effect upon the involved nerves, but it is done indirectly, *through the removal of pressure conditions in the spinal region which were producing the existing inhibitory effect.* What is true of the stimulation in this case we are persuaded is true in the vast majority of cases. If it is the direct stimulant effect on the nerve, why will not *titillation of the skin* in the process of tickling, or the application of an electric stimulus be productive of equally good or more favorable results?

In the second class of conditions the analogy between the horse and the organ is far-fetched. While it is true that the horse may become discouraged there is nothing to indicate a possibility of a similar condition in case of an organ; on removal of the lesion the disease condition itself is the only "touching up" process necessary to arouse the entire responsive powers of the organism. When the removal of the lesion is impossible the so-called stimulation or inhibition that is supposed to be advantageous may perhaps be a real though *incomplete removal* of a part of the lesion condition. Any *breaking up* treatment of the spine in the rigid condition of that structure opens up the tissues and undoubtedly frees the nerve and vascular mechanism of the spine sufficiently to account for the benefit that results from the treatment. With reference to the inhibition of *pain* which is the typical example of the value of inhibition as a therapeutic measure, a few considerations may not be out of place. This proposition is fundamental: *The success in overcoming any pain condition is in direct proportion to the amount of structural adjustment effected.* Given a pain condition with little structural change present, the possibility of diminishing that pain will be a minimum; with the greater removable structural abnormality associated with the pain will go the maximum possibility of pain removal. For instance there are numerous cases of pain resulting from visceral disorders. In these cases there will be also *muscle contractures* in the spinal region either primary or secondary. In either case the pain will be overcome in proportion to the extent to which the muscular contracture or other lesion is diminished. Reference has been made to the fact that in experimental physiology it is most difficult to apply pressure gradually enough to prevent stimulation not to speak of the possibility of lessening the nerve action concerned. This is possible, that the nerve action may be lessened by a *destructive process* such as is associated with the action of the various anodynes. It is possible that the good effect from pressure continuously applied over the nerve terminals may result partly from this actual though temporary destruction of the nerve terminals. We are inclined to think that in so far as the pain condition is removed by this direct nerve pressure it is produced by some such disorganization or molecular disturbance of the nerve protoplasm; which if true makes it at once apparent that such treatment is one of doubtful value. It has been assumed that the stretching of the *sciatic nerve* produces the lessening of the pain by virtue of pressure of the nerve sheath upon the axis cylinder processes throughout their extent. Physiological experimentation shows that the stretching process at first renders the nerve protoplasm more irritable; if long continued its irritability becomes lessened or totally destroyed, in which case there must be produced a disturbance in the arrangement of the protoplasmic molecules such as to interfere with their normal relationships. Such an explanation may account for the good effects that often follow the stretching of the sciatic nerve in so-called sciatic rheumatism. The other explanation is the more probable, i. e., by the hyper-extension of the limb tension of the associated structures is removed with a resulting lessened impingement upon the nerve and its branches.

In **summing up** the discussion emphasis is to be laid upon the fact that the removal of lesion or other cause of disorder constitutes the logical treatment for that disorder. Where a structure or organ needs stimulating or inhibiting, it can be done in but one proper way and that an indirect way, i. e., the removal of the cause that makes it necessary to stimulate or inhibit. Hence we formulate the two following similar propositions:

1. *The necessity for stimulation presupposes an existing inhibition; the removal of the cause of that existing inhibition constitutes the legitimate method of stimulation.*

2. *The necessity for inhibition presupposes an existing stimulation; the removal of the cause of that existing stimulation constitutes the legitimate method of inhibition.*

These propositions are fundamental and comprehend the essence of the osteopathic view of the treatment of disordered conditions and are applicable to the entire field of disease.

Treatment of Disease Caused by Abuse.

In discussing the causes of disease attention was called to the fact that abuse of an organ or its function will ultimately produce a *diseased condition* of that organ. What constitutes the *legitimate treatment* for such cases? It is obvious that a **negative** treatment is undoubtedly called for, i. e., simple abstinence from abuse. If *stomach* disorder be caused by continual over-loading, lessen the load. If *writer's cramp* result from excessive exercise of the limited set of muscles, stop writing. If the environmental conditions are such as to subject the individual to abuse of the *respiratory tract*, move out and away from such environment. This proposition seems valid: *In case of disease due only to abuse and not associated with structural disorder, no positive manipulative treatment is indicated.* Through ages of false training men have become established in the belief that for every apparent disorder something should be done in the way of definite artificial treatment. Reliance has heretofore been placed on the drug. With the one who has learned of the efficiency of osteopathic measures he assumes a "treatment" is necessary under the similar circumstances. In many cases he is right. In numerous cases he is wrong. In those cases where *temporary* disorder results from manifest abuse treatment is unnecessary and perhaps harmful. In this regard advocates of any form of psychic therapeutics are essentially correct. Let alone and nature will be the all-sufficient factor in cure. But experience and reason both indicate that there are limits to the recuperative power of nature, and osteopaths emphasize that in many cases that limit is represented by a definite obstruction in the machinery through which nature manifests her curative power. In such case artificial aid is indicated. Note this fact. *Most cases primarily due to abuse are not unassociated with structural disturbance.* In many cases a *predisposing* lesion is present which represents a factor involving definite difficulty in nature's reparative processes. In more cases *secondary* lesions will arise which add to the disorder and constitute new causal factors. In both of these cases definite manipulative treatment is called for and without question is advantageous. Hence it is found that cases in which treatment is not necessary or helpful are comparatively rare, and the osteopath should never fail to carefully examine a condition before he pronounces it a case requiring no treatment except the negative one of abstinence.

Will a patient recover under osteopathic manipulation when he refuses or is **unable to abstain from abuse?** Numerous cases of such are found. Occupations requiring life in adverse circumstances of environment must be continued by many in order that life itself may be supported. The miner still must live in the mine, the writer still must use his exhausted fingers, the unfortunate must still use ill-nourishing food. Can such recover? In countless cases, yes. In any case, only with greater difficulty. As illustration may be cited any number of cases of *eye trouble* that have been successfully treated at the A. T. Still Infirmary where the patient at the same time was taking the school course and was compelled thereby to abuse his eyes. So long, however, as abuse is the sole factor, which is only an occasional condition, little can be done if the abuse is continued.

On the other hand, will a patient recover if, predisposing or secondary lesions be present, no manipulative treatment be given and the patient **simply abstains** from abuse? This is undoubtedly true in a large number of cases. For it has already been shown that while function is much more markedly self-regulative than in structure yet nature is successful, unaided in many cases, in overcoming a definite structural change. This will be more noticeably the case with reference to the lesions which have arisen as secondary processes during the course of the abuse than in those cases where a predisposing lesion was present from the beginning. In the latter case it is likely that the tendency to the disorder will not be overcome and hence the condition regained will be that of the organism previous to the abuse, i. e., there will still be a predisposition. But in all cases where lesion conditions of any kind are present practice and common sense indicate that removal of lesion and abstinence from abuse must go hand in hand if most satisfactory results are to be obtained.

Miscellaneous Notes.

A few questions of general interest invariably arise in the mind of the student with regard to the difficulty experienced in overcoming the lesion, the time required to effect a cure, and the frequency and length of treatment, and it seems advisable to note a few of the facts which enable us to explain the varying results obtained, and suggest the factors necessary to be considered in judging cases, although it will be noted that in many instances the judgment of the physician in the immediate case will be the court of final appeal.

The first to be noted is an explanation of the fact that **lesions are not immediately removed.** Osteopathy has made its reputation before the world perhaps more because of a few occasional startling instances where a single treatment has overcome a case of long standing than by the vastly greater number who have been cured only after long and toilsome effort on the part of both physician and patient. The strength of the system is derived from the latter class but it is most noticeably brought to the attention of the world by the former. Why is it that all cases are not of the "quick cure" class? If the treatment consists in re-arranging the luxated parts why not do so immediately as does the engineer with his engine? There are several facts which serve to explain this situation. In the first place the man-machine does not quickly change its parts under *normal* conditions. While there is continual change it is a process requiring time. It is no less true in abnormal states. The vitalizing force carries forward its work of repair certainly but slowly. In this there is a marked distinction from the man-made machine. *Again*, it is necessary to remember the conditions presenting themselves in case of a lesion. When first produced the tendency is to draw back into line or otherwise overcome the abnormal part by the inherent power of adjustment. In many cases nature is successful in this effort. In occasional cases she is unable to accomplish the result and in such we have the field of operation for the physician. But note the second effort on the part of nature. Failing in applying adjustment by drawing back to normal alignment the perverted structure she applies it in the way of *adjusting the surrounding structure* in position and form, to the new abnormal one. This becomes especially noticeable in case of a hip dislocation where it is known that the superior hip muscles have permanently shortened while the inferior ones have correspondingly lengthened. A general re-arrangement of parts will also take place in case of a vertebral or a rib lesion, so that in numerous cases the new condition becomes finally a normal one in the sense at least of producing no marked abnormal functioning; not normal, however, in the sense of the new arrangement being as substantial as the original. In a certain percentage of such cases there will still be a partial failure to adjust and a real and chronic lesion prevails. It is necessary then for the physician to either overcome this partial adjustment or to give enough of aid by manipulation to permit a full adjustment to the new condition. In either case it is obvious that some considerable time will be necessary. Of course the above considerations have especial reference to chronic lesions. In acute cases much less time and fewer treatments will be required.

Again, in many cases the **lesion is not entirely removed**, that is, in the sense of securing a complete return to normal of the perverted part. This is less often true when we consider the other side of the lesion idea, the perverted function. For while in many cases the structure may not be entirely overcome, in most of these the perverted function will have disappeared. Note the fact that as a general rule the *function will have become normal before the structural parts will have been entirely overcome.* This fact depends on the power of adaptability possessed by the organism. It is able to produce normal function with tools that are not as yet ideal. From this fact we see one explanation of the lesion's incomplete reduction. The patient, as soon as he feels normal and sees no further symptoms of any disorder, will assume that his cure is complete; and for the time and perhaps permanently that is true. Hence he will refuse longer to pursue the treatment. In all such cases emphasis should be laid on the fact that the incompleted structural reduction will remain a weakened condition and hence be a continuous menace to the health of the individual either in causing a return of the original disorder or of another that is possible from the same lesion. Further, owing to the partial adjustment that has taken place in the chronic case the strength of the new articulation or adhesions may be such as to defy the most persistent treatment. We are persuaded, however, that in the great majority of cases the original normal condition of structure as well as function may be restored provided opportunity in the way of time is secured.

With regard to the **frequency of treatment**, only general rules may be given. At the risk of becoming tiresome, the statement must be emphasized that it is not the physician but nature that heals. If it were the former one might be justified in frequent attempts to adjust a part. Since it is the latter, time must be permitted in order that the gradual process of repair should take place. It must be remembered that a condition which is such as to preclude immediate adjustment must be one in which a process of **reverse growth** must take place before the part can be restored to its original position. It will be a "growing back" in real truth and growth requires both time and quiet. If a beginning can be made in reduction at the first treatment one should be satisfied; then allowing sufficient time to elapse for adjustment to the new conditions that have been produced the process of repair and restoration will be carried forward with sufficient rapidity. In general a frequency sufficient to compel a continuous soreness throughout the entire interval is usually too great. In chronic diseases the average case will prosper most satisfactorily with treatment applied *two or three times per week.* But each case must be a study in this sense as in others. In some cases oftener and in many cases a less frequency of treatment will be found most satisfactory. For instance, the "Old Doctor" has always insisted—and younger practitioners are learning slowly that he is right—that the ordinary case of asthma should not be treated oftener than once per week or ten days. On the other hand *acute conditions* require more frequent attention. In such the changes are much more rapid both with respect to repair and to the pathological states that are produced. Further, owing to the latter fact there are continually arising secondary lesions and other causes of disorder which must have attention. An acute case will usually need treatment one or more times per day during the more critical periods.

The considerations in the above paragraph hold in part in regard to the **length of the treatment.** The young osteopath invariably will give more time to an individual treatment than will an older practitioner. It is characteristic of Dr. Still himself, that he "treats a case and goes," and his success is no less remarkable than the brevity of his treatment. There is such a thing as drawing upon the vitality of the patient by a too lengthy treatment. It is not likely a long treatment will be given except by him who gives a general rather than a specific one. For it takes but a few moments to produce sufficient irritation of a local part to cause serious and successful protest on the part of the patient. Where the body is treated as the masseur treats much time is required, but osteopaths are not masseurs. Cases are met with occasionally where, owing on the one hand to lack of skill on the part of the practitioner and on the other to an extreme tissue tenderness of the patient, some preliminary treatment may be necessary before specific work can be given. In such cases time may be used to good advantage in somewhat prolonging the treatment. In nervous individuals any indication of hurry on the part of the practitioner will react unfavorably on the patient.

With reference to the **rapidity of movement** a caution is necessary. In dealing with all cases, whether primarily a bony lesion or other tissue, quick movements are not advantageous with but a few possible exceptions. A quick movement will usually act as a stimulus to an already hyper-sensitive tissue. Hence the tissue is made to "set" against the effort to move it. Muscle and other tissues which are directly worked upon in treatment are structures which under all conditions change their shape and condition only gradually. The tissue can be led but only with difficulty and with much possible harm will it be driven to its normal relationships.

There is a **possibility of harm** in the treatment by manipulation. The statement is repeatedly made that "if osteopathy does you no good it will do you no harm." The statement is interesting in that it is more or less untrue. Osteopathic manipulation *properly applied* will not be likely to result in danger but in the hands of an individual unacquainted with the laws of leverage and the arrangements of the levers which he uses in most movements, there is much possibility of harm. While it is not true that *the force sufficient to reduce a lesion is sufficient to produce one*, yet there is enough of truth in it to be worthy of notice. The harm may result because of the *intensity* of the application. The intensity may be either in the abruptness or in the absolute amount of force used. There are certain leverages in the body by which a sufficient force may be applied to rupture the strongest ligament, while a force not so great but suddenly applied may easily produce serious injury. The harm may result because the treatment is *too prolonged.* In such a case the tissue either becomes exhausted or what is more common, over-irritated, with a resulting congested or even inflamed local area. In the same way irritation may follow *too frequent* treatment, in which time for repair is not given. Under such circumstances there is little possibility of producing satisfactory results and much chance of causing further disorder.

We do not speak thus at length on the possibility of harm from treatment wrongly applied simply because of theoretical reasons. Sufficient evidence is brought forward to show that disorder has resulted. With ordinary care and average judgment the treatment is entirely harmless but where those qualities are lacking it may not be so. In any case it would not be a difficult matter to show that while there may be some danger associated with the administration of osteopathic treatment it is *infinitely more safe than that of drugging*.

With reference to the *method of the movement* that may be employed it is necessary to emphasize that probably no two practitioners who have been long in the field will execute a particular treatment in exactly the same way. There are a large number of methods in the employment of the same principles of adjustment each of which may, under certain circumstances, present its own advantages. Individuals differ in the ease with which a movement can be executed. Hence it is illogical for a teacher to insist that a method must be employed because it is the correct one. It is not necessarily so. The patients themselves differ quite markedly in reference to the readiness with which they yield to particular treatment and it will be found by experience that what is perfectly appropriate in one individual will not be satisfactory in another although the lesion may to all appearances be the same in each case. True, in all movements account must be taken of the leverage employed; the physician must know the situation of articulation, the attachments of muscles and the like. But he can only know these as they exist in the average case. Every new case will present new conditions and will require at least slight differences in the application of treatment. Hence in a later section discussion is given to a few common movements that are in general use merely to emphasize and illustrate the principles that underlie every adjustment that is effective. The mere imitation of any physician's peculiar methods will always be unsatisfactory. Understand the forces it is necessary to use, determine in each case through what parts those forces may be applied, then adapt the method to the circumstances of the case. By following such a plan the student becomes a man of emergencies and learns to use his mental powers on each individual case instead of yielding to the pernicious habit of passing each of his cases through the routine of an unvarying set of manipulations.

CHAPTER IX.

COMPARISON WITH OTHER SYSTEMS.

In the foregoing chapters considerations in general form have been given to the outlines of the osteopathic philosophy, suggesting the application of the latter to the etiology, diagnosis, and treatment of disease. In the present chapter the description of the same picture will be continued by the method of **contrast**, attempting, in suggesting the salient points in the other systems, to show the indentity in concept between all other schools, and the distinct and fundamental difference between them and the osteopathic system. In making the comparison it will be necessary to refer somewhat in detail to the principles and methods associated with the other various systems. The items of information have been derived from various sources, all of which are authoritative. We shall discuss in order the following more or less distinct systems: drug therapy, electrotherapy, hydrotherapy, psychotherapy, and mechanotherapy.

Drug Therapy.

Throughout all ages men have relied quite largely upon the internal administration of other than food materials for hope of alleviating their physical disabilities. Whether the drug was used as a distinct combatant of the disease *entity* that was formerly believed to exist, whether it was given for a direct *chemical effect* on the body tissues, or whether given as a *placebo*, it has held patient and physician in its thrall throughout the centuries. Until comparatively recent times little attempt was made to show any relation between the nature of the medicine and the effect on the disorder, all substances in the pharmacopeia holding their position by virtue of the fact that observation of their effects on the organism seemed to suggest a curative value. That the observation was usually false is indicated by the brevity of life of each individual drug —the specific of one decade becoming a discarded relic in the next, a condition as true today as ever in the history of medicine. That the **empirical method** was practically the only one used in the past is evident and that it still is largely employed is equally true. Dr. T. Lauder Brunton is undoubtedly an authority on the giving of drugs hence no objection should be recorded against accepting his statement as representative of the general profession. In his work on *Lectures on the Action of Medicines*, published in 1899, these words are found in reference to the use of *alcohol* in certain conditions: "The rule for the administration of alcohol is a very simple one. It is to sit by the side of your patient for a while and watch him after the administration of a dose of alcohol, and if you find that the alcohol brings back the various functions nearer to normal, then it is doing good; if the functions of the organs diverge further from the normal after the administration of alcohol, then it is doing harm" (p. 329). But it must not be thought that at the present time nothing is being done by the advocates of the drug in the way of attempting to put the system on a scientific basis. Never in the history of medicine has so much attention been given to the investigation into the nature of the effects produced by the various drugs upon body tissues. Never has the study of the chemical conditions of the body been so intense as at the present time, in the hope that by determining the chemical nature of body tissues in health and disease chemical substances could be obtained which would in a chemical way modify the body conditions. The study is primarily for the purpose of *determining how, through a chemical medium, a function may be modified.* The question demands an answer and the very fact that it is asked suggests that the old school investigators have an approximately correct conception of the nature of disease, i. e., perverted function. Unfortunately they have not yet been able to grasp the fact that function can only be modified through the structure that is associated with the function.

In the present stage of drug practice several specific purposes are kept in view. These various purposes will be briefly discussed.

Drugs are given for their **stimulant** effect. In those cases where the activity of an organ is below par some drug is given which is believed to have a tendency to increase that activity. In certain nervous disorders *strychnine* is given, for its effect is known to be exerted upon the nerve centers thereby increasing the facility of discharge; *digitalis* is in very common use as a cardiac stimulant and exercises its influence upon the heart mechanism directly; *morphine* in small doses gives a peculiar sense of general well-being and as such exercises a stimulant influence upon the nervous system; the numerous *bitters* used for purposes of increasing the appetite are further examples. It is to be noted in this connection that while the drug in one sense acts upon the tissue, it is the *reaction* of the tissue upon the drug that produces whatever good result may follow. The tissue exerts its excretory and other protective powers in order to rid itself of the presence of the irritant material, and in so increasing its activity its function may be temporarily normalized.

A second effect produced by the drug is that of the **sedative**. Any drug which produces a lessening of activity is spoken of as possessing sedative properties. *Opium* with its alkaloidal extracts is the typical example; while in most cases it will produce a slight stimulant action, it is most used for purposes of deadening pain. Its principal effect lies in rendering the cells of conscious sensation less responsive to incoming stimuli. Hence, while the irritant causing the pain is still present the pain itself may not be felt because of the lessened irritability of the higher centers; *cocain* lessens the over-activity of the spinal cord and of the peripheral nervous system by producing a lessened irritability; *aconite* is a depressant of the heart and hence is used in cases of extreme activity of that organ; various *astringents* are given which, acting upon the mucous membrane of the intestinal canal, lessen its peristalsis.

A third function of the drug is that of **neutralization**. A simple illustration of this use is the household remedy for sour stomach, ordinary *soda*; formerly, the salts of *salicylic acid* were given in cases of rheumatism on the assumption that they hastened absorption of the deposits by neutralizing them; at the present time the medical fraternity is enthusiastic over the use of various *serums* which are assumed to have a neutralizing effect upon the toxins generated in the body by bacterial action.

Substitution constitutes another of the purposes in drug giving. It has long been known that in anemia there is a poverty of red blood corpuscles and of hæmoglobin believed to be due to a lack of iron. Hence arose the practice of administering *inorganic iron compounds* with the idea that this material could be directly substituted. The view has of late years been discarded since it has been demonstrated that practically none of the iron thus administered is assimilated, and while at the present time it is still administered its supposed good effects are explained from its stimulant action on assimilation processes; in the case of administration of the organic extracts from various of the *ductless glands* of the body we have other illustrations of the substitution idea. For some time it has been known that the absence, congenital or otherwise, of the thyroid gland results in a dwarfing of body and mind, and it has further been found that when these glands from other animals or extracts from the gland were given to the individual as a part of his food the condition was often partially or completely overcome. In such a case the material secreted by the gland of a lower animal constituted the substitution. This however partakes more largely of a dietetic than a drug treatment, for the material is already organic and in such a form may be assimilated in the same manner as is food material.

A further action that certain drugs were supposed to exert was that of a **germicide.** With the comparatively rapid rise and almost universal acceptance of the germ theory of disease the medical profession arrived speedily at the conclusion that the problem of overcoming disease was solved. Since the bacterium was the cause of most disease conditions the only requisite for preventing and curing the disease was the drug or other means which would annihilate the microorganism. Hence in the laboratory, experiments were carried on to determine what particular chemical substance would destroy or render inactive each specific micro-organism. Unfortunately it was soon found that owing to the extreme tenacity of life manifested by the average bacterium, *any drug sufficient to destroy its life was more than sufficient when administered internally to destroy the body cells.* Hence the present use of germicides and antiseptics is largely limited to external administration in the form of sprays and antiseptic washes.

Practically all effects of the drug may be classified under the above five divisions. The question arises, are the results **real and satisfactory.** It is not denied that the administration of the drug is sometimes effective and in numerous cases seems to temporarily relieve. There is no question that digitalis will usually stimulate the heart's action; that morphine will often temporarily lessen pain; that fairly good evidence is presented that the diphtheria antitoxin may lessen the mortality rate; or that other drugs may sometimes be of some value. The question is, *does the good resulting from their use exceed the harm?* All experience goes to show that the harm is in excess and the better class of physicians of all schools are beginning to realize that fact. A few of the objections to the use of the drug, suggesting how the harm is likely to result, may not be out of place.

With the possible exception of the germicide every drug given is for the purpose of **combatting effects** and practically ignoring the cause. A cholagogue is given to stimulate the *liver* functions. In doing so the physician recognizes only the torpid liver, i. e., the effect; the *opiate* lessens the conscioueness of pain but the cause of that pain still persists.

An irritant drug given to stimulate an organ but **adds to the burden.** A *renal* stimulant causes double work on the part of the kidney; that organ being already overworked with reference to its nutritive condition must, in addition to throwing off the toxic material from normal katabolic activity, eliminate also the drug which has passed into the vascular system.

There is always danger from a possible **cumulative effect.** In the constant use of *digitalis* as a heart stimulant the time will usually come when the ordinary dose instead of producing its usual stimulant effect will bring on a state of collapse with a possible fatal termination. The old school authorities recognize such to be the case although the explanation is not forthcoming.

If it were possible to apply a remedy directly to the tissue that needs it without bringing it in contact with **other organs not involved** in disorder there would be less objection to the use of drugging. But in case of most of the organs the cnly ready channel through which the tissues may be reached is the circulatory system, and whether the drug be injected directly into that system or be taken by absorption from the alimentary canal all parts of the body must of necessity be contaminated with the drug. Such being the case it is not difficult to understand why other parts of the body become poisoned even though the diseased organ may have been benefitted. It is notoriously true that the stomach of the constant drug taker is in a continual state of disorder and simply because that viscus has been converted into a receptacle for material never designed to enter it.

One of the most severe indictments of the drug system lies in the fact that there is always a possibility of **habit formation.** While this is especially true of a few drugs, such as alcohol and morphine, *there is no drug which is exempt from the possibility.* Thus Crothers in his work on "Morphinism and Narcomania from other Drugs" enumerates a whole series in which observation shows the possibility and probability of the habit formation. Morphine, cocain, chloral, chloroform, tobacco poisons, ether, arsenic, quinine, and numerous others are named. That the drug addiction has gained an extreme hold upon the American people is indicated from the fact that *one individual in every six hundred* is permanently addicted to the use of morphine. When we stop to consider the dozen or other drugs in almost as common use the picture becomes appalling. And when the fact is understood that the effects from the use of morphine, cocain, and several others are equally as disastrous to the individual and to the nation as is alcohol, it would seem that the time is ripe for including in the temperance crusade evidence and anathema against the use of drugs. In this connection the statement of Dr. A. P. Grinnell in a late issue of the *Medico-Legal Journal* is suggestive: "Sooner or later the reformers of the world have got to divert some of their feverish antipathy to alcoholic stimulants and consider calmly and intelligently the drug evil. The deleterious influence on the individual of all forms of drug addiction and the consequent effect on society and all relations of mankind, make its considerations in its sociologic and criminal aspects of paramount importance. The courts have never given much judicial importance to drug habits, but widespread development of drug addiction must surely, sooner or later, bring the matter into greater legal prominence." In connection further with the fact of habit formation, one of the most prominent medical journals (*American Medicine*) has this to say in a recent issue: "In the 'American Journal of Pharmacy' for November, 1902, is the report by Mr. Hynson, chairman of the committee appointed by the American Pharmaceutical Association to investigate the question of the acquirement of the drug habit. This report, while it is written from the standpoint of the pharmacist, reveals a state of affairs so truly appalling that it merits the consideration of every physician, indeed of every person interested in the welfare of society. As perhaps the most accurate means of determining the question of the increase in the drug habit in the last few years, the committee gives the statistics concerning the importation of two plants most commonly employed for this purpose—namely, opium and cocaine. Since 1898 the population of the United States has increased *ten per cent.*; the amount of opium imported, however, has increased to the startling extent of *five hundred per cent.*, and this despite the fact that it is less frequently used by physicians than in years past. The importation of opium for 1902 amounts to the astounding sum of 712,000 pounds; and this is exclusive of more than a ton of morphine. This increase in the importation of opium is paralleled in the case of cocaine, the quantity of that alkaloid brought into the country in the year covered by the report being three times as large as the importation of 1898. As the committee points out, it is impossible that there should have been any such enormous increase in the legitimate demand for the drug. Indeed, it would seem probable that the administration by physicians, certainly of opium and probably also of cocaine, has diminished rather than increased, and it is thus safe to conclude that practically all of this supernormal demand is by drug 'fiends.' From responses to letters addressed to a number of pharmacists and physicians in various cities and towns in the East, the committee concludes that in the eastern part of the United States out of every one thousand inhabitants about three are addicted to the use of some drug other than alcohol. The condition of affairs among certain classes is almost inconceivable; thus one of our correspondents, whose business is in the Tenderloin district of New York is personally acquainted with two hundred opium habitues, while the police officers assert that cocaine adulterated with acetanilid is peddled from door to door as an ordinary necessity of life. Such a condition of affairs is so threatening to the very existence of society that its causes cannot be too thoroughly investigated in order to discover a proper remedy."

A writer in another journal (*Medical News*) in discussing the rapid inroads patent medicines are making upon the health and finances of the American people has the following to say: "As a nation largely neurotic—both ancestral and acquired—we offer an inviting field to venders of such wares, who ply their trade with a vigor worthy a better cause, and with results of which we must make note if we would conserve the best interest of many whose well-being is given to our care. It goes without saying that the larger, by far, number of the many nostrums—nervines, antineuralgic pills, powders, tablets, and liquids—so much heralded and lauded for relief of pain and nervous unrest, have morphine as their active part. And this 'part' in some is not small. In one, largely advertised, there is one-eighth grain in each teaspoonful. The risk of morphinism, in certain persons, from that amount is large; in fact, a smaller, in a highly nervous patient on whom it acts kindly, will create the disease. A ten-years' case of morphinism, under my care, seven years ago, had its rise in a one-sixteenth grain daily dose. Even larger risk of inebriety obtains in using the various nostrums containing cocain, so much lauded for the relief of coryza and other nasal ills. In the form of catarrh snuffs and solutions, its power for harm is far greater than when taken by mouth; in fact it ranks almost—or quite—with its subdermic effect, by virtue of the highly absorptive nasal mucous membrane, and its nearness to the brain, making its seductive power and ill effect on mental health especially prompt and pernicious. One of these nostrums contains 1⅞ per cent. cocain—two per cent. is the strength often used for anesthesia—and any 'cure' having that amount is dangerous. Insanity is certain if its use be continued."

The following table showing the percentage of alcohol in certain patent medicines is also suggestive, especially in view of the prevailing energetic campaign against beverages which contain greatly less percentages:

Greene's Nervura	17.2
Hood's Sarsaparilla	18.8
Schenck's Seaweed Tonic	19.5
Brown's Iron Bitters	19.7
Haufman's Sulfur Bitters	20.5
Paine's Celery Compound	21.0
Burdock's Blood Bitters	25.2
Ayer's Sarsaparilla	26.2
Warner's Safe Tonic Bitters	35.7
Parker's Tonic	41.6
Hostetter's Stomach Bitters	44.3

Finally it remains to consider as a definite objection to the use of the drug the **uncertainty** of its effects. That it is uncertain what the result may be in any given case no informed physician will deny. The search for "specifics" has practically been abandoned and for good reasons. The fact that every living individual is *a law unto himself* was never more clearly emphasized than in the manner in which different individuals respond to the drug, or the same individual to the same drug at different times. Because of this individual peculiarity the use of drugs for curative purposes can never be satisfactory nor scientific.

The following paragraph taken from an article in the July issue of the *American Journal of Physiology* (On the Effects of Subcutaneous Injection of the Extract of the Suprarenal Capsule upon the Blood-vessels of the Rabbit's Ear, by S. J. Meltzer and Clara Meltzer) is significant in connection with the above considerations: "Now our knowledge of the effects of all drugs, alkaloids, toxins, or metabolic products, is mostly derived from a study upon normal animals or organs. Are the effects the same when the organs are deprived of their normal innervation? As far as we know this question has as yet hardly been seriously raised. Our experiments have demonstrated that the effect on pathological organs can be diametrically opposite to that on the normal ones!" (p. 260.)

ELECTROTHERAPY.

The various forms of electric application are made use of for various purposes in connection with disease. At one time it was used more for diagnosis than for cure and in this respect at the present it is of some value. It is known that the application of a current to a nerve produces a definite and appreciable change in that nerve technically spoken of as electrotonus. Comparisons with respect to this condition between normal and abnormal nerves will usually show distinct differences. Hence the "reaction of degeneration" is an important indication of disorder of a nerve structure. The same is true to a less noticeable degree in the case of muscle tissue. As a diagnostic agent it may further be of value in certain medico-legal relations, in determining a real from a simulated condition. In those cases where sinister objects are in view in assuming the symptoms of a particular disease in order to procure damages, the application may in many cases absolutely show the falsity of certain of the claims.

But within comparatively recent years a **curative value** has been assumed for the application, and with the rapid desertion of the drug by both laity and profession recourse is had to the use of electricity. In general the same purposes are believed to be accomplished by the current as have been assigned to the drug. McGregor-Robertson (*Physiological Physics*) enumerates the following: *stimulant*, *counter-irritant*, *anti-spasmodic*, *electrolysis*, *cautery*. Of these the last two are primarily surgical in their use and as such may have their legitimate place in the surgeon's armamentarium. Monell and Hayem both suggest a specific *trophic* action from the application, the former instancing a case of increased growth in stature by application to the articulations. This action should be considered as a subdivision of the stimulant action.

Is the method **effective or satisfactory?** Let the authorities and the practitioners experienced in that method answer. Hayem (*Physical and Natural Therapeutics*) emphatically declares it is *more uncertain than the drug*. Could there be a stronger statement! In this connection he says: "But the reader has been able to see that our knowledge is still not far enough advanced for us to think of formulating in a precise way the mode of action of electricity upon the organism. The only certain thing seems to be that this action is very complex even where it is exerted upon a healthy organism. *A fortiori*, it is still more obscure and more difficult to define when we are working in a therapeutic way—i. e., by applications upon parts modified by disease or upon parts whose manner of reacting deviates more or less widely from the normal. Moreover, under a great many circumstances we are ignorant of the real conditions under which we are introducing the electric agent. We are almost absolutely ignorant of the pathological physiology of the neuroses and of most of the diseases of the nervous or neuro-motor system, diseases which are precisely the ones in which electrization scores its most incontestable successes. It would be useless, therefore, for us to lay any stress upon the various theories upon which observers have thought to base the rational employment of electricity. Empirical results are so far the only ones that can serve us as a guide." Verworn in his work on *General Physiology* declares, "In cases where by disease a portion of a nerve has become temporarily impassible to stimuli, medical treatment endeavors, often with success, to hinder the atrophy of the tissue supplied by the nerve by stimulating it artificially by electric currents, *and in this action of the galvanic current lies the therapeutic importance of electricity*." (Italics mine). Jacoby in his two volume work on the subject refers more or less at length in no less than sixteen separate paragraphs to the value of the application because of its *psychic* effect. Note the significance of this paragraph found on page 133 of Vol. II: "We should never forget that it is not the electricity as such that cures, but that it is the entire procedure of electrization, with all the physical and psychic effects thereby produced," and in another paragraph he suggests the advisability of doing all arranging of apparatus *in presence of the patient* being careful to avoid any failure in the attempt, otherwise the suggestive effect will not be so great.

With reference to the value of the **Roentgen ray** as a therapeutic influence, little can be said at the present time. Its value as a diagnostic agent is unquestioned. Sufficient experimentation has not as yet been made relative to its therapeutic value to warrant definite claims one way or another. As a *surgical accessory* in removing morbid growth it may become of value. Note this fundamental fact, however: *The ray sufficient in intensity to destroy a micro-organism or a cancer cell will also be sufficient to destroy a normal body cell*, and further, *the ray cannot be limited in its course or in its effect to the former.* Here we have seemingly to deal with conditions that confronted the early germ theorists who attempted to render the micro-organism ineffective by giving a drug definitely destructive to it only to find that while the germ was destroyed such was no less true of the body cell. Further evidence for or against the X-Ray is awaited, confident that its value is limited to a narrow field.

The same considerations hold with respect to the various forms of **phototherapy,** whether the cure be in the form of violet rays, green rays, or allopathic doses of ordinary sunlight. All rest upon the same basis.

It will be seen by a careful analysis of the foregoing statements that the foundation for the practice of electrotherapy *is the same as that for the practice of drug medication.* In other words, the electrotherapists are still fighting the battle from the rear by attempting to overcome disease by combating its manifestations. When the electrotherapist applies his battery for the purpose of stimulating a lax organ he is using the same principle that the drug therapist employs in the use of chemicals for the stimulation of that organ. When he reduces a sensory condition, as of a neuralgia, he is merely destroying the sensibility of that nerve in a manner similar to its destruction by the use of an anodyne. When by application of electricity for secretory, vaso-motor, or trophic effects he attempts to increase metabolic processes he is still working peripherally rather than centrally. The real cause of disease conditions seems to be an unknown quantity, or the assumption is made that the removal of such cause is outside the realm of possibility.

HYDROTHERAPY.

In hydrotherapy the osteopath has in numerous cases a less objectionable substitute. Not that it is desirable to incorporate its practice as part of the osteopathic system but in that with the present development of the osteopathic science proper our ability to apply distinct and effective osteopathic procedure is limited. It is further to be noted that there are occasions where emergencies arise which can only be met with some foreign and artificial means. In most cases the use of water as a vehicle of heat or cold is the least objectionable. Its promiscuous use for occasions where it is entirely uncalled for is greatly to be deplored. Actual practice is found to need but an occasional use of such methods and if proper application could be made of the osteopathic principle such use would be an extreme rarity.

The more common use of water as a therapeutic measure lies in its value as a **thermal agent.** In many cases of high temperature it is a distinct advantage for purposes of reducing such by means of a simple sponge bath or the more extreme and dangerous method of immersion. So far as actual experience indicates it is in extremely rare cases where the latter method is risked.

Its use as a **stimulant** is of some value in certain cases. Where applied locally as in the case of a dash of water in the face of a fainting individual it is not associated with apparent danger; but where applied generally the reaction is always an uncertain quantity and hence the procedure is not to be advised except under extraordinary circumstances. That the value of the reaction is as uncertain as in the case of drugs cannot be questioned and rests upon the fact that no two individuals respond in the same way to the application. As a general stimulant repeatedly applied it is a pernicious practice and causes a condition of habit little less objectionable than that of the drug. For there is no question that the simple practice of a daily cold general bath is *not an unmixed good.* Man is not an aquatic animal so far as his external surface is concerned and neither should his normal metabolism be made to depend on the artificial stimulus supplied by the daily stimulating bath. Note that there are extremes in both directions. We do not argue for uncleanliness but we insist that a distinction be made between an excretion and a secretion. Herein lies the fallacy of the one extremist who insists that the "pores must be kept open" by continual washing with soap in order that the excretions may be removed. We insist that *the skin is as much a secretory as an excretory organ.* This is especially true with relation to the sebaceous glands the sebum from which acts as a nutrient material to the hair, an oil for both hair and skin, and a protection against infection over the entire body surface. It is a peculiarity of the sebum that the fats which it contains do not become rancid, i. e., they are unfavorable soil for the development of micro-organisms. He who robs the skin of this material by repeated applications of soap opens an easy pathway for infection.

A further use for the application of water is as a *sedative.* It is common knowledge that numerous cases of pain associated with an inflammatory lesion may often be lessened by the application of either heat or cold, the choice of which is largely determined by experiment with each individual case.

In numerous cases of **constipation** the warm water enema is valuable. Especially is this true in the various conditions of impaction where, associated with the opening up of the bowel by manipulation the movement can be effected with less difficulty. In this connection a word of caution is necessary. The writer has had occasion to examine a number of cases of atony of the rectum which he was persuaded were direct results of the regular use of the enema. It is absolutely as true of the enema as it is of the drug that after continual use the bowel becomes largely dependent on the abnormal stimulus for its movement and like the drug requires increasingly more intense application. *No claim for cleanliness or haste can justify other than an occasional use of the injection;* for it must be remembered that *all mucous membranes are self-cleansing* and as such do not require the continual ablutions to which some individuals are unfortunately subjected. These considerations hold good not only for the mucous membrane of the rectum but are equally true with reference to lavage of the stomach, to vaginal douches, and to the washing out of the bladder. In all these cases the normal cleansing and protecting material—mucous—is removed, the glands become over-stimulated, and finally from lack of normal protection various pathological conditions are produced or established.

PSYCHOTHERAPY.

The rapid rise of a large number of cults who claim to be able to overcome disease through application of the fact that the mind has a direct influence over the body metabolism is one of the remarkable facts of the last half century. Whether they be styled Christian Science, magnetic healing, faith cure, or simple mind healing, all are based upon the one principle. That cases presenting considerable functional disturbance have been permanently cured under the ministrations of their followers is no longer questioned. In all of their contentions, absurd as some of them may be, there is an element of truth. That body affects mind and that in turn mind affects body are propositions subject to no dispute. The *extent* of that influence in either case constitutes the battle ground of the contestants. At the basis of their philosophy we find a tenet which is fundamental to the osteopathic conception and that is what has been repeatedly emphasized, that it is the organism and not the physician that cures, and that nature has a remarkable power of self-restoration. The objection to the psychotherapist of the extreme school is that he fails to recognize that there must be a limit and in reaching that limit nature must be aided before further progress can be made. Herein lies the physician's duty.

It is not advisable at this time to enter into detail with reference to the methods or means of suggestion as a therapeutic agent but a **principle** may be enunciated which will cover all cases of disordered mental conditions or body conditions resulting from the mental disturbance. In the first place it will be noted that so-called *purely psychic disorders* will be the ones most readily overcome by the mental healer. There is such a condition which we may designate as the *vital level*, fluctuations and disturbances of which may be caused by extraordinary mental or emotional activity. This disturbance of the vital level will only be a temporary one, the organism itself seeking its own level and restoring its own equilibrium. In case the mental or emotional excitement be extreme in intensity or prolonged in time *structural conditions* may be disturbed as a result of the extreme mental or emotional functioning. Even then in many cases the vital level will be restored, the structural changes having been overcome following the cessation of the psychic disturbance. But as has been indicated in other sections structural conditions are less immediately under the control of the reparative forces and hence will be more likely to persist. When such do persist the vital level is not restored and we have presenting a real structural lesion. With such a case the osteopath has especially to deal in *the removal of this secondary lesion.* The principle for which we contend in all these cases is that *mental and emotional as well as body conditions constantly tend toward the normal* and if open channels of interchange are maintained between the cells at the basis of psychic functioning and their sources of supply those psychic functions will be restored in their integrity. The continued over-exercise of the psychic functions such as over-study, worry, and the like, constitute an abuse of psychic functioning, the abstinence from such abuse constituting the only necessary treatment in cases uncomplicated by obstructive lesion. In psychic conditions, then, we have to deal with cases *essentially similar to body conditions*, for so far as our work is concerned the psychic activities are the functions of certain nerve cells. Those functions will be normal if the structures at their basis are kept in a condition of normal nutrition, and since every case of any severity invariably presents more or less marked lesion, the treatment will be different only in the manner of helping the patient in abstaining from further abuse.

MECHANOTHERAPY.

The subject of cure by manipulations and exercises of an active nature has in late years gained a remarkable prominence. As one of the results of this interest in mechanical methods there is an unfortunate tendency on the part of many to assume that osteopathy is but a special form of what others have long been applying under the name of massage or Swedish movements. That there are seeming similarities, both in the objects in view and in methods of treatment no one will deny. But that these similarities are only apparent while the real difference is fundamental is a proposition agreed to by every one who takes the pains to investigate. It seems wise therefore to enter somewhat in detail into the subject.

For the purpose of working upon safe ground, it is necessary to have a definite understanding as to what constitutes massage and these other mechanico-therapeutical measures. According to Kleen, "By massage (which means to press or to knead) we mean a mechanical action which is performed on the soft tissues for a therapeutical purpose, by means of certain manipulations, namely, stroking, rubbing, kneading and striking." Kellgren, after Ling, includes in massage also shakings and vibrations. Although massage strictly does not include the gymnastic movements which involve the exercise of the organs of motion, and Swedish movements strictly do not include massage procedures, yet in practice and in the theory of effects of these procedures the two are so interwoven that they may with all propriety be considered together.

To indicate the development of mechanical therapeutics it will not be amiss to give a brief statement of its **history.** Some idea of massage and its effect probably has been known from the earliest times. The ancient Persians, the Egyptians, and even the Chinese, 3000 B. C., made use of these physical means of cure. Among the Greeks considerable progress was made a century B. C. Hippocrates refers to the use of frictions in *sprains, luxations and constipation*, and records a list of cases. Among the Romans massage and gymnastic exercises were in high repute, and in the second century of our era Galen made considerable study and application of mechanotherapy. Like other elements of civilization during the dark ages, little progress was made. In the fourteenth century when anatomy was studied with greater enthusiasm than ever before, the system was revived, and from that time to the present has had a more or less varied experience. That a knowledge of the effects of mechanotherapy was more or less prevalent in the time of Lord Bacon is indicated from the writings of that distinguished man who says: "Frictions make the parts more fleshy and full, as we see both in men and in the currying of horses. The cause is that they draw a greater quantity of spirits and blood to the parts; and again they draw the aliments more forcibly from within; and again because they relax the power and so make the better passage for the spirits, blood, and aliment; lastly, because they dissipate and digest any inutile and excrementitious moisture which lieth in the flesh, all of which helps assimilation." In the early part of the seventeenth century, massage was made to contribute to the service of beauty. Hoffman, in the early part of the eighteenth century greatly assisted in the promotion of mechanotherapy by his works, more particularly his writings. He declares "that on account of their influence upon the circulation, the appetite and general condition, gymnastics are the best of all remedies,'' and also following Hippocrates and Galen, treats quite fully of massage. Following Hoffman, individuals in Germany, England and France, separately and after their own manner contributed to the development.

Mechanotherapy in Sweden began largely with Peter Henry Ling who lived from 1776 to 1839 and from him the **Swedish movements** as a system dates its origin. Ling was essentially a gymnast, being a teacher of gymnastics and fencing in the university of Lund, and it was the beneficial effects of the movements upon himself that led to the development of his system. While employing these movements of the body for therapeutical effects, however, he did not neglect massage but recognized its helpfulness and incorporated it as a part of the Swedish movement system. Although this system is constantly associated with Ling's name, he by no means originated the several movements comprising it but undoubtedly he did exert a large influence on organizing the various therapeutical measures thereby creating a distinct system.

It is since the middle of the nineteenth century that mechanotherapy has made its greatest advance, and in Holland, in Germany, in Austria, in England, and in France, as well as in Norway and Sweden, physical methods of healing have been and are being developed. In **summing up**, Kleen remarks that massage as yet hardly holds the place in therapeutics to which it is entitled, and suggests as an explanation of this fact two reasons: First, the practice has largely been in the hands of unscientific persons and therefore in many cases has been more harmful than helpful; second, using his own words, "it must also be admitted that the unsatisfactory standing of mechanotherapy is partly the fault of us physicians. Hitherto the world of scientific medicine has neglected this form of treatment, the practice of which is always more troublesome than writing prescriptions and almost always less remunerative. Very many physicians are still so ignorant of mechanotherapy that they are alike unable to understand it or to teach it to others. Finally, there is a class of men in our profession afflicted with what I should call intellectual snobbery, who will on general principles have nothing to do with a method of treatment that calls for mechanical labor." Further, quoting from Kellgren regarding the slowness of the development of mechanotherapy, we note this complaint which has such a familiar ring: "The result of the manual method in these and other nervous diseases would be still more successful if the patients had recourse to the treatment sooner. At present it is used as the last plank after everything else has failed. Not only then have we to contend with the diseases in their very advanced stage, but also with the sunken courage and lost energy of the patient which reacts so unfavorably on his general health."

Passing to a consideration of the **technique** of massage several forms of manipulation are described. *Effleurage* consists of a series of strokings over a portion of the skin or other soft tissues in a centripetal direction. The more pronounced and immediate effect of this is acceleration in the circulation of the blood and lymph through the local part. According to Ling slight strokings tend to soothe pain in the superficial structures as well. *Frictions* are in the nature of rubbings in a circular direction over small areas and are employed to promote absorption. *Petrissage* consists in a kneading of the tissues either between the thumb and fingers of the operator or against bony and other tissues of the body of the patient. It is supposed also to aid absorption and acts as a mechanical stimulation of the muscles as well as producing an effect on the nerve terminals within the tissue. *Tapotement* consists of light blows or choppings given by the flat of the hand, the fingers, or the edge of the fist, and acts as a mechanical excitant of muscle and nerve, the excitation causing contraction of muscular tissue which results in increased activity of the flow through superficial vessels and nerves. The *shaking* movements as given by Ling, are applied to portions of the body more or less easily moved and are advantageous in promoting absorption, in its stimulating effect, and in its reduction of congested and inflammatory conditions thereby lessening pain and increasing glandular activity. This movement is applied to the pharynx, larynx, thorax, and abdomen, as typical cases. For instance, in its application to the lower part of the thorax, the operator places one hand on either side, making quick compressions and relaxations, thus influencing chest and abdominal activities. A modification of the shaking movement is seen in *vibration* and is applied to the eyes, throat, chest, and abdomen. The effect is similar to that of the shaking movement but is supposed to be especially efficient in reducing disturbed sensory conditions. In distinctively *kneading* movements effects are gotten on impacted bowels by direct work along the course of the intestine, while kneading associated with the shaking movement is declared to be helpful in biliary calculus.

As to the **special effects** secured by the masseur, there are, according to the latter, many that the osteopath undoubtedly secures indirectly. He often meets cases which are more or less addicted to the treatment habit, and who apply at his office for a "toning up" treatment to relieve them of the feeling of exhaustion. Masseurs have the same idea in mind when they indicate that massage, more particularly effleurage, aids very materially in overcoming fatigue in groups of tired muscles. The products of muscle katabolism, which are largely responsible for the feeling of fatigue, are thus forced out more rapidly making way for nutritive supplies. Further, as Kleen states, massage acts both as a *pressure and suction pump*. The forcing of the fluid from the tissue creates a negative pressure which acts as a further force in circulation. This fact is taken account of in conditions of an inflammatory character which, as the masseurs themselves point out, begin with the dilatation of the small vessels of the part, with a subsequent slowing of the blood stream. Hence in the treatment which consists of working around an inflamed area as in appendicitis, or tonsilitis, or gastritis the osteopath is doing merely what the masseur does. A case is cited in this connection of a cure in retention of urine from an enlarged prostate by direct manipulation of the gland, a procedure many osteopaths are free to advise and use. A further effect is claimed for massage in the prevention and possible cure of muscular atrophy, at least where that atrophy is due to peripheral causes, for example lack of exercise of a certain muscle group. In this case there is, according to the reasoning of the masseur a *trophic* effect, either through the medium of special trophic nerves or through the direct blood supply. And they have recognized a further effect of massage than the mere local and direct influence on blood flow; for in speaking of tapotement having an effect on the *heart* Kleen says: "So far as the human subject is concerned, little more can be said than that massage, no matter how it is employed, produces reflex effects both during and after its application, which effects are seen in the narrowing as well as in the widening of certain blood vessels; in the rise as well as in the fall of arterial blood pressure; in the quickening as well as in the slowing of the pulse. Still it is safe to say that the particular character of these effects is determined by the manner in which the massage is given, by the place in which it is applied, and the organs reached by it," and he refers to the common experiment showing that after massage of one arm, probably through a vaso-motor effect a dilatation or a constriction of the vessels of the other arm results. He also speaks of a rise of blood pressure during addominal massage due to a constriction of the arteries of the mesentery.

A further result to be gained by massage is in the breaking down of newly formed capillaries where **new growths** are developing. Frictions are the procedures employed and in this connection the osteopath naturally thinks of his destruction of the "feeders" in certain congested and inflamed conditions of the external coats of the *eye* or the eyelids.

Ziegenspeck refers also to massage for the breaking down of *adhesions* between the uterus and rectal wall.

Another purpose for which the masseur works is one which osteopaths constantly have in mind, namely, the **control of circulation**; and the result is gotten, not only by the influence exerted on general blood flow and blood pressure through the medium of vaso-motors, as for instance when Kellgren indicates that shaking or other manipulation at the pit of the stomach exerts a direct influence on the circulation of the *abdomen* and hence of the entire body, or in another example in which he cites the relief of headache and congestion of the brain by work in influencing the circulation to the head through the effect gotten on the *occipital nerves*; but he also attempts a direct control of the blood flow as evidenced by cases cited of circulation changes by direct pressure on the *abdominal aorta* and of the relief of fainting from shock by pressure on the *internal jugular* veins.

There are those who insist that in **nerve massage and vibration** the masseur has his most efficient therapeutic measure. As illustrative of the application the following cases are cited by various authors: overcoming the spasmodic action of the *diaphragm* both by inhibition at the origin of the nerve and by shakings applied at the pit of the stomach; trouble with the *eye* in which direct pressure is made on the eyeball itself thereby stimulating its nerve mechanism; vibration of the *nasal and supra-trochlear* branches of the fifth in catarrh of the nose and frontal headache; vibrations of the *dental branches* of the fifth resulting in the relief of neuralgic toothache; the striking example given by Ziegenspeck in which he claims that slight choppings on the back and percussions transversely across the sacral region are said to induce the central nervous system to exercise a tonic influence upon the relaxed *ligaments of the uterus*; the still more remarkable instance in which Kellgren's work states in regard to frictions along the *pneumogastric* nerve, "its effect upon the heart is utilized when the action of the latter is too strong," or referred to by Kleen in this wise, "I would point out that though we may by pressure upon the vagi in the neck cause slowing and even cessation of the heart, still it is by no means a harmless procedure and its usefulness under any circumstances whatever remains to be proven;" and still another example as given by Kleen in which stretching the *sciatic nerve* is advised in case of sciatic rheumatism. Not only is this direct effect gotten by means of nerve stimulation but also the possibility of affecting remote organs through reflex activities is granted. In Kellgren's work the following *summary* is given relative to the effects of nerve vibrations: "First, raising of the nervous energy; second, diminution of pain; third, contraction of the smaller blood vessels; fourth, stimulation of the muscles to contraction; fifth, increased secretion of the glands; sixth, diminished excretion from the skin; seventh, decrease of temperature."

Finally, masseurs are aware of the fact and the possible significance of **tender points** in the tissues along the spine over the area from which nerves are given off to organs which are in a diseased condition; evidently, however, they have considered these tender points as always secondary to the diseased viscus. Cases are cited in one of which where there was a disease of the *lungs*, the patient was very sensitive along the spine between the shoulder blades, and in another, diseases of the *generative organs*, the bladder, and rectum were found associated with various tender places along the lumbar and sacral regions.

Thus far it has been indicated that in many ways there is a similarity between the various systems of mechanotherapy and that of osteopathy. It remains to substantiate the proposition that there is a difference essential in kind and fundamental in importance. What is that vital difference? A few differences have been presented to the public which are certainly **non-essential**. It is declared that massage is *general* in its application, osteopathy specific; that it is only very rarely that massage is given to local parts for local troubles. From what has been said above it will be seen that this distinction is decidedly lame. While the general treatment in massage holds prominent sway, to declare that local treatment for local effect is very rarely used is, to say the least, over-stepping the bounds of caution. It will be seen from the foregoing that massage can be as specific in its application as is osteopathy so far as localizing the treatment is concerned. A second distinction made is that massage is only a *part* of a system while osteopathy covers the whole field of disease. A very little analysis only will be necessary to indicate the non-essential character of this distinction. It is true that osteopaths claim that their science covers the whole field of disease. It is also true that there are numerous diseases with which osteopathy has not yet come in contact, and further there are numerous diseases over which osteopathy so far has not been able to exercise much control. Admitting this is not granting that in a further development of the science it will not be able to control these diseases. So far as the masseurs are concerned, they make the claim for their practice that it is being found applicable to more and more of the disease conditions, and that the ultimate status of the system cannot be foretold. A *third distinction* which is made is that while osteopathic practice necessitates a thorough knowledge of anatomy, physiology, and etiology, these branches are not essential in massage. This so-called distinction, while indicating an ignorance of the practice of massage is also grossly unjust to the followers of that system. The distinction merely compares the well trained osteopath to the uninstructed, untrained masseur, the unfairness of which is evident. True, a large number of the masseurs are uninstructed in these branches but are trained to perform certain movements and are under the direction, in many cases, of a regular physician; the osteopath might take an ignorant man and without any instruction in these branches teach him to perform certain osteopathic manipulations which would be productive of good results, and yet should the claim be made that he were a representative of osteopathy a storm of objection would arise. There are fake masseurs and assistant masseurs as well as fake osteopaths and assistant osteopaths.

The **essential distinction** between osteopathy and all other systems of healing based on manipulation clusters around the etiology of disease. While these other systems, as indicated at least by their practice, look at disease from a peripheral standpoint, osteopathy views it from a central standpoint. Starting with the cell theory as a basis, they have regarded life and hence disease as a series and a complication of cell activities. Taking a concrete case, a certain set of cells constitutes the liver. Under normal conditions the part taken by the liver in the life of the organism consists in the sum of the activities of that particular group of individual cells. A diseased condition of the liver is but the activity of the cells in the group,abnormal in kind or quantity;hence remedial measures have been applied directly to them. The masseur, by compression, stroking, shaking, or nerve stimulation, acts directly upon the liver. On the other hand, the osteopath, taking into consideration the ability of nature to functionate properly, recognizes a central force sufficient to keep in normal action this particular group. And when a disturbance in the normal activity of those cells is manifest he reasons that the influence from this central force to the involved cell group has been obstructed, diverted, or otherwise interfered with, and his work consists in discovering the nature of that interference, the point of interference, and the removal of interference. This constitutes the only purely osteopathic consideration of health and disease, and if a differentiation is made between osteopathy and the other forms of mechanotherapy, this is the view that must be accepted.

SUMMARY.

A few of the facts relative to the more important of modern methods of dealing with disease have been touched upon and if care has been taken it will be observed that there is a remarkable **similarity of basis** throughout. We are prepared to insist that the bases are identical; that a difference between any two is a difference in detail and in degree only, not a difference in essentials. The basis of all the methods is that enunciated boldly by the drug therapists, *treat the symptoms as they arise*. In so far as any system is guided by such a rule of practice it must occupy an illogical position. The manner of treatment of symptoms, if such treatment be necessary, is a comparatively inconsequent matter. It is not meant by this that one method is necessarily as good as another in accomplishing the result, for such is hardly true. But it must be insisted that the position assumed is fundamentally the same. On this basis the phrase "natural methods," in common use, is a misnomer. No method is a natural method where artifice is necessary. Only that method is natural in which the organism unaided effects a cure. The reason for the inclusion of every known method with the lone exception of drug healing in the category of "natural methods" must be regarded as a profound enigma. Why this singling out of the drug? If it be natural for the sick man to expose his nude body to the burning rays of the sun in taking the "sun cure"; or to inject or otherwise use continued excess of water in the method of the hydrotherapist; or to introduce into the body a charge of electric energy; or to ignore the fact of disease; or even to apply manipulative stimulation or inhibition; it certainly is no less so to administer a dose of soda for a sour stomach. Demonstrate that there is fundamentally any difference in the absolute between the action of the drug and the action of these others and there will be reason to confine condemnation to that alone as being unnatural. This is no plea for the drug. It is undoubtedly true that of them all the drug is associated with the greatest possibility of danger, but it must be insisted that that fact does not make any distinction in kind. The author is opposed to all of them on the basis that they are all illogical methods; but in those cases where a logical method is not available it may be advisable to resort to that least associated with danger. *He who persists in including in the osteopathic system these so-called natural systems has no authority to exclude the drug.* In so far as he does include all these, his is not a system but a conglomerate and the practitioner should be willing to take his proper place among the naturopaths whose practice he follows but whose claim on his allegiance he ignores.

Hence in the case of a disorder of an aggregation of cells—a viscus for instance—what is the treatment by the practitioner of other schools? It is the same in principle whether the agent be drug, electricity, water, heat, light, suggestion, or mechanical stimulation. If the organ be sluggish a **stimulant** is given. An excess of impulses presumably reaches the organ which causes increased activity. What matter, fundamentally, whether the excess result from drug or nerve impulse from higher center, from mechanical irritation or electric charge? Or if the organ be over-active what difference whether the inhibitory effect be produced by one or by another?

If an excess of acid be present in the stomach is it the acid that is at fault that the drug giver should attempt to **neutralize** it by an alkali; or is it the fault of the gland in being over-active that it should be quieted; or are the digestive forces derelict to duty that they should be whipped into normal activity by water, or by mechanical pressure, or by electric touch? These measures can at most be but temporary. The acidity, from whatever cause, will not be present except the instrument through which the digestive processes are performed be interfered with. The only essential in the treatment is to remove the interference to those processes which normally provide the neutralizing substances, or better, to relieve the condition which causes the necessity for a neutralizing substance.

And why attempt to **substitute**, whether it be a drug as iron for anemia, or a force as an electric current in nerve exhaustion, when all such necessary substances and forces are present potentially in the food materials? Rather remove the impediment to the assimilation processes which prevents the normal conversion of that potential into a kinetic manifestation.

In like manner, why be satisfied with attempts, which can never be entirely successful, to **destroy the microorganism?** The body, by virtue of its white corpuscle, its alkalinity and its special acid substances, its nucleins and its alexins of the blood, and its numerous superficial structures and substances, is already thoroughly protected except when its nutritive condition is below par due to disorder of its mechanism. Rather it is the part of wisdom to attend to the structural condition of the organism which will permit or compel a normal function.

Fundamentally then the difference is an **absolute one**. The distinct and peculiar position of the osteopath as an advocate of a new system lies in his contention that disease is **caused or maintained by structural disorder,** the removal of which constitutes the treatment. If the liver becomes disarranged the drug therapist administers a cholagogue; the electrotherapist introduces an electric stimulant; the hydrotherapist applies water; the mental healer removes hindering mental conditions; the mechanotherapist compresses and stimulates by mechanical means; while the osteopath removes the hindering structural condition which prevents normal nutrition and hence restoration of normal metabolism.

PART II.

CHAPTER X.

THE SPINE.

GENERAL SURVEY.

Because of the fact that the spine is of such fundamental importance to the osteopath a brief general survey of its structure and relationships will be given before taking up separate divisions for specific study. That the spine is of such importance is recognized by every practitioner, for it is only in occasional cases of disease that no treatment is given to it, while almost invariably regardless of the nature of the symptoms presented, the careful osteopath will make a study of its various parts in the process of diagnosis.

With reference to the general **contour** of the spine a few points should be noted: The *normal curves* are four in number, two of which may be considered primary, the others secondary and compensatory. During fetal life and to the second year of infancy the anterior curvatures are not markedly developed—indeed during intra-uterine life the spinal column constitutes the arc of a circle while in infancy it is comparatively straight. As the child assumes the erect posture the anterior curvatures become developed, that development being necessary for purposes of *equlibrium*. The thoracic and the pelvic curvatures are physiological in the sense of forming a cavity for the protection of various viscera. In addition to this advantage there is the equally important one of providing against the shock to the body generally and to the brain especially that would otherwise occur at every jar or even footfall, the column in this way performing the office of a mechanical spring. In noting the anterior and posterior curvatures the fact should be remembered that *a vertical line* *cutting the tips of the spinous processes of the verterbræ is not parallel with the longitudinal axis of the spinal column taken as a whole*, this fact being dependent upon the difference in obliquity existing between the spinous processes of the various regions; for instance in the mid-thoracic region owing to the extreme obliquity of the spinous processes a line passing through these will approach much more closely the spinal axis than it would in the lumbar region. Hence, a spine appearing perfectly straight as judged by the row of spinous processes will not be so in reality. In making judgment with respect to the prominence or otherwise of the various curves the transverse processes should be noted, to correct errors arising from consideration of the spines alone. A spine which has in reality had its curves obliterated is technically spoken of as a *straight spine* and will often be associated with the so-called *smooth spine*, a term which has come into use as representing a condition in which the connecting structures between adjacent processes have become thickened and in numerous cases contracted, giving it undue rigidity. The smoothness is not necessarily indicative of a state of lesion, for it may be a simple filling in of normal tissue, but the rigidity in most cases is evidence of a lesion.

The **rigid spine** depends upon one or more of several pathological changes. It may be due simply to *muscle contracture* in which case the rigidity will temporarily yield to a relaxing treatment; it may be dependent on overgrown and contracted *ligamentous tissues* resulting from irritation, congestion, or inflammation of those structures; in some cases it is due to structural alterations in the articular and intervertebral *cartilages* from erosions or deposits; while in extreme cases when associated with a former inflammatory lesion, it is due to *bony ankylosis*, in which the diagnostician will not be able to detect any movement between adjacent vertebræ. In considering the case of the rigid spine the fact should be remembered that with *increasing age* there will normally be increasing rigidity.

Cases are met with considerable frequency presenting the opposite condition to the above, in which the **laxity** of the spinal column is quite apparent. This will be equally noticeable whether the patient is in the erect or horizontal posture. In the former, movement of the part is free and extreme and the patient will seem to be unable to hold the spine erect for any appreciable length of time; in the latter if he lies upon the side a lateral curvature will seem to be present with the convexity below, this appearance being due to the weight of the body upon the yielding column. Such cases are usually the result of a chronic condition in which nerve force and blood conditions have become altered; in many cases it simply represents a stage secondary to a former rigidity dependent upon muscle and ligamentous contracture.

Lateral curvatures are among the more common lesions and are usually double, i. e., if a *primary* curvature is present in the upper or middle thoracic toward the left, there will be a secondary or *compensatory* right lateral curvature in the lumbar region. This will be true of practically all lateral curvatures of any considerable degree of development, the compensatory condition developing in the same way and for the same purpose as those of the antero-posterior type, i. e., for purposes of maintaining equilibrium. With reference to the lateral curvature it should be noted that it is again true that the extent of the curvature of the spine taken as a whole *may not be correctly represented by the line of spinous processes*; for with many cases of lateral curvature there will be a rotation of the vertebra upon its vertical axis in such a manner as to cause a greater lateral drift of the body of the bone than of its spine. The cause of this peculiarity need not be here detailed except to indicate that it is dependent upon the peculiar relations of the articular processes and the direction

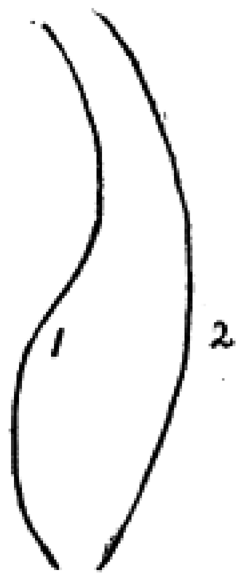


Fig. 9.—No. 1 is in more stable equilibrium than No. 2. Hence compensatory curvature is physiological.

of the tension exerted by the muscles with reference to the leverages presented. The *diagnosis* will be determined by the line of spinous processes, the line and prominence of the transverse processes, the difference in the prominence of the angles of the ribs on the two sides, together with the carriage and attitude of the patient and individual peculiarities associated with each case.

For the purpose of determining the condition of any **single vertebra**, both the spinous and transverse processes must be examined. Of the two the transverse will be associated with less possibility of error because of *two facts* namely: they are less subject to causes compelling abnormal growth conditions and hence will vary less from the typical shape and, second, the pair affords opportunity for comparison. The spinous processes are the more easily reached and are of advantage because of that fact. In noting the *relative position* of spines the fingers may be rapidly drawn down over them or on either side, in this way tending to produce flush-

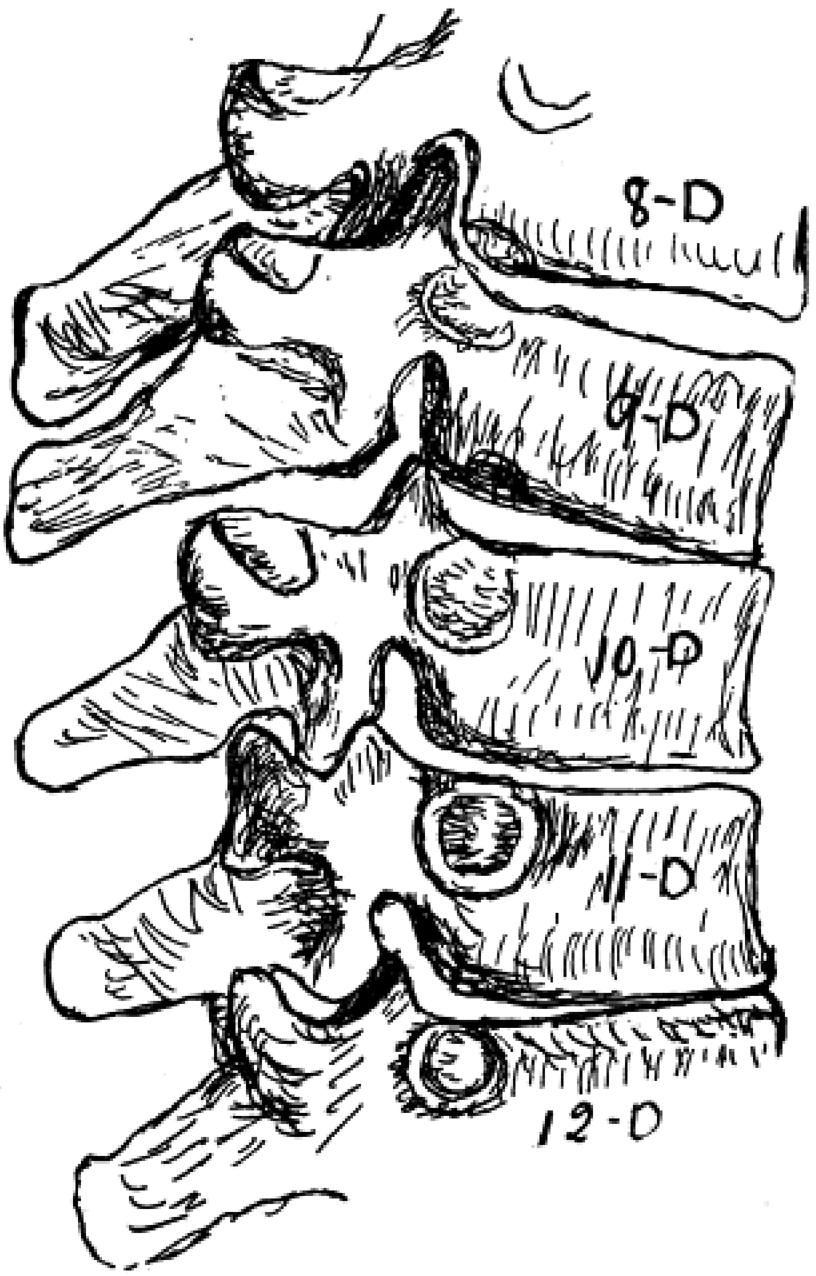


Fig. 10.—Approximation between 8th and 9th and separation between 11th and 12th thoracic spines.

ing or pailor of the skin overlying them, in which condition they may be compared with each other. Or in the rapid passing of the hand the *muscular sense* will suggest any slight swerves or deviation not noticeable on first inspection. *Separations* between spinous processes suggests a weakness dependent on overstretched ligaments. In most cases the condition is not a separation of the vertebræ as a whole but a separation of the posterior aspects with a corresponding approximation of the anterior parts, i. e., the bodies. In the lax spine, where a large area is involved, it is likely to be a real separation of the vertebræ as a whole, and dependent on a generally stretched condition of all the connecting structures. On the other hand two adjacent spines may seem to be unduly *approximated.* This may be due to one or both of the opposite conditions, i. e., tightening and shortening of the ligamentous tissues posteriorly or throughout. *Anterior subluxations* will seldom be determined by reference to the spinous process alone but will be noted on comparison of the transverse processes with those above and below. The same is true with regard to the posterior, lateral, and twisted conditions. Perhaps the most common type of subluxation of a local part is the *torsion* or twisting of the column at the junction of two adjacent vertebræ. Note that the *total torsion* possibility of the spine in normal conditions is about 100 degrees.—(Holden). In the cervical region, the sacro-lumbar junction, and the dorso-lumbar articulation, most of the rotation is normally produced. In other parts there is present some turning while under the abnormal circumstances sufficient may be present to be easily detected. This will be possible by reference to the position of the spinous process, the transverse processes, and the angle of the associated rib. In *lateral subluxations* of single vertebræ, not only the spinous process but the transverse will be out of line with those adjacent, and the angle of the rib on the side toward which the part is displaced will be prominent. Many conditions diagnosed as lateral will on closer analysis be found to be a torsion. Hence the necessity to take note of as many of the points of prominence as present themselves.

To determine the **serial number** of the particular vertebra disordered, a few facts may be helpful. The *second cervical* is the first spinous process noted on superficial examination. It is prominent, bifid, and quite subject to variation in size as well as in relative development of its two tubercles. The bifid condition may not be noticeable to the amateur except on careful palpation. The *third, fourth, and fifth* spines recede anteriorly in the erect position but may easily be noted when the patient is supine and completely relaxed. The *last cervical* and *first thoracic* on account of their prominence are easily detected. The last cervical may be distinguished by noticing the sixth whose spinous process usually rests upon that of the seventh in a saddle-like manner, and will often be felt as a tubercle upon the spine of the latter a few millimeters from its tip. The *typical spines* through the thoracic region will be *on a level with the transverse processes of the vertebra next below*, hence the level of the spine is not necessarily nor usually the level of the more important part of the lesion. The inferior angle of the scapula is on a level with the spine of the *seventh thoracic.* The spine, transverse processes, and spinal end of twelfth rib are on a level at the *last thoracic.* Also, there is usually a more marked separation of spines at the junction of the lumbar and thoracic regions than above or below. The level of the *fourth lumbar* is the level of the superior part of the innominata. The *lumbo-sacral junction* is noted for its separation of spines and its greater mobility. This latter point may be essential to note in some cases where the *first sacral* spinous process is prominent. Do not be misled in reference to this junction. Often the *fifth lumbar* is anterior but more often it is a dipping forward of the articulation due to some weakness of the anterior or disproportionate strength of the posterior ligaments in which the process may not be as prominent as it normally is. Further, this is a region of *wide normal variations* and the abnormal condition may be more apparent than real. Emphasis should be laid on the following with reference to the general survey of the spine.

1. Examine in more than one **position.**

2. Take note of **other points** than mere displacement of parts, i. e., soreness, contractures, and others to which attention has been called.

3. Inquire as to the **relative use** of the two sides, i. e., whether "right handed" or otherwise. Dr. Still calls attention to the fact that all the bony prominences will be more prominent on the side most largely used. In many cases a slight curvature is noticed toward the side of greater development.

4. The row of spinous processes marks the middle line of a distinct **median furrow,** the regularity of which is a valuable general point in the diagnosis. This median furrow will be most noticeable in the dorso lumbar region where its boundaries are composed of the muscle mass associated with the erector spinæ system.

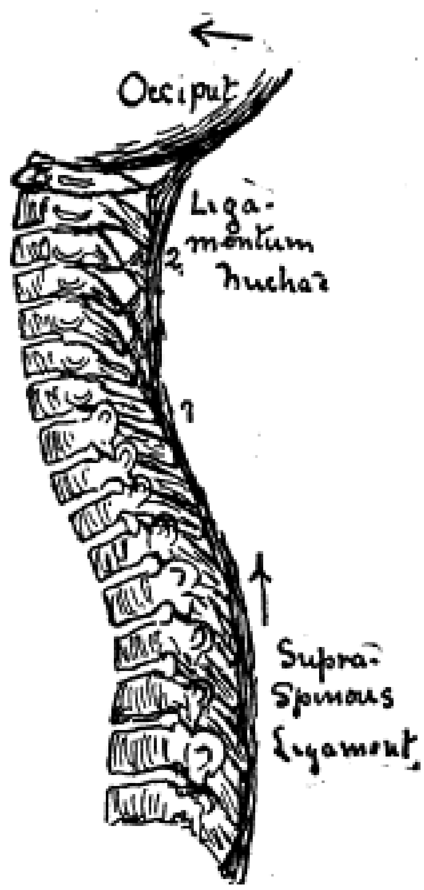


Fig. 11.—Showing effect on vertebral spines of flexion of head.

5. **Tenderness** is usually more noticed on the side toward which the subluxation was produced. But in most cases where present at all it will be noticed at all parts. *Bending the head* forward and downward strongly will often cause pain at the point of lesion that otherwise would not be detected; this by virtue of the fact that the ligamentum nuchæ, continued throughout the spine by the supra-spinous ligaments, exerts an upward and outward tension on the spinous processes which pass obliquely downward and outward. *Pressure on the head* downward and with slight rotation will produce pain at the point of lesion.

This is notably true of inflammatory conditions such as are present in Pott's disease.

6. Usually **muscle contracture** will be easily detected as an associated lesion. In most cases this will locate the deeper bony and ligamentous distortion. Care must be taken to distinguish between a real contracture and a condition of tissue adjustment to the existing deeper lesion, for in many cases prominences will be noted which are not at all due to a pathological condition of the muscle itself. On the convex side of a curvature there will often be greater superficial prominence while the actual contracture will be on the side of the concavity.

7. Note the **sounds** produced by movement of parts. These are more noticed in the cervical part of the spine and the costo-vertebral articulations. They depend on, first, *friction* of ligaments or articulations due to lack of lubrication; second, the *same cause* which operates to produce the snapping of the phalango-metacarpal junctions on extension of the fingers, the "breaking of the current" suggested by Dr. Still; third, *adjustment* of displaced structures. In most cases little importance is to be attached to the sounds unless unduly prominent for they can be produced in most normal individuals..

8. The average lesion is **slight in extent.** It seems necessary to emphasize this fact continually because of the assumption on the part of the beginner that every lesion is comparable to a hip dislocation. In one sense this is true—that is, in so far as it is a change in position of the involved parts, but in most cases the displacement will be measured in millimeters rather than inches. This does not of course mean that the effect produced will be slight. Further, in noticing the prominence in the case of a lesion it should be remembered that the *projection is not due simply to the bone but to the overlying softer tissues*; for where the bone is displaced the tissue against which it is forced must of necessity suffer irritation with a resulting condition of contracture or enlargement

from congestion and inflammation with infiltration, or finally of overgrowth. But there are exceptions in which a lesion of a single vertebra may be so marked that it would not be far from wrong to speak of it in terms of at least quarter inches. Such will either be complete dislocations suddenly produced, which are rare, or deviations gradually produced in which the bony and ligamentous growth has been sufficiently changed to allow of the displacement. That such a condition is occasionally met with will be agreed to by all osteopaths, and that it is possible is reasonable from the fact that the molecules of a block of granite may be gradually changed by sufficient pressure acting continuously. The gradual change of living bone under a muscle or other continuously acting force is much more reasonable and is known to occur.

GENERAL AND SPECIFIC EFFECTS OF SPINAL LESIONS.

A discussion of the manner in which the **spinal lesion** produces the disorder of function will represent the entire field, hence we shall speak at length of the immediate and remote results possible from such condition together with a consideration of those anatomical and physiological facts which tend to throw light upon the manner in which the lesion involves the organ in disorder. The fundamental consideration will be the anatomical relationships between the tissue acting as lesion and the structure—artery, nerve, or other part—acted upon by the lesion. Hence a recapitulation of certain known but little emphasized structural conditions will be given.

Note that the **entire field** is covered. The spinal lesion may involve the organ by *direct pressure*, by impingement on *artery*, *vein*, *lymphatic or nerve*. In the *cervical region* the following will be involved: vertebral, intervertebral, cartoid, and thyroid arteries and corresponding veins and lymphatics; the fifth, seventh, ninth, tenth, eleventh, and twelfth cranial, the eight pair of spinal, and the sympathetic nerves; direct pressure upon structures from an anterior condition of the cervical spine as a whole. In the *thoracic region* there will be direct pressure by crowding from an anterior displacement of the spine; pressure on cervico-thoracic, intercostal, and intervertebral vessels; the twelve spinal and the numerous parts of the thoracic sympathetic nerves. In the *lumbar portion* impingement will be made on lumbar and intervertebral vessels and the spinal and sympathetic nerves. In the *pelvic spine*, sacral nerves, both spinal and sympathetic, and vascular branches will be affected, while the *coccyx* by its anterior distortion will directly involve the rectum and associated structures.

In all of these situations the method of impingement and the explanation of results will in general be the same, and hence only general considerations will be given, reserving the details for those sections dealing with the discussion of the several divisions of the spine and body.

A Typical Condition.

One of the most common lesions with which the osteopath meets is **torsion**, or a twisted condition between two adjacent vertebræ. What will be the effect on the typical articulation? There are three *body* ligaments, anterior, posterior, and intervertebral substance; two *lateral* yellow elastic ligaments connecting the laminæ; two *articular* structures with their typical parts; two *spinous* ligaments, the supraspinous and intra-spinous; and two *inter-transverse* ligaments. In addition to this typical ligamentous material there is present the *muscular slips* of the deep layers of the spine, and all the space being filled up by supporting *connective tissues.* With the torsion condition present all of these various structures will be *put upon the stretch* as well as suffering greater or less *change in situation*. Into and out of the spinal canal pass the *following structures* by way of the intervertebral foramen: the arterial branch coming off from the intercostal to pass within the spinal canal and aid in the supply of the spinal cord; the intervertebral vein or plexus carrying waste material from the same region; lymphatic vessels and spaces concerned with the nutrition of the same part; the spinal nerve made up of the junction of its roots, which occurs just within the foramen; branches, many in number, from the various parts of the cerebro-spinal and the sympathetic nervous system.

First, the **artery** may be impinged, not necessarily by the bony prominences but by the ligamentous and connective tissue tension and the general crowding resulting therefrom, and from an associated congestion and infiltration due to the original strain or displacement. The pressure upon the artery, if efficient, will produce in the part to which it is distributed, i. e., the spinal cord and other canal structures, a condition of *ischæmia.* This condition must of necessity produce greater or less disturbance of the metabolism of the cells in the spinal cord with a consequent *disorganization of the impulses received and distributed therefrom*; for while the axis cylinder process is not appreciably subject to fatigue, undergoing little katabolism and hence requiring little nutriment direct from the blood stream, the cell bodies are very susceptible to the changes in the quality and quantity of their food supplies. In this connection the physiological fact should be noted that *the outgoing impulse from a nerve center is not the simple continuation of an impulse received from an afferent pathway,* but depends directly upon changes, chemical and vital, brought about in various ways within the cell body protoplasm. Hence the ischæmic condition of the spinal cord, by deranging and limiting the metabolism of this cell protoplasm, will very materially interfere with normal nerve discharge. It is possible that if the pressure upon the artery is sufficiently long continued and irritating, a *hyperæmic* condition may result. This would depend upon the gradual exhaustion of the tissues in the wall of the artery with the resulting lax condition permitting vascular dilatation.

The **vein** or venous plexus which drains the local spinal area will be more yielding to pressure than the artery because of the less rigid nature of the venous wall. Hence with the ischæmic condition produced by pressure on the artery there will be associated a venous hyperæmia, which, other things being equal, will likely be more serious than the former. This is due to the fact that the venous blood contains material of a nature ultimately toxic to the tissues and continually becoming more so the longer it is retained in a part. With such a condition present in the spinal cord a preliminary excited condition of the cells will be probable owing to the chemical structures of the acid and other materials in the venous blood acting upon them, but a later and more permanent condition of inhibition of impulses will result owing to the depressant effect of the prolonged presence of the toxic material.

The **lymphatic system** may be more or less impaired by the same pressure conditions. This naturally would result in the same general disorders of nutrition found in the arterial disturbance. The lymph being the medium from which the tissues directly get their nutriment, the necessity for freedom of that system becomes apparent. These three structures, artery, vein, and lymphatic, are so closely associated in their functioning capacities and in their anatomical relationships that the lesion affecting one will affect the other, and the resulting disorder will be practically the same in each case.

The **spinal nerve** may be impinged upon by the same general crowded condition of affairs but owing to the fact that its nerve sheath is comparatively strong and unyielding it is less likely to suffer thus directly than are the other structures mentioned. Pressure may in some cases cause sufficient irritation of the nerve terminals within the sheath, i. e., the nervi-nervorum, or of the axis cylinders proper, to produce disorder in the parts to which the nerve is distributed. Hence conditions of a *motor* and *sensory* nature may result; muscular contractures of nearby or remote tissue and neuralgic and other disorders of sensation are common. In addition to these disturbances which have reference to the special function of the spinal nerve disorders of the sympathetic may result from the fact that practically *all spinal nerves carry with them fibres derived from the sympathetic.* It is suggestive to note the fact that in locomotor ataxia degenerative changes in the peripheral afferent system constitute the morbid anatomy, the degeneration according to some authorities beginning in the cell bodies in the ganglion on the posterior nerve root, *this ganglion being closely related anatomically to the intervertebral foramen and its associated structures* and hence reasonably subject to lesion.

The **sympathetic system** may be involved by the lesion, and all things considered, is without doubt the most subject to interference by any of the forms of spinal lesion. Owing to its paramount importance in osteopathic reasoning and to the further fact that its anatomical and physiological relationships have not been sufficiently emphasized by the old school authorities, and because it is difficult for the average student to understand, a general survey of the entire system will be given, indicating the more important details.

The Sympathetic System.

Fundamentally there is *no distinction between the sympathetic and the cerebro-spinal systems.* Under normal conditions the former is but an outgrowth from the latter during the earlier weeks of fetal life. At that period of the life of the embryo when a vertical section shows the medullary groove well developed and the walls of which represent the ectodermal cells which give rise to the nerve cell bodies of the spinal cord and brain, on either side toward the upper aspect of the groove and later the canal there will be noticed a **ridge** of this original nerve cell tissue. This ridge eventually becomes separated from the other part and, dividing into groups, develops into the *ganglia of the posterior spinal nerve roots.* As outbuddings from this ridge a little later will be noted a series of clumps of cells, most of which becoming separate from the original ridge, form the series of *sympathetic ganglia* which are known in the developed state as the gangliated cord of the sympathetic, but some of which in the form of migrating cells pass outward to various parts of the growing embryo and ultimately develop into the ganglia of the *sympathetic plexuses* and *intrinsic ganglia* of the viscera. These several clumps of cells with their outgrowing axis cylinder processes should logically alone comprise all of the sympathetic system. What is usually included are the *double row of connected ganglia* one on either side of the spinal column, the fibers passing to and from these ganglia making connection on the one hand with the spinal nerves through the *rami communicantes* and on the other with the various *prevertebral plexuses* formed largely by branches received from the gangliated cord and containing a few cell bodies, and the final *distributing filaments* from these plexuses to the various viscera.

With regard to the **gangliated cords,** four divisions are spoken of. The *cervical portion* consists of the three ganglia with their connecting cords, and lies at the side of the bodies of the vertebræ behind the carotid sheath *in the connective tissue and in front of the transverse processes* from which they are separated by muscular and connective tissue. The *thoracic portion* consisting of eleven or twelve ganglia with their connecting cords lies in front of the *heads of the ribs* in the areolar and other tissue lying behind the pleuræ. The *lumbar portion* consisting usually of four ganglia lies to the inner side of the psoas muscle on the antero-lateral aspect of the *vertebral bodies* behind the large abdominal vessels. The *sacral portion* consisting of the four ganglia lies to the inner side of the row of sacral foramina in the *connective tissue* separating the pelvic organs from the sacrum. The cords in this region converge to form the *ganglion impar* lying in front of the coccyx, in a way similar to the formation of the *ganglion of Ribes* situated on the anterior communicating artery in the cranial cavity. In all of these regions the ganglia themselves, and less probably their connecting cords, are more or less subject to pressure from associated structures.

The **plexuses** are numerous and are associated with practically every viscus of the body. The *cardiac* made up from branches of the cervical ganglia is situated in close relation to the upper part of the heart and the arch of the aorta, and will be subject to lesion directly by abnormal conditions of the thoracic organs. The *pulmonary* plexus made up from branches received from the upper thoracic ganglia and a few fibres from the cardiac plexus, lies on the root of the lung, and will be subject to lesion in a manner similar to that of the cardiac. The *solar plexus* is the largest in the body and gives off fibres that make up the individual plexuses associated with most of the abdominal organs. This plexus is derived from branches from the thoracic ganglia forming the three splanchnic nerves, and lies upon the spinal column at the second lumbar and in front of and associated with the great vessels. It is subject to lesion by direct pressure from abdominal tumors, displaced viscera, impacted feces, and the like. Cords passing down from this plexus and re-inforced by fibres from the lower thoracic and lumbar ganglia make up the abdominal aortic plexus. The *hypogastric plexus* continued from the aortic and re-inforced by fibres from the lumbar and sacral ganglia, lies between the two common iliac arteries upon the last lumbar body and the promontory of the sacrum, *within the meshes of a dense connective tissue material*. The tightening of this connective tissue, the general ptosis condition of the abdominal organs, or tumor and pregnant states may involve the plexus in disorder. From the lower part of the hypogastric plexus fibres are given off to either side of the cavity of the pelvis where they form the *pelvic* or inferior hypogastric plexuses. Throughout, these various plexuses are further added to by branches from some of the cranial or spinal nerves.

The **connection** between the sympathetic ganglia and the central system is equally complex and important. The rami communicantes are usually considered a part of the sympathetic system although the white ramus is in reality a part of the central system. These communicating structures connect the ganglion and the anterior primary division of the spinal nerve. They get their names from their appearance which is due to medullary sheaths in the fibres of the white ramus and the absence of that sheath in the grey ramus. Inasmuch as the function of medullation is unknown the point may be ignored as to whether or not the fibres are medullated, excepting to note the fact that in large part those fibres which arise in connection with the spinal cord and which should properly be considered as a part of the central system, are medullated, while those arising from the cells in the sympathetic ganglia and hence the essential sympathetic fibres are almost entirely non-medullated.

Of those fibres which form the white ramus and which arise in connection with the central system, there may be recognized *three distinct types*. The **first** of these, arising in cells of the grey matter of the spinal cord, pass out by way of the anterior root of the spinal nerve, through the common trunk, into the anterior primary division, and from thence passes with others to form the white ramus, and ends in connection with one or other of the ganglia in the gangliated cord. Fibres of this type may either end in the ganglion first reached or pass up or down to end in an adjacent ganglion, or by virtue of collaterals, end in several ganglia, thus covering territory governed by *from one to four ganglia*.

Fibres of the **second** type also arise in the spinal cord and pass out in the same manner to the gangliated cord, but instead of ending by arborizations in connection with those ganglia, pass through them unchanged and enter the *rami efferentes* which pass to the prevertebral plexuses. Here they may end around cells in the plexus whence the impulses are carried onward to the end organ by a new neuron, or they may pass directly through the plexus to reach the viscus or intrinsic cells in the viscus. This type and the first named are *efferent in function*.

The **third** type of white fibres has its origin in a cell

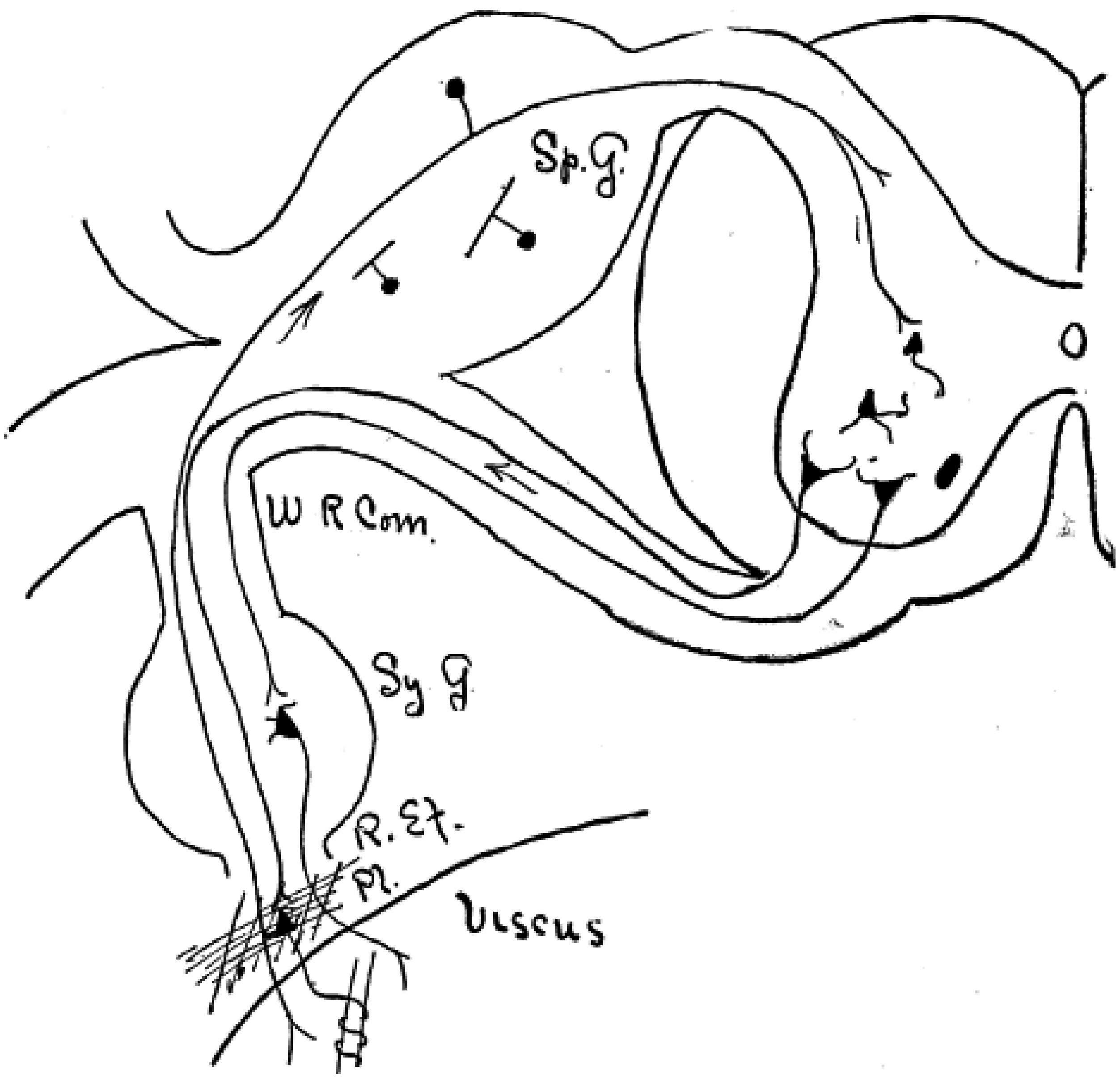


Fig. 12.—Showing distribution of fibres of white rami.

body located in the *ganglion of the posterior nerve root* from which one process extends centrally to arborize around other cells in the cord, while another leaving by way of the *posterior nerve root* peripherally passes into the common trunk and thence over the same course pursued by the second of the above types to end without further interposed neurons in connection with the viscera to which it is distributed. This type constitutes the visceral sensory or *afferent system* of the sympathetic.

In the *grey ramus* are fibres which pursue various courses. With few if any exceptions these grey fibres arise from the cell bodies composing the sympathetic ganglia. **One type** thus arising from the ganglion passes outward into the proxi-

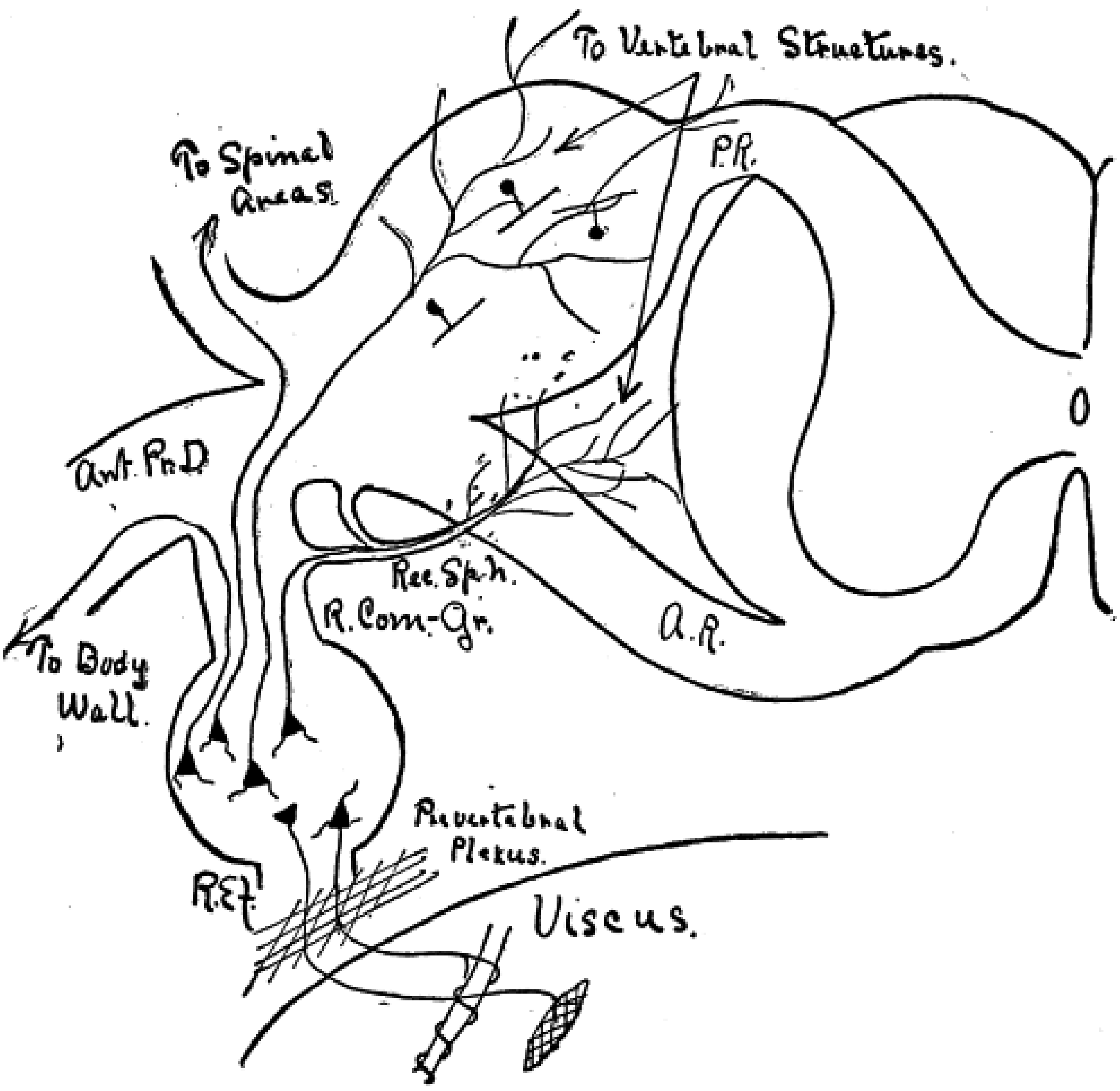


Fig. 13.—Showing distribution of fibres of grey rami.

mal part of the grey ramus but leaves it before the junction with the spinal nerve proper is made, *to join the recurrent branch of the spinal nerve* which has arisen from the common trunk, and passes with the fibres of that branch back through the intervertebral foramen giving off numerous *fibrils which pierce and supply the ligaments, muscles, vertebræ, and various of the structures in the circumferential part of the spinal canal, and ultimately reaching the coverings of the cord.*

A **second type** of grey fibre passes through the grey ramus to the anterior division whence it passes *peripherally* to be distributed with the anterior branch of the spinal nerve, furnishing impulses of a vaso-motor, pilo-motor, and secretory character to the structures in the body walls.

A **third type** passes into the common trunk and thence to the *posterior division* of the spinal nerve to be distributed to structures among the superficial tissues of the spinal region.

A **fourth type** passing to the common trunk enters the *sheath of the posterior nerve root* and distributes its filaments to the intervertebral structures and into the spinal canal as far as and including the dura mater and probably reaching the deeper coverings. No similar arrangement has been noted definitely with reference to the anterior nerve root.

A **fifth type** passes by a connecting cord between adjacent ganglia and thus serves to connect two or more of the ganglia of the sympathetic cord.

The **last type**, arising from a cell in the ganglion passes by way of the *ramus efferentes* to terminate possibly in a vagrant ganglion but usually directly in the viscus supplied from the plexus.

With regard to the **functions** of these various fibres both white and gray, much difference of opinion exists, but enough is known to indicate the following general facts. Motor fibres distributed to various structures are known, such as *vaso-motors* both constrictor and dilator, the former largely limited in their exit from the cord to the interval between the first thoracic and second lumbar; *viscero-motors* and *viscero-inhibitors* passing to supply the involuntary muscle tissue of the viscera, the *cardiac accelerators* from the upper thoracic region being a special type of the viscero-motor; *pupillo-constrictors and dilators* which, distributed to the muscle tissue of the iris, produce effects similar to the other of the motor nerves. In addition to the motor function the sympathetic also distributes *secretory* fibres to the sweat glands and less demonstrably to various other glandular structures. *Afferent impulses* are carried by those white fibres which have their cell bodies in the root ganglion. It is a *fair assumption* that afferent fibres pass from the viscera to end in the sympathetic ganglion, but experimental evidence on this point is not entirely satisfactory.

Regarding the **possibilities of disorder** from lesion of the spine affecting the sympathetic, much may be said indicating the reasonableness of the osteopathic explanation of disease. It was suggested that the ganglia may be subject to pressure and hence disturbance of function result, but owing to the fact that the ganglion is protected by rather dense fibrous tissue such a condition is less likely than disturbance of the rami communicantes which are much less thoroughly protected. Personally however we are inclined to the opinion that *the more common and more serious of the disorders result from the irritation to the delicate nerve terminals distributed to the ligaments and other vertebral and intervertebral structures as they are given off from the recurrent spinal nerve and the filaments which pass from the sheath of the posterior nerve roots.* Only a slight lesion sufficient simply to put upon these filaments a slight increase of tension would be necessary to produce far-reaching results. For undoubtedly these filaments passing to and through the ligaments and other connecting tissues and vascular structures and through some of the muscular slips could quite easily be thus irritated. Note further that these filaments doubtless govern in considerable part the *nutrition to the cells in the spinal cord,* producing in this way effects similar in nature to those suggested in discussing the

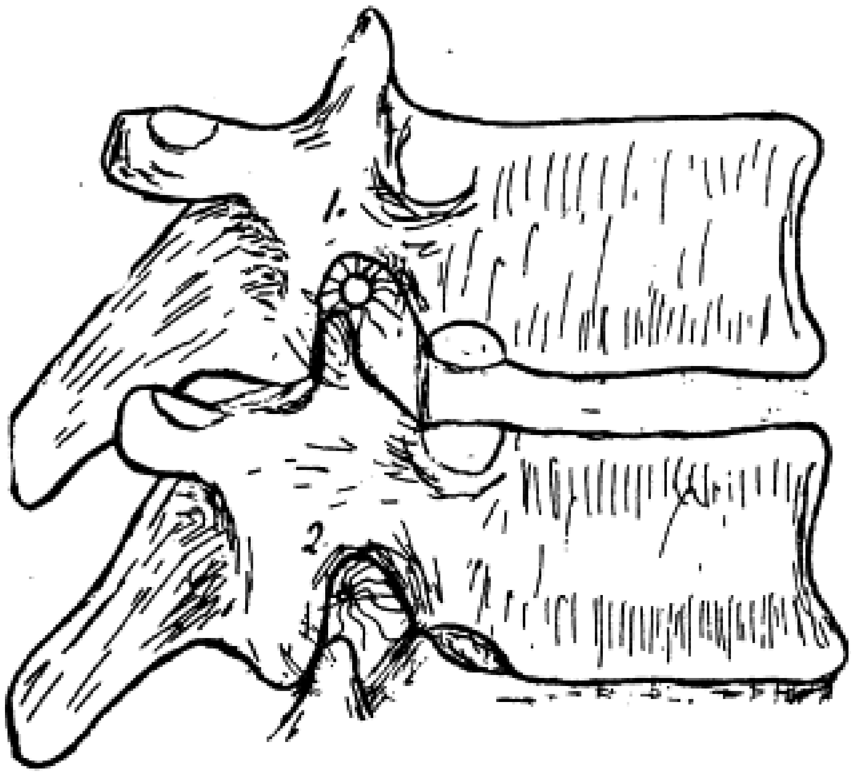


FIG. 14.—Showing distribution of (1) filaments from posterior nerve root and (2) from recurrent nerve, to spinal structures.

effects of the lesion upon the intervertebral vascular system. Quain makes the definite statement that the *pia mater of the cord is supplied by filaments from the grey rami.* Since this is the sheath that governs in large part the vascular condition of the cord lesion to these fibres will certainly be productive of disorder.

THE VASO-MOTOR SYSTEM.

In order to understand certain further effects relative to the influence of lesions on the sympathetic and related systems a brief recapitulation of the vaso-motor mechanism is necessary. By the term **vaso-motor** is meant simply a nerve mechanism which governs the caliber of the vascular system by increasing or decreasing the tone of the muscle tissue in the vessel wall. The mechanism is probably universal in the vascular system though barely demonstrable in the lymphatic vessels and less completely shown in the vein than in the artery. Presumably the capillary system is destitute of any immediate nerve control. The arterial side of the circulation is more or less completely under such control and in large part the control of the arterioles comprehends the control of the vascular system. It is in this part of the vascular system that there is found the greatest relative amount of muscle tissue and hence the greatest abundance of nerve distribution.

Two classes of vaso-motor nerves are represented, the *constrictor* which increases the tonic condition, and the *dilator* which decreases that condition corresponding to the influence exercised over the heart muscle by the vagus. In large part the same nerve trunk contains both kinds of nerve fibres. In a few known cases they are distinct. In general the constrictor nerves are limited to the white rami which are given off from the spinal nerves from the second thoracic to the second lumbar inclusive, while the dilators are contained in abundance in several of the cranial and spinal nerves.

The vaso-motor mechanism is essentially a reflex arrangement in which the *efferent pathway only contains the vaso-motor* *nerves*, any sensory nerve coming into relation with the cell bodies of the efferent nerves acting as the afferent pathway. Whether there are special afferent nerves associated with the vaso-motor mechanism is not definitely known except in the one case of the *depressor nerve* of the heart. Sensory nerves distributed to the wall of the artery itself may carry a special afferent impulse for motor response. The *condition of the blood* with reference to the quantity or quality may be a factor in the possible automatic action of certain of the vaso-motor centers. The third necessary part in the reflex arc is the *center* and there are numerous such associated with the constrictor and dilator pathways. The *general* vaso-motor center, bilateral in arrangement, is known to exist in the medulla; *secondary* centers are found in the cord, indefinite in number and influence but undoubtedly acting in a segmental capacity; some authors insist on further secondary centers located in the ganglia of the sympathetic but the evidence for this proposition is inconclusive, although it would seem a fairly safe assumption.

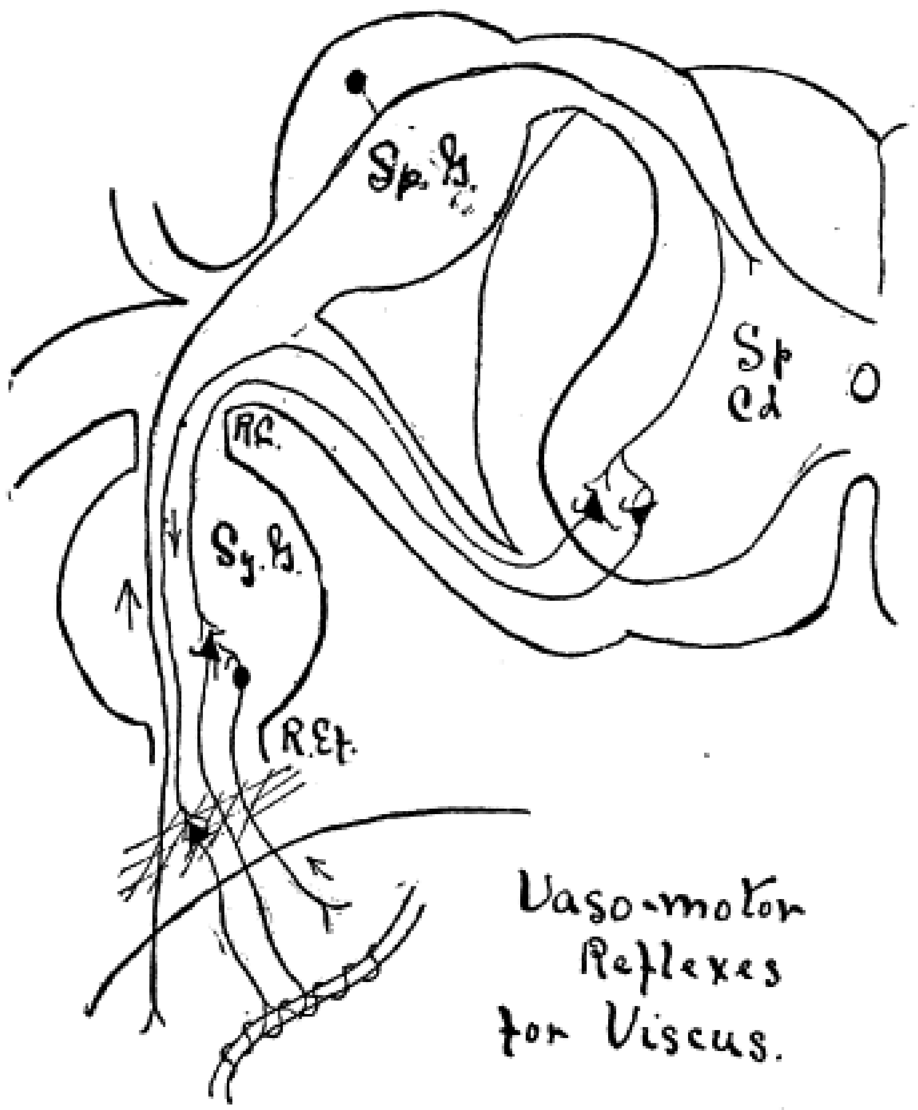


FIG. 15.—Representation of way in which a viscus secures increase or decrease in blood supply.

With respect to the **action** of the two forms a few differences have been noted; the constrictors respond more quickly to a stimulus though the effect is less prolonged than is the case with the dilator; the constrictor is also more easily exhausted and degenerates more quickly after section; the constrictor influence is a *continuous* one while the dilator is an *intermittent* one and serves as an emergency apparatus. Each organ of the body is supplied with a local mechanism, the so-called vaso-motor centers being represented by spinal and other areas, as follows:

1. All parts of the **head** including the brain, the cervical and upper thoracic regions.
2. **Lungs**, from the second to the seventh thoracic.
3. **Heart**, the pneumogastric nerve and the upper thoracic.
4. **Intestines**, fifth thoracic to the second lumbar.
5. **Liver and spleen**, the lower thoracic.
6. **Kidney,** lower thoracic and upper lumbar.
7. **Bladder and generative organs,** the lumbar and sacral regions.
8. **Limbs**, lower cervical to upper thoracic, and lower thoracic to upper lumbar.

The several regions represent those parts of the gray matter of the spinal cord and sympathetic ganglia which seem to act as definite centers for controlling the local supply, and osteopathic experience bears out the physiological experimentation in thus assigning these various regions.

SPINAL LESIONS AFFECTING VASO-MOTORS.

It is a **striking fact**, when once attention is called to it, that in the vast majority of disease conditions there will be either a condition of inflammation or evidence of a previous inflammatory disorder. Thus an ordinary cold in the head, or a bronchitis, or a bronchial pneumonia is but an inflammation partially dependent upon stagnant blood; gastritis, peritonitis, and catarrahal jaundice, represent similar mucous inflammation; Bright's disease is an inflammation following congestion of the kidneys, while many paralyses and valvular heart troubles represent conditions resulting from inflammation. Osteopaths are firmly of the opinion that in an indefinite though undoubtedly large number of cases a part if not the whole of the cause is to be found in a disorder of the local vaso-motor mechanism. Stagnant blood is always a predisposing if not an immediate and exciting factor in the production of disease. Further, every organ and tissue requires for its normal functioning a definite amount of blood and a sufficiently rapid drainage. Under circumstances of perfect health the amount of blood in a part is regulated with the most exact nicety. When because of increased labor, an organ—for instance the stomach—requires an additional amount of blood a stimulus, such as the presence of food materials mechanically acting upon the gastric mucous lining, is applied to the nerve terminals distributed there. As a result an impulse is transmitted along the visceral afferent sympathetic to the ganglion or segment of spinal cord which represents the local vaso-motor center. This center is influenced in such a way as to send out efferent impulses over the vaso-dilator nerves that pass by way of the sympathetic system back to the arterioles associated with the gastric mucosa. Through the influence of these nerves the muscle tissue in the walls of the arterioles lessens in its tone and permits the general blood pressure to force an excess of blood into the yielding vessels. Or *this other possibility* presents itself. The afferent impulses coming into relation with the cell bodies giving off constrictor influences, lessens the normal chemical and vital activity in the cell protoplasm with a consequent lessening of the intensity or rapidity of impulses that continuously pass over the constrictor nerves distributed to the muscle. The effect will be the same as in the other case, i. e., a dilatation due to loss of tone, and general blood pressure. (See Fig. 15). But in case an irritant were acting upon some part of this mechanism such as to disturb the equilibrium of the impulses associated with the organ, an irregularity in the blood supply would result and hence a disturbance of function. Such an **irritation** could easily result from a spinal lesion of almost any of the types mentioned in a previous section. In this case the assumption is made that the lesion affects the *outgoing* nerve and this causes the circulatory disturbance. But it is an equally plausible one that the lesion should affect fibres of an *afferent* nature as they pass from the ganglion through the devious pathway back to the spinal cord there influencing in times out of season those cells which in season dispense a proper quality and quantity of impulses. But another explanation suggests itself. The spinal cord has its vascular system and its vaso-motor control and doubtless *each segment has to a greater or less extent its own local arrangement.* Those fibres which control the caliber of the vessels of the spinal cord pass in part by way of the routes suggested in discussing the distribution of the grey rami. It was further emphasized that these filaments that pass back into the canal are, of all parts of the sympathetic system, the most subject to lesion. Hence when a lesion occurs these fibres above all others will be the ones to suffer, which means conditions in the spinal cord analgous to those referred to in connection with the stomach. That is, a condition either of ischæmia or hyperæmia of the cord may result, in either case producing a disturbance in the outgoing impulses from all parts of the segment. Note that theoretically there are two possible explanations of both the hyperæmic and ischæmic conditions resulting from vaso-motor disturbance. Hyperæmia will result from either a stimulation of the vaso-dilators or an inhibition of the vaso-constrictors, while ischæmia will result from either a stimulation of the constrictor or, provided we accept the doubtful assumption that the dilator is continuously active, the inhibition of the dilators. Where both fibres to the same part are acted upon equally the immediate result may not be apparent for the one will tend to counteract the other. But in a comparatively short time when both elements become exhausted, dilatation will result, and the effect in the long run *will always be an inhibition of the tone of the vessel.* Hence we should expect to find in most diseases dependent upon irritation to the vaso-motor mechanism, a congested condition, and such indeed are the observed facts.

In case of a lesion thus present and producing manifest disorder, it must not be assumed that the effect is a **simple** one. For, because of the strain in the production of the lesion and because of the interference with the mechanism controlling the nutritive conditions of the entire local spinal structures, there will be pressure exerted in all directions through the congestion and infiltration of the structures, thus making possible countless varieties of local and remote effects.

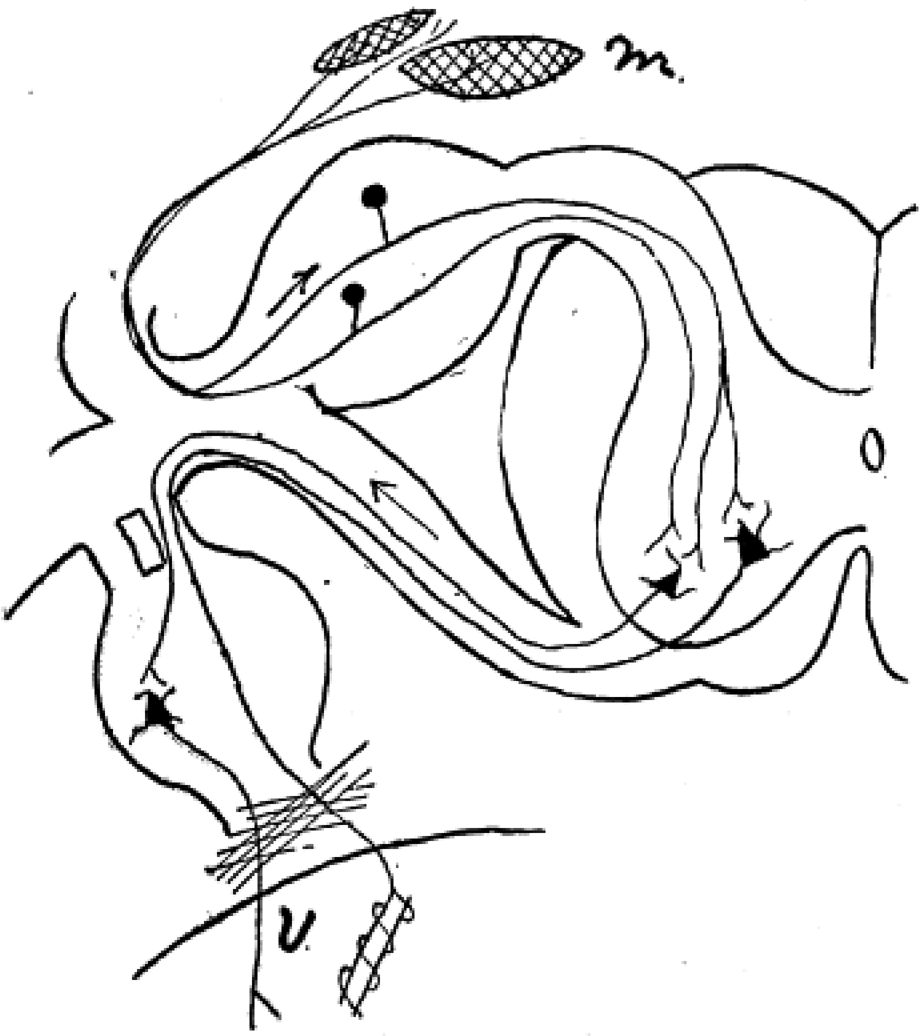


Fig. 16.—Diagrammatic explanation of disordered viscus from contractured spinal muscles.

But it is not necessary to assume that the sympathetic system or the vaso-motor mechansim must itself be subjected to pressure from the lesion. For, in connection with the segment of the cord are myriads of *spinal afferent pathways* from the deep and superficial, near and remote structures, which are continually pouring in their streams of impulses from the periphery. An irritating force acting upon these afferent fibres will cause an excess in the metabolism of the segment involved. From this conception we may understand the explanation of congestive and catarrhal conditions of the various viscera dependent on **muscle contracture**. Owing to the wide distribution of afferent spinal nerves in and among the fibres of the muscle a contractured condition of that tissue will produce an increase in the shower of impulses transmitted to the spinal segment. Hence from exposure or other cause, if the upper thoracic spinal and chest muscles contract, a congested condition of the *lung* structures will result and the way opened for bronchitis or pneumonia; if the lower thoracic or lumbar structures be tightened, congested or catarrhal conditions of the *intestinal mucosa* occurs and a diarrhœa results; or a thickening of the suboccipital tissues will produce congestion of the *nasal* and orbital regions and a cold in the head with conjunctivitis follows. This will be dependent on a more or less general physiological law that has been referred to, i. e., the activity of a given collection of nerve cells depends upon the total number of impulses that pass to it from all sources. This does not necessarily mean that the greater the number of such impulses passing to the center the greater will be the activity of the part in sending out impulses; for it is known that one of the functions of the higher parts of the nervous system is that of inhibiting actions that would otherwise take place. This function of *inhibition* is pre-eminently

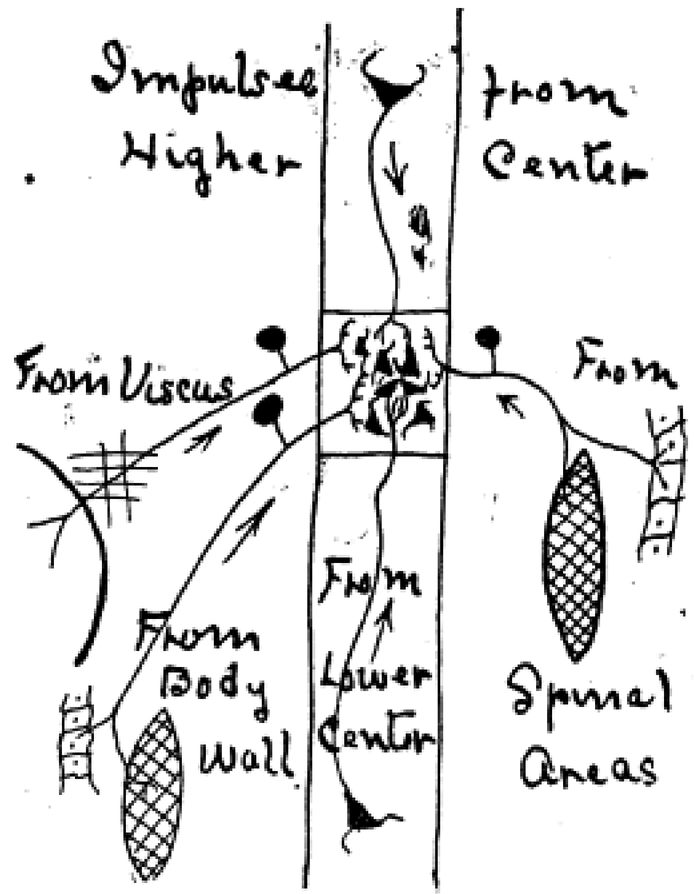


Fig. 17.—Showing the numerous areas from which segment of cord may be influenced.

a power of the cortex but some evidence indicates that the spinal cord may exercise it under certain circumstances. The law may be further modified by the unknown factor of a *vital directing force*; but in general the action of the center will vary with the number and intensity of stimuli reaching it from the periphery or other parts external to it.

In connection with the above it is advisable to further emphasize the fact of **radiation of impulses** which is a phenomenon of all nerve tissue. Normally the effect of an incoming impulse will be associated mostly with the segment that receives it. For instance, the phenomena of Pfluger's laws of unilateral and symmetrical response show that a slight stimulus will affect only the limb to which the stimulus was applied. Increase the intensity or duration and the corresponding limb will respond. Still further intensify the stimulus and there is produced a radiation up and down in the adjacent segments, showing an overflow of impulses from the segment which receives, into those nearest at hand. The phenomenon is also noticed in connection with the immersion of one hand in hot water; in this case both limbs respond by vaso-motor changes. Considering these various facts it is not at all difficult to believe that a stimulus in the nature of a continued contracture of a spinal muscle may result in sufficient local change of spinal cord metabolism to affect the cell bodies whose axis cylinder processes pass through the sympathetic system to be distributed to various end organs in the viscera. Or on the other hand it is no more

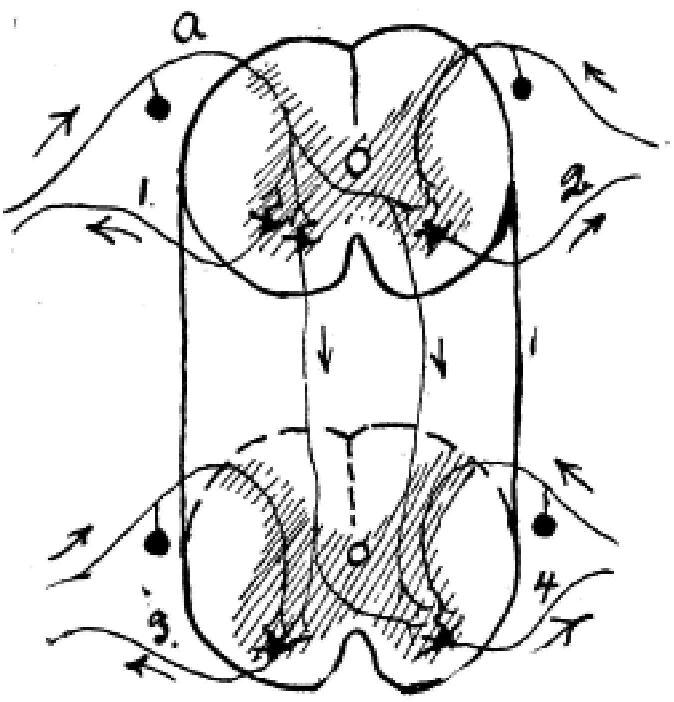


FIG. 18.—Illustrating Pfluger's laws of the reflex. Stimulus applied at *a* will produce response in serial order in fibre 1, 2, 3, and 4, depending on a graduated application.

difficult to conceive of a sufficient number of visceral sensations—pain, for instance—passing to the cord segment, to there cause an overflow into the cell bodies whose processes pass to the spinal muscles. In this latter case a *secondary muscle contracture* would be the result.

Another suggested explanation of the effect of contractured spinal muscles upon the various viscera, has reference to the anatomical relations between the blood supply to the cord and that to the muscles. Taking a typical region, the thoracic, it will be noticed that the same branch of the intercostal artery supplies both the spinal cord and the spinal muscles and other superficial tissues. The contracture of those spinal tissues acts in a mechanical way to obstruct the blood flow to and from the superficial spinal region with a consequent forcing of an excess of blood into those branches most closely related, i. e., the branches to the spinal cord. As a result there will be a disturbed cord metabolism from the hyperæmic condition produced; and the same numerous immediate and remote effects referred to above will be produced. This explanation, usually referred to as **Hart's theory**, is not entirely satisfactory, but nevertheless is of value as helping to explain all disorders due to a collateral hyperæmia. While it is possible that those branches nearest to the ones obstructed will be first involved in an overfilled condition it cannot long persist *except an impairment of the local vaso-motor mechanism be produced.* For the blood stream throughout the entire system being an open one, the entire system will expand to accommodate the blood shut out from the superficial spinal area, owing to

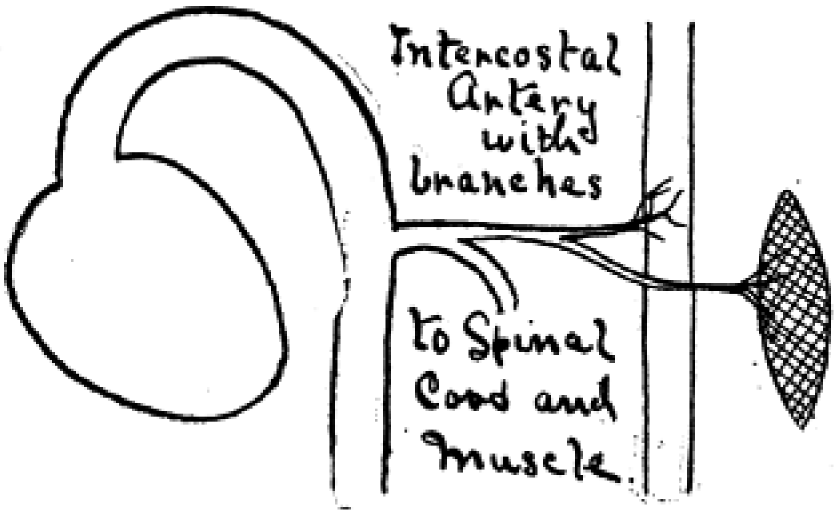


FIG. 19.—Illustrating Hart's theory.

the pressure of fluids being propagated equally in all directions. If there is a less resistance associated with the branches to the cord, then there will be a tendency for dilatation in these. And this condition is likely soon to result owing to the usually complex nature of the spinal lesion. But this will manifestly involve the integrity of the *local nerve apparatus*, and hence it is necessary to consider that involvement as an essential in the production of a disorder of any permanency. The fact that a blockage of any part of the vascular system thereby producing a hyperæmic or ischæmic condition in the part, will secondarily produce the opposite condition in some other part, is worthy of attention whether it be in relation to the spinal cord or other structure. Owing to the approximate constancy in amount of the total fluids of the body a hyperæmia in one part means an ischæmia of another, whether due to direct pressure on the vessel or to vaso-motor disorder.

OTHER EFFECTS.

What has been said with reference to the effect of the spinal lesion upon the vaso-motor mechanism will be true in large part with reference to the **other functions** of the sympathetic fibres. In the upper thoracic region the lesion may affect the *pupillo-constrictor* and *dilator* fibres which pass to the muscle tissue of the iris with a resulting condition of dilated or narrowed pupil. In the same region arise the fibres which carry *accelerator* impulses to the heart muscle. Hence the lesion may produce over-activity or lessened activity of the cardiac muscle. In the middle thoracic the *viscero-motors* to the upper intestine may be excited and a condition of muscular cramp or increased peristalsis may result; or on the other hand the *viscero-inhibitors* may be disturbed and a disorganization of intestinal motion follow. Throughout all parts of the spine lesions may interfere with the *pilo-motor* fibres that are given off and hence disturbance of the functioning of the hair and of the sebaceous glands will occur. The *secretory* fibres that pass to the sweat glands in all parts of the body may be irritated by the lesion and changed secretion with various associated effects be the consequence, while similar fibres which pass to the visceral glandular organs may be equally disordered with a resulting disturbance of external or internal secretions which may have the most profound effects upon both local and general body metabolism.

It has been pointed out that with the bony or other deeper lesion there will usually be a muscle contracture which may be primary or secondary. By reference to the sympathetic system the student is prepared to understand how a **secondary muscle contracture** may be produced from a diseased viscus. For a specific case we may take the condition of gastritis. In such a condition there will be irritation to the mucous lining of the stomach which affects the terminals of the sensory nerves distributed therein. As a result an afferent impulse passes by way of the sympathetic afferent nerves around to the posterior nerve root and thence into the spinal cord. Here it will influence various of the cell bodies with which it comes into relation. Among these are the cells in the anterior horn of the grey matter whose axis cylinder processes pass out by the anterior nerve root and over the posterior primary division of the spinal nerve to the muscles of the thoracic region of the spine. These fibres carry first, *motor* impulses to the muscle fibres, and hence the increase in the impulse may be sufficient to cause a simple muscle contraction which if long continued will develop into a typical contracture. But secondly, the cell body irritated may give rise to impulses which are transmitted by way of the sympathetic fibres to the posterior primary division and end in connection with the muscle tissue in the walls of the muscle vessels. These influences may be either *constrictor* or *dilator* in character and in either case a disturbance of the muscle nutrition will result which will lead to contracture. Ultimately whether constrictor or dilator is affected the vascular condition will be one of stagnation.

But it would seem unnecessary to assume that the impulse along the sympathetic afferent fibre should pass to the spinal cord at all. As before indicated there is some evidence and much reason to show that some of the afferent fibres from the viscus end in connection with the cell bodies of the ganglia of the sympathetic. It is known that here are cells whose processes pass to the posterior primary division of the spinal nerve. It is entirely reasonable to assume that the afferent impulse ending in the ganglion initiates changes in the cell bodies by a process of radiation of impulses which is universal in all grey matter, sufficient to affect those cells which convey vaso-motor or other impulses to the muscle tissue of the spinal area, resulting in a contracture affect. Altogether the facts of anatomical nerve distribution and the laws of nerve action make it quite reasonable that a contracture may be produced. The fact of the secondary contracture will hardly be denied though the explanations may be at fault.

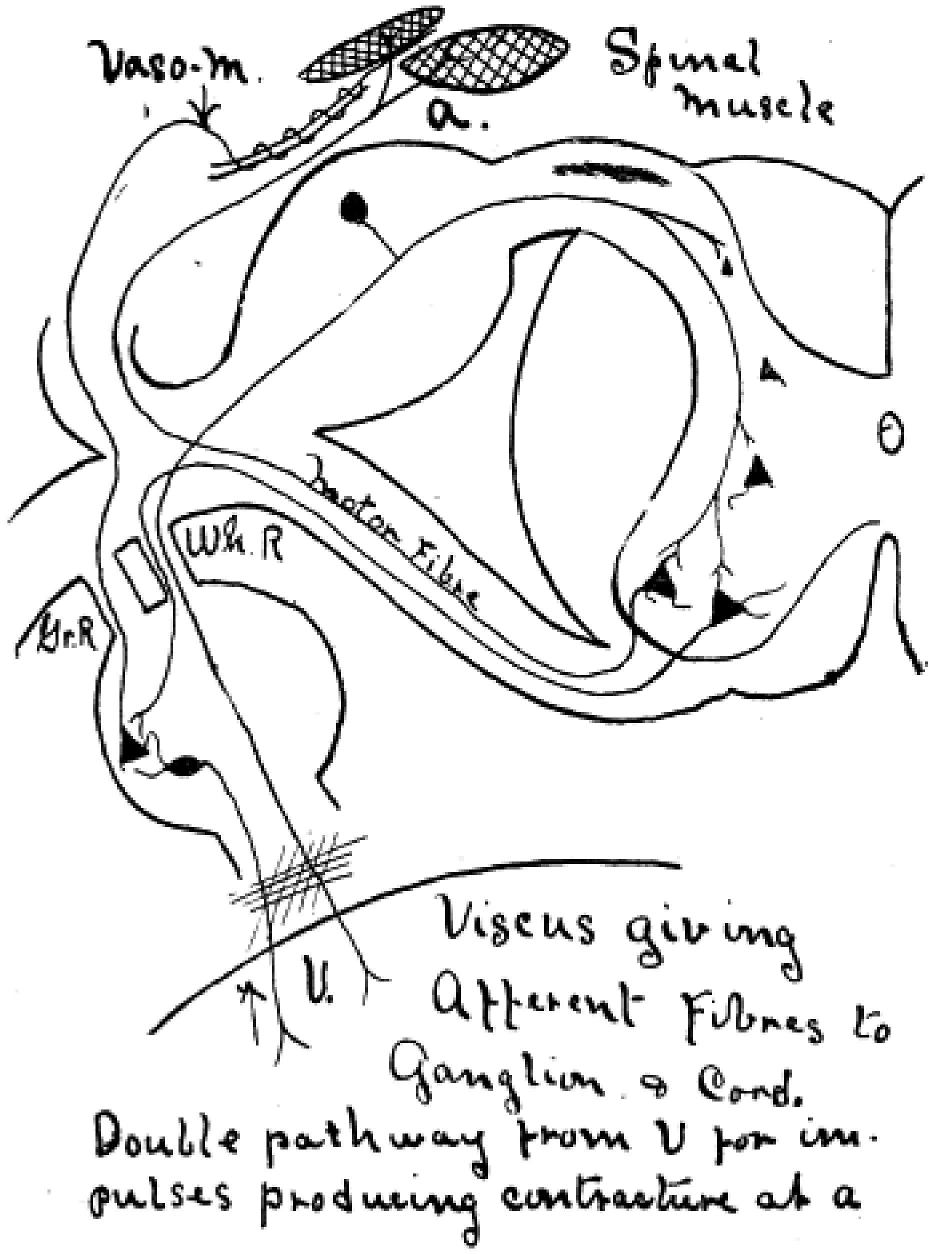


Fig. 20.—Diagrammatic explanation of spinal muscle contracture secondary to visceral disorder.

CHAPTER XI.

CERVICAL LESIONS—DIAGNOSIS AND TREATMENT.

Superficial Structures.

The points emphasized in a previous chapter regarding the necessity for observing the part under **different functional conditions** hold especially in case of the neck. The manner in which the head is held while the patient is in an erect position, is in numerous cases suggestive of cervical disorder. The *lateral inclination* of the head suggests a lesion of some form, usually contracture, on the side toward which the head is inclined. Torticollis is a typical example of the extreme type. The *carefulness* with which the head is carried suggests an inflammatory disorder of the deep tissues such as caries, a severe headache, or other condition in which the jarring of the body is associated with increased pain. The *general contour* of the lines of the neck with reference to the presence of regions of fullness or depression should be noted. In many cases a distinct difference will be detected in the prominence of two corresponding parts of the neck, which is suggestive of disorder. Note however that it is not proof of such disorder. It often occurs that the side most used will show greater muscular and general tissue development than does the other. Hence the necessity for inquiring as to the *relative use* of the two sides, the occupation, or the exercise habits of the individual. It is well to speak in this connection of the necessity for careful *comparison of sides* where symmetrical structures present themselves, for it is common experience that a part may vary from the type pictured as normal in the mind of the physician and still be normal so far as the one under examination is concerned.

With the patient in the **horizontal position** additional facts may be brought out owing to the greater relaxation that is secured simply by the assumption of this position. With the ordinary patient undergoing his first examination there will be considerable anxiety or nervousness which of itself, through influencing various nerve connections, would tend to obscure the usual condition. In this position there will be a less *restraint* on the part of the patient, and by engaging him in conversation or otherwise getting his mind employed, the muscle tissues will still further undergo a spontaneous relaxation.

With the patient in these different positions the **following** should be carefully examined; muscle groups including the lateral, posterior, and anterior; ligamentous structures which comprehend the deep vertebral connecting tissues and the ligamentum nuchæ; the cervical vertebræ, inferior maxillary, and hyoid bones; the laryngeal and tracheal cartilages; the tonsils, thyroid and lymphatic glands; and those vascular and nervous structures that can be more or less directly reached.

Notice the situation and the condition of the **sterno-mastoid** muscle. Owing to its prominence it serves as a definite *landmark* for locating other structures and assists in overcoming certain lesion conditions. The muscle can be made prominent by rotating the head to the side opposite the muscle examined and can be put upon the stretch by bending the head to the opposite side and rotating it toward the same side. This latter movement will assist in elevating the anterior end of the clavicle, sternum, and upper ribs. Occasionally the muscle will be found *contractured* or otherwise in a disordered condition. By attention to the region of its nerve supply together with some direct work upon the muscle itself the condition can usually be overcome. Of the *structures* which lie in close relation to the muscle, several are important: the carotid artery, the internal jugular vein, and the vagus nerve in their common sheath of connective tissue pass through the cervical region behind the anterior margin of the muscle; the cervical portion of the sympathetic cord lies underneath the common sheath; cervical nerves including the phrenic and the brachial plexus, will be found behind the lower half of the muscle in close association with the scaleni; the superficial and deep cervical lymphatics also lie in close relation to this muscle and in many cases of inflammatory disorders of the upper respiratory and digestive tracts, the glands will be found enlarged and tender, in which case they should be avoided as much as is possible in examining and manipulating the associated structures. These various organs may be more or less irritated by disordered conditions of the muscle.

The **scaleni** muscles are of considerably greater importance to the osteopath than is the sterno-mastoid, in so far as their own abnormal conditions and the production of abnormal conditions of other parts are concerned. Notice the *attachments* and situation of these muscles. Ignoring the posticus, often absent and seldom important, these muscles are concerned with changing the position of the cervical vertebræ and the first rib. The *normal condition* of the scaleni muscles seems to be one of greater density and tension than that of the average muscle at rest, and the student should become familiar with the normal sensation in their palpation. Note the further fact that they lie in close relation to the irregular and roughened *transverse processes* so that any pressure or other direct manipulation should be done with caution, or an irritation and hence additional contracture will result. These muscles may be easily detected by palpation posterior to the lower half of the sterno-mastoid muscle and following along and in front of the row of transverse processes. In a contractured condition one or both of *two effects* will occur, i.e., a distortion of the cervical vertebræ or a subluxation upward of the first rib. In most cases it will be the latter and a tightened and tender basal portion of the neck will be complained of by the patient. The contracture of the scaleni will be *dependent on irritation to the cervical branches which supply* *them*, and hence adjusting the deeper lesions will be the fundamental treatment. Aid may be given by direct treatment to the muscles in the various ways suggested for overcoming contractured muscles. A common method is a serial one of stretching, approximation of orgin and insertion, and direct pressure. One hand flexes the head to the opposite side enough to slightly tense the muscles, then as the head is rotated back, pressure is made by the other hand directly upon the muscle; but the pressure must be *carefully applied* or the treatment will avail nothing. These muscles may be used for purposes of adjusting the ribs and vertebræ and will be spoken of in that connection under the appropriate subject. *Structures in close relation* to the scaleni muscles and subject to lesion therefrom are branches of the cervical plexus, phrenic nerve, brachial plexus, and arterial and venous channels, together with a few of those mentioned in connection with the sterno-mastoid. The *brachial plexus* is of special import because of its close relation. Fibres composing the plexus arise from between the anticus and medius and form upon the lower part of those muscles, passing therefrom over the first rib to reach the axillæ.

The **posterior muscles** are of much value in diagnosis and are interesting in their assiociation with many diseases of the cervical and cephalic structures. Attention is called to the fact that in numerous instances there will be a quite appreciable *difference in temperature* between the posterior and other groups of cervical muscles, the condition of the former usually being one of a lower temperature than that of the latter. Especially is the *suboccipital* region worthy of notice. Perhaps no other region of the body is so often found in a state of contracture or so often made use of in manipulation. The depression in the mid-line next the occiput caused by a partial division of the ligamentum nuchæ and less abrupt ones on either side of the upper attachment of that structure are to be noticed. *Pressure* in these regions will often cause a sensation of pain or fullness in different parts of the head.

Headaches, general vaso-motor disturbances, feverishness, and the like are often caused and cured in this region. In nearly all cases of *headache* some relief may be given by a strong but careful relaxing pressure applied by bending the head back against the fingers pressed deeply into the tissues at this point. Owing to the close relation of the centers in the *medulla* to this part of the spinal cord, various effects, near and remote, may be gotten by a relaxive and adjustive application. The *ligamentum nuchæ* is a structure associated with this region which is of interest to the osteopath. Its *attachments* are suggestive; above to the occiput, below to *every spinous process from the seventh cervical to the sacrum.* For it is practically continuous with the supra-spinous ligaments in the other parts of the spine. In many cases the ligament itself seems to be in a contracted state, and the patient will complain of a drawing sensation in that area. Often the simple process of flexing the head forward on the chest will produce a tempory if not permanent relief. It is of further value as a *factor in diagnosis.* The tensing of the ligament as above suggested will put on tension all of the ligamentous slips between adjacent spinous processes throughout the spine. Owing to the usual oblique direction of the spinous process a considerable leverage will be secured. If lesion exists in any part and if pain is present it will likely be felt when the flexion is produced. In some cases where other methods fail to show tenderness this is quite effective. As a means of securing *adjustment* of parts the ligament is valuable. By the pull upward parts may be separated and moved somewhat laterally, and if pressure with the free hand be employ-

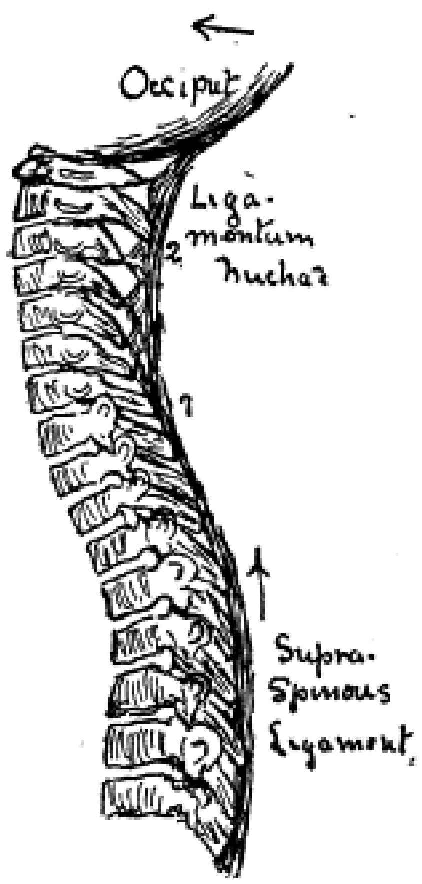


FIG. 21.—Showing leverage secured on spinous processes by forward flexion of head.

ed upon the spinous process movement of any vertebra may be effected.

The **hyoid bone** is a structure that should be carefully noticed. Having *no articulation* with other osseous tissues and being suspended within ligamentous and muscular structures, its relative position is indicative of the condition of the latter. Usually there will be little difficulty in locating it but in occasional cases where there is an excess of other cervical tissue or a denseness of surrounding structures some difficulty may be encountered by the inexperienced in detecting its *position*. Note that it is the first dense structure lying above the prominence of the thyroid cartilage, the latter always being sufficiently prominent to be easily detected. By placing the hand over the tissues on one side and pressing to the other, the greater cornua of the opposite side will be detected through the tissues. Then by maintaining contact with this and exerting pressure back again, the other will be felt. Note the readiness with which it yields to pressure between the fingers. It it resists, *ossification* is well developed; otherwise, as in all younger individuals, it is quite yielding and indicates its cartilaginous composition. The cornuæ can usually be traced back to their continuation with the ligamentous structures which suspend the bone. Note these deep tissues to determine their contracture and tenderness. Compare the two cornuæ in regard to their *respective levels*. When one side is higher than the other it usually means a contracture on the same side, of the supra-hyoid muscles; less often a contracture of the infra-hyoid muscles on the opposite side. The feeling of the tissues themselves together with the sensory condition manifested will render the difficulty of diagnosis less serious.

The discussion of the hyoid leads logically to the consideration of the **throat structures**. These are, taken as a whole and separately, of the greatest importance. In every case of throat or nasal difficulty as well as disorders of other parts in that region, these muscles will be found in a condition of tenderness and contracture. Pain can be easily produced by deep pressure upward and inward, in a normal condition, but will be quite marked where abnormality exists. In many cases of *catarrh* this region may be the only one presenting sensory disturbance. In their close relation to the cervical vessels and nerves, contracture of these tissues can very easily affect portions of the body above and below. The direct *relaxation* of the parts may be most readily effected by placing the patient in the supine position, and standing at the side, reach over and with the flat of the hand and fingers exert deep but gradual and careful pressure, at the same time rolling the head to the opposite side or lifting it up and flexing it directly over and upon the manipulating hand. This latter movement markedly increases the approximation of origin and insertion and allows deeper pressure with less irritation. In many cases this treatment will be little more than a *temporary expedient*, and hence it will be necessary to look for the deeper lesions which can usually be found associated with disturbance of the upper cervical vertebræ, the removal of this last named being the logical method for permanent cure.

The **tonsils** will be noticed if they are in an inflamed or enlarged condition. Normally they are not subject to palpation *externally*, but on considerable enlargement will be felt, together with the infiltrated tissues—which is a usual acaccompaniment—by pressing deeply upward underneath the angle of the inferior maxillary bone toward the faucial region. *Internally*, whether in a normal or other condition, they will be seen on either side of the isthmus of the fauces. The tonsil is a lymphoid structure and should not be directly treated except with extreme care.

The **cartilages** associated with the respiratory tract should be examined. The prominence known as "Adam's Apple" (*pomum Adami*) usually more marked in the male, is the most noticeable part of the *thyroid cartilage* and is valuable as a landmark for locating the hyoid bone above and the thyroid gland below. Note should be taken of the yielding or resisting nature of the cartilage, the latter suggesting an ossification which is comparatively common among elderly individuals and more common than a similar condition of the other cartilages. Movement of the thyroid against the cricoid immediately below it, produced by lateral to-and-fro pressure, will usually show a form of *crepitus*. No particular significance is to be attached to the condition but the patient will often assume that something is wrong on discovering the peculiarity. In palpation over these structures a tendency to produce *coughing* may be noticed. This is suggestive of a hyper-irritable state of the vagus or of the laryngeal branches which supply the structures.

Underneath the laryngeal cartilages in the median line and on either side will be felt the **thyroid gland** more developed in the female adult. The isthmus which connects the two lateral lobes is a half inch in width and crosses the median line in front of the second or third tracheal ring of cartilage. The lateral lobes extend above and below this level to a variable distance. In many individuals the gland will be rather indistinct on inspection or palpation but in others it will be quite prominent. An enlarged condition is spoken of as *goitre*, and is a disorder quite commonly met with. Owing to the pliable nature of its parenchyma and to the fact that it is composed of lymphoid tissue any rough handling either of the normal or of the abnormal organ is to be condemned, though careful pressure is not dangerous. The usual lesions associated with the disease are found in the upper chest and lower cervical regions.

The various **vascular and nervous** structures have been mentioned in discussing the muscles. The external *jugular* vein with the associated superficial lymphatic vessels and glands crosses the sterno-mastoid in a vertical direction. This and the other vessels referred to often give valuable hints with reference to the condition of the *heart action*. The *inferior thyroid* vessels may be noticed in some cases where a supra-thoracic crowding is interfering with their function. The *phrenic nerve* passes down over the scaleni muscles from its mid-cervical formation, into the region of the chest. Cervical lesions often irritate its roots and obstinate hiccough result. The nerve can be more or less directly *reached* by pressure downward and inward in the angle formed by the junction of the sterno-mastoid with the anterior end of the clavicle, or occasionally pressure downward and outward in the depression above the sternum. The *gangliated cord* may be reached indirectly by pressure applied to the front of the transverse processes of the vertebræ. The wisdom of such pressure is decidedly open to question since more harm than good will usually result.

THE CERVICAL VERTEBRÆ.

These vertebræ are peculiar from several standpoints. Their *greater mobility* which renders them more susceptible to luxation, the *variety* in the formation of the several bones, and their *closer relation* to the important medullary centers make a detailed discussion imperative for a clear understanding of the numerous disorders that may arise from a cervical lesion, and a proper appreciation of the effects secured by adjustment of the cervical tissues.

In making an **examination** of the vertebræ it is often necessary to produce as complete a relaxation as is possible, and hence after noting the various peculiarities that may be presented while the head is held erect, the patient should assume the horizontal posture. Then by a quiet series of rolling of the head from side to side together with pressure and other methods for temporary relaxation, the patient will be in a proper condition for minute examination of the deeper structures. The *flat of the hand* should be laid carefully upon the antero-lateral and postero-lateral aspects and while rolling the head to the side pressure is exerted in a direction opposite to the movement of the head. Or, standing at the head of the patient and clasping the postero-lateral structures on each side the neck may be quietly manipulated sufficient to temporarily relax. In some cases where there is an inflammatory or makedly congested condition of the neck and throat muscles it may be painful to apply much direct pressure to the parts. In such case the writer has found the *following method* satisfactory especially in cases associated with much lymphatic enlargement and inflammation. Standing at the head of the patient grasp the chin with one hand, the occiput with the other, then keeping the axis of the head parallel to the axis of the body, rotate the head through a complete circle and reverse. A few rotations thus applied slowly will open up the deeper structures and produce conditions that will quite appreciably lessen the tension and sensitiveness so that further examination becomes possible.

Having gotten the superficial tissues relaxed several important points are noticed with reference to the nature and relations of the cervical vertebræ. Note that in the erect position there will be a distinct *anterior convexity*, so much so that the spines of the third, fourth, and fifth will be only with difficulty made out. The considerable mobility of this part of the spine in comparison with other regions will be another striking fact and any rigidity not dependent upon a voluntary though unconscious contraction of the cervical muscles suggests a thickened ligamentous condition. Rolling the head from side to side, showing a difference in the comparative *amount of rotation*, is a method of value to determine the lesion. The *flexion* of the head strongly forward on the chest should not be associated with much discomfort in the average individual. If the latter be produced lesion is indicated. This same method should throw the vertebræ sufficiently posterior to enable one to detect the spines with the exception of that of the atlas. In many cases the spinous, the transverse, and the articular *processes* of each of the vertebraæ can be made out without great difficulty. It is usually stated that the rudimentary spine of the first cervical cannot be detected. Yet if sufficient care be taken with reference to a preliminary relaxation, *that process can be detected* in twenty-five percent of cases. By gradually insinuating the finger in the depression between the occiput and the spine of the axis after a preliminary relaxing treatment, the spine will be felt as a definite tubercle deeply within the tissue. But in most cases reliance must be made on the *transverse processes* and the surrounding tissues for the determination of the situation and condition of the atlas. The transverse processes will be detected between the angle of the jaw and the mastoid process of the temporal bone, varying within rather wide limits with individuals. In most cases they are easily detected but in a few there may be considerable difficulty in locating them owing to the condition of the tissues and the development of the processes. It would seem that the transverse processes of the atlas, more than the similar processes of others, are subject to great variation in relative *position, size, and shape.* Not only that but in half the cases examined there will be a difference in size, perhaps in shape, between the two processes of the same atlas. Hence the physician should be on his guard against a hasty judgment with reference to the nature of the atlas lesion.

All things considered, the most satisfactory position for examining the atlas is the horizontal one with the examiner standing at the head of the table. Applying the surface of the index fingers gently on either side underneath the angle of the inferior maxillary, careful pressure is exerted toward the median line. In most cases the fingers will soon come in contact with the ends of the processes. If they are not immediately felt *take time* and allow the fingers and tissues to become accustomed to each other, then with careful exploration in all directions the processes will be detected. In some cases they will be found rather *underneath* or even behind the mastoid process. In others they will be forward and *above* a line passing through the most prominent part of the angles of the inferior maxillary. In many cases they will stand out on a *level* with the mastoid or the jaw, while in others they will be so *deeply situated* as to be reached only with difficulty. By comparison of the ends of the transverse processes on either side with the mastoid, maxillary, and other points of prominence, it can be determined whether there be a lateral, a twisted, a tipped, or otherwise distorted condition. Examine along the *postero-lateral arches* of the atlas. While these arches cannot be directly reached the overlying tissues will almost invariably indicate a lesion by their soreness, congested and contractured condition. In the region of the transverse processes *tenderness* and density of tissue will usually be manifest. Even in normal conditions the region of the transverse processes will usually be rather sensitive and hence care should be exercised in examining the part and in forming conclusions based on the sensory condition. In most cases one side will present a more marked sensory disturbance and that side will usually be the one toward which the vertebra is displaced. The *movements* that normally may take place between the atlas and the occiput are flexion, extension, and a lateral sliding, and in case a lesion is present it may be an extreme of any one or more of these. In many cases there will be a direct *lateral* condition with reference to the occiput, but an approximately normal position with reference to the other vertebræ, in which case the condition is more appropriately a subluxation of the occiput. In other cases it will be distorted with reference to both. A *tipped* condition is a fairly common one. This is dependent usually on a greater muscular tension on one side than on the opposite. A common condition is a *tightened posterior musculature* which draws the posterior arch upward in close proximity to the occiput. Or one side will be more closely approximated and the *level* be disturbed. A *torsion* is often met with. This is indicated by the anterior position of one transverse process in comparison with a posterior position of the other. The whole vertebra may be somewhat *anterior or posterior* with reference to the occiput but can go only inappreciably posteriorly with reference to the axis, owing to the relation between the atlas and the odontoid process of the axis. Yet it is illogical to affirm that it is absolutely impossible. *No change is impossible* provided the force shall act sufficiently long or sufficiently intense. With reference to the disturbance between the *atlas and axis*, the condition is more commonly a torsion, rotation being the most marked normal movement and accounting for most of the rotation in the cervical region. Lateral subluxations are also common, while the other possible conditions are occasionally observed.

In examination of the **axis** several landmarks present themselves. The *prominent spinous process* whose bifid nature is usually easily detected affords much information. Care must be exercised in forming conclusions from observation of this structure since because of its large size it is quite subject to variation in its growth. It is perhaps normally more developed on the side of the body which is used the most, and hence in examination of this as in other vertebræ it is always wise to inquire if the patient be right-handed or left-handed. The *transverse and articular* processes afford further opportunity for examination. The former will usually be found on a level with the spinous process underneath and behind the transverse process of the atlas. In some cases some difficulty will be encountered but usually the prominence will be sufficiently marked. The lesions associated with the axis are in general the same as those mentioned in connection with the atlas and will be detected by a comparison of the several points of prominence of the adjacent vertebræ, with the further notice of conditions of tenderness, contracture, and other states indicating lesion.

In examination of the **third to the fifth** inclusive, a few additional facts should be noticed. In the erect position the normal individual will present an anterior convexity but in the supine posture the curvature may be obliterated. In either position manipulation will show marked mobility in an antero-posterior direction. In many cases if the finger be pressed horizontally across the spine of the fourth cervical, strong pressure of the head back upon the finger will produce actual pinching of the finger between the spinous processes of the second and sixth. In the *diagnosis* of lesion reliance is made upon the position and condition of the transverse and articular processes. The former are the more subject to normal variations in size and shape and hence are not as satisfactory as are the latter. Further, owing to their irregular nature and the fact that very delicate structures lie immediately in front—i. e., the deep cervical vessels, sympathetic cord, and trunks of the spinal nerves—greater care must be exercised or harm may be done in pressing down upon them. The row of transverse process are noticed if pressure be applied *in front* of the sterno-mastoid muscle, backward and toward the median line, except in the lower part of the neck where they may be reached behind that muscle. On the other hand if pressure be made behind the sterno-mastoid, forward and toward the median line the row of articular processes will be felt. The articular processes—less markedly the transverse—will appear as a *ridge of bony tissue* presenting regularly distributed prominences. The latter represent the junction of two adjacent processes. It is at these points that prominence and pain will be most noticed if lesion is present. Then by reference to the other considerations of the lesion judgment may be made respecting the nature of the part under suspicion. The depth, antero-posteriorly, of the *pharyngeal cavity*, will be a point of interest in diagnosis of antero-posterior swerves of the cervical vertebræ, the posterior wall of the pharynx being formed of the bodies of the upper cervicals overlaid with connective, muscular, and mucous tissue.

The sixth cervical is noticeable because of close approximation of its spinous process to the superior surface of that of the seventh. The **seventh** is detected by its prominent spine which, though usually stated to be less, is often equally as protruding as the spine of the first thoracic. The *transverse process* of the seventh is usually felt just above and a trifle in front of the junction of the first rib with the process of the first thoracic. In many individuals a considerable mass of muscular and other tissues in this region makes its detection somewhat difficult. By reference to the spinous process of the seventh which is on a slightly lower level aid will be given. *Rotation and flexion* of the head on the neck in various ways will assist in determining the distinction between the spine of the last cervical and the first dorsal. Owing to the greater amount of tissue associated and the articulation with the rib, there will be noticeably less movement between the first and second thoracic than between the last cervical and first thoracic.

Adjustment of Cervical Vertebræ.

The general principles underlying the adjustment of the bony lesion have been referred to in a previous section. Briefly they are *exaggeration* of the lesion, *rotation*, and *pressure* upon the part. In many cases a preliminary relaxation is advisable while in a few relaxation may be the only treatment necessary. In general acute cases require more relaxation than do those of a chronic nature. Personally, in most cases of the latter, the writer gives but little attention to preliminary relaxation, but often *follows* the direct vertebral treatment by a quiet soothing pressure. In the average chronic case a slight movement of the vertebra toward its normal position is all that is desired, and that can be sufficiently accomplished without previous relaxation. At least the preliminary treatment will be only temporary in its effect on the muscle and as soon as the relaxive process is withheld the muscle again begins to contract. Note that *a chronic contracture is usually direct evidence of a deeper lesion* and that lesion is one that is shutting off normal interchange between the muscle and its sources of supply. The relaxive treatment applied after attempts to adjust the deeper parts is for the *purpose* of overcoming any excess of contracture or irritation that has arisen because of the stimulus from treatment.

A few specific cases will be given to illustrate the **principles** back of all movements designed to correct cervical disorder. A right lateral atlas is diagnosed. With patient on his back the physician stands at the head of the table with the fingers of each hand similarly disposed, clasping the tissues along the region of the *postero-lateral arches* of the atlas; at the same time the thumbs may be placed on the transverse processes. *Exaggerate* the lesion by thrusting with the left hand directly to the right the tissues over-lying the lateral arches; at the same time the head of the patient is pressed against the abdomen of the physician with sufficient force to give steadiness of movement. Then with exactly the *reverse process* pressure is applied over the right lateral arch and rotation is effected by movement of the hands and body of the physician. Do not, in exaggeration of the lesion, merely bend the head in the direction opposite to the displacement, as that will tend to *diffuse the exaggeration* over a larger area. Further, except in obstinate cases, *do not use much pressure upon the transverse processes*. This region is always tender and in lesion conditons is makedly so, hence the pressure may cause enough irritation to result in increased tightening of tissues. In nearly all cases enough lateral pressure for the purpose can be exerted on the lateral arches whose sensory condition will not be so disturbed.

Another method which has certain advantages is applied with the patient in the same position and with the exaggeration, rotation, and pressure produced in the same way except that one hand of the physician with fingers on one side and thumb on the opposite clasps the postero-lateral arches; with the other, which is placed upon the crown of the head, manipulation is made for purposes of rotation. Or with the head of the patient against the abdomen of the physician, the free hand grasps the chin for the purpose of manipulation and rotation. In all of these movements pressure is exerted downward upon the head in the direction of the axis of the spinal column in order to keep the muscles and other tissues as lax as is possible, although the treatment may be *finished* by slight longitudinal traction. This latter movement should not be used with too much force and should be a straight pull, not a jerking or twisting movement.

The same principles as the foregoing may be employed to advantage with the patient in the **sitting posture**. With the forehead of the patient resting against the chest of the physician the upper cervical tissues may be clasped by the fingers on either side of the atlas. Then by the chest and hands together and assisted by application of the chin of the physician to the crown of the patient's head, rotation and movement can be effected in any direction. Or with the patient sitting erect, the physician standing at the side places one hand on the crown of the head for purposes of rotation while with the other the cervical tissues are clasped in the usual manner. In case of a twisted atlas some pressue may be applied to the transverse processes in the direction to effect restoration; while in *anterior lesions* it may be necessary to get the fingers somewhat in front of the processes to exert a backward pressure. Bending the head strongly forward and pressing downward while at the same time working the part from side to side in many cases effects an adjustment of the anterior condition.

All of these various treatments can be easily applied and with equal or greater success to other of the cervical vertebræ. Owing to their less obstructed situations direct pressure may be gotten upon most parts of the bones and hence pressure may be exerted without hindrance in the direction the part should go in order to re-assume its normal position. In most cases it will not be advisable or necessary to exert pressure upon the transverse processes. The articular and spinous processes and associated tissue being sufficiently prominent the part may be moved at will. Strong but careful *rotation* of the head to either side is of advantage not only in detecting various lesion conditions but also in overcoming the deep ligamentous or muscular thickenings. *Flexion* of the head on the chest will tend to draw any of the cervical vertebræ in a posterior direction. (See Fig. 21). This will be more true with reference to the sixth and seventh cervicals to which the ligamentum nuchæ is more directly attached; if at the same time lateral pressure be applied to the spinous process alternately in each direction these two vertebrae can be very considerably affected.

The Inferior Maxillary Bone.

The inferior maxillary is a structure deserving more notice from the osteopath than its apparent functions would seem to justify. By virtue of the close relations existing between the articular structures of the condyle and certain important nervous, muscular, and glandular structures, it is often found associated in a causal relation with various local disorders. In making the **examination** the two general principles already referred to should be remembered i. e., examining the part during functional activity and functional rest. The normal movement of the bone is a complex one involving several sets of muscles, the elements of the movement being a vertical, a lateral, and an antero-posterior change in position. In examining the part in activity the patient should lie supine upon the table with the physician standing at the head. Then directing the patient to open and close the mouth note should be taken whether the mid-point of the chin *deviates* from the median line. In numerous cases it will be seen on opening the mouth to swing to one side, which usually indicates a difference in the tension of the muscular or ligamentous structures between the two sides, the deviation being *toward the side of greater tension.* This usually will depend on a pathological condition of the tissues on the side of greater tension but in occasional cases the lax articulation is the abnormal one. If now the fingers of the physician be inserted deeply behind the ascending rami the greater tension of the one side will become quite apparent. During the process of movement of the jaw note should be taken of the *sounds* quite often produced in the articulation. These sounds are similar to those produced by pressure on the ribs at the transverse articulations or in the cervical vertebrae on rotation of the head. In many cases it will be heard only on the one side and that the side of greater laxity. In others the sound seems to be produced equally on the two sides and in most cases will be more marked in those individuals whose other articulations are unusually lax. In many cases of these the condition would seem to be a normal one, at least in so far as other evidence of disorder is concerned.

The **lesions** associated with the inferior maxillary constitute simple *tension* conditions of the articular structures and partial or complete *luxation* of one or both sides of the bone. The movement of the articular surface of the condyle upon that of the temporal bone is a complex one. One movement consists in a simple sliding forward of the condyle to the anterior part of the articular surface which terminates upon the postero-inferior part of the articular eminence. In some cases of lesion it would seem that the condyle on one or both sides were resting *directly upon this eminence*. In other cases the subluxation consists in a *lateral sliding* of the bone as a whole. In these two types the part presumably is held in its abnormal position by muscular and ligamentous contracture. In a *complete dislocation* the condyle will rest upon the articular eminence or more or less completely in front of it, in which case the mouth will be forcibly prevented from closing. Where the dislocation is a *unilateral* one the symptoms are not so marked and there is more or less possibility of movement. It is with the subluxations, however, that the osteopath has most to do.

The **treatment** of the inferior maxillary usually resolves itself, in the case of the slight subluxations, into overcoming the tightened muscular and ligamentous conditions. This means that in many cases definite lesions will be associated with the upper cervical region which cause the disturbance of the nutrition of the articular structures. It is often sufficient to make use of a few so-called *specific treatments* grouped under the general head of "springing the jaw." The articulation can be affected by having the patient *open the mouth against resistance*. This is accomplished satisfactorily in the following manner: The physician standing at the head of the table, places the palms of the hands on the malar eminences and with the fingers grasps the point of the chin; then holding the mouth closed the patient is directed to open it. The articulation will thus be loosened through the action of a *lever of the third class* in which the chin is the fulcrum, the resistance of the articular structures the weight, while the power is applied through the digastric and other muscles passing from the hyoid bone to the horizontal ramus of the jaw near its anterior extremity. Placing a dense substance between the molar teeth and then approximating the incisors by pressure upward on the chin will produce a similar effect through a *leverage of the first class*. A third method producing similar results consists in closing the mouth against resistance. In this movement the fingers of the physician are inserted, while the patient's mouth is open, into the depression in front of the auditory canal caused by the lowered coronoid process. Owing to the painfulness of the treatment the author is personally *opposed to its use*. Another method in which opening the mouth against resistance is employed, forces the condyle upward and forward. In this the movement is similar to the one first described except that the fingers are applied *near the angle* of the jaw or at least at a point posterior to the insertion of the muscles that depress the bone.

Among the **effects** of these various forms of inferior maxillary lesions, are *neuralgias* associated with branches of the fifth cranial with which the articulation and other parts of the jaw are in connection; *ear aches* are common effects of subluxated conditions of the bone; *throat* and *tonsil* disorders are often noted while disordered conditions of the *parotid gland* may result owing to its approximation to the ascending ramus.

CHAPTER XII.

CERVICAL LESIONS—EFFECTS.

The disordered states that by observation have been found to depend on cervical lesions are extremely numerous and varied. It is theoretically if not practically true that any organ or tissue of the body may be made to suffer by interference in this region; it is not the purpose of this section to speak of all possible conditions, but those more commonly associated and which present a reasonable relation to the known anatomical and physiological facts in connection with the region.

EFFECTS FROM DIRECT PRESSURE.

In a previous section several ways were specified in which a lesion may affect an organ, viz., by direct pressure upon it, or impingement on artery, vein, lymphatic, or nerve mechanism associated with it. Through these several media the cervical lesion produces its effects. Few definite organs are closely enough associated with the cervical structures to suffer from direct pressure but those few are of some considerable importance. It is stated that the **spinal cord** may suffer from direct pressure in case of a luxated vertebra. Manifestly such a case must be rare, since a lesion sufficient to reach through the protecting coverings of the cord must be in the nature of a complete dislocation of the vertebra. It is known that there are such cases several of which have been treated by osteopaths and with success. A condition as severe must be profound in its effects, and such is true of the observed cases, a complete or partial paralysis resulting in the parts supplied from the cord below the lesion. The old school physicians recognize such possibilities. Hilton instances a case or two where by a diseased or weakened condition of the ligaments supporting the odontoid, that process was allowed to fall back producing more or less direct pressure upon the cord. In these cases a fatal termination followed. In death from hanging the effect comes from the forcible rupture of the supporting ligaments of the odontoid which causes the latter to exert direct pressure upon the cord. It is not difficult to conceive of a *less intense result to follow a less serious weakening* of these same connecting structures from faulty nutrition; but in most such cases it is more reasonable to assume that the effect follows because of impingement, not directly on the cord, but upon the vascular and other structures which are concerned in keeping the cord in a normal condition of metabolism.

The **thyroid gland** may suffer from an anterior crowding of the lower cervical region, thereby putting the adjacent tissues on irritation and tension. The sympathetic ganglia may suffer in like manner from vertebral, ligamentous, or muscular lesion. A discussion of the latter more properly comes under another section for which it will be reserved.

EFFECTS FROM VASCULAR OBSTRUCTION.

Among the effects of cervical lesions many are readily explained by reference to the obstruction of arteries, veins, and lymphatic vessels which connect with the various organs. Among these we may speak at some length of the carotid, vertebral, and thyroid arterial systems with their associated venous and lymphatic channels.

The **carotid artery** passes from the cervico-thoracic junction behind the articulation of the sternum with the clavicle to pass upward toward a point midway between the angle of the inferior maxillary and the mastoid process of the temporal bone, dividing on a level with the superior margin of the thyroid cartilage and fourth cervical vertebra into the *external* branch which passes on to supply the extra-cranial structures, and the *internal* which, passing through the carotid canal, is distributed to the various intra-cranial structures. In its cervical course it lies between the sterno-mastoid, sterno-thyroid, sterno-hyoid, omo-hyoid, and platysma myoides on the external aspect, and the scalenus anticus and longus colli muscles, the trachea, larynx, thyroid gland, esophagus and pharynx on the posterior and internal aspects. It will, then, be more or less *subject to obstruction* by contracture or other abnormal condition of one or more of these various structures. Note should be taken of the fact that a lobe of the thyroid gland often overlays the artery and in enlarged and hardened states of that organ it may offer serious impediment to normal flow. By virtue of a *narrowed cervico-thoracic junction* serious hindrance may be caused to the flow from the deeper arteries from which the carotid arises, with not only a disorder in the parts supplied by its branches but also impairment of the integrity of the *heart's action*. The further distribution of the branches of the external cartoid in and among the muscles and other structures of the face and infra-maxillary region gives rise to numerous possibilities of impairment of blood flow when those structures are in a condition of lesion. The corresponding *venous and lymphatic vessels* are similarly disposed with reference to the structures involved in lesion and hence interference with lymph supply and venous drainage may produce numerous disorders resulting from congestion and infiltration of the various organs. Hence, various disorders dependent on venous congestion and arterial anæmia may result from contracture and other forms of lesion associated with the cervical region. These may be in relation to any part to which the vascular structures are distributed, i. e., eye and ear affections, headaches dependent on cranial congestions or anæmias, or on similar conditions of the scalp; facial eruptions, hair malnutrition; diseases of the throat, the nasal passages, and the deep and superficial structures of the neck, especially the upper part. Notice that in general the venous and lymphatic vessels accompany the arterial trunks and hence *any lesion suffi-*

cient to involve one will be likely to involve the others, so that the total ill effect will be greater in the part than would result from obstruction to a single one of the systems. For instance pressure exerted by the tightened structures in the region of the jugular foramen will likely affect the branches of the carotid artery and tributaries of the jugular vein with a resulting condition of intra-cranial arterial anæmia and venous hyperæmia. Note further that *the pressure will affect the venous flow more markedly than the arterial*, owing to the more yielding nature of the venous wall; hence while the arterial blood will not enter the cavity sufficiently rapid to maintain normal nutrition, it will pass inward more rapidly than the venous blood can return, with the result that a venous congestion will be added to the arterial anæmia.

The second of the vascular systems likely to suffer from cervical lesion is the **vertebral.** The vertebral artery arising from the subclavian passes upward and outward to enter the foramen in the transverse process of the sixth cervical vertebra, from whence its course is through the similar foramina of the other vertebræ. After passing through the foramen of the transverse process of the atlas it passes backwark and inward *between the margin of the foramen magnum and the arch of the atlas and behind the articular surfaces, in close association with the occipito-atlantal ligaments.* From thence it pierces the dura mater and arachnoid, dividing to send a branch upward to assist in the formation of the circle of Willis and others downward to supply the cord throughout its whole extent. During its course the artery is *subject to lesion* from various structures. Before passing into the foramen in the process of the sixth cervical it lies between the longus colli and scalenus anticus muscles. Chronic contractures of these structures may easily produce disturbance of the blood flow. During its progress through the cervical foramina it is subject to lesion by distorted osseous and ligamentous structures. In the region of the atlas it is in contact with the superior oblique muscle and as it passes over the arch of the atlas in company with the occipital nerve is subject to pressure by tightened conditions in that region which elevate or otherwise distort the first cervical or disturb its relations with the occiput. It is stated by Quain that in extreme rotation of the head the artery is put upon the stretch and is compressed on the side from which the head is turned. Under normal conditions this of course will not affect the blood flow for a sufficient time to result in disorder, but in chronic thickening of the structures and marked displacements it is not unreasonable to assume a considerable possibility of harm.

Branches from the vertebral artery pass off laterally and constitute the **intervertebral** system. These pass into and through the intervertebral foramina to supply the spinal cord and its surrounding structures including the general spinal column. Hence thickened ligamentous and muscular conditions as well as the common subluxations of the vertebræ may easily interfere with the interchange in this region. Other branches pass to supply the deep cervical muscles and other soft tissues and thus are subject to pressure from abnormal states of these structures. The venous part of the intervertebral system, while not made up of the same size or number as the arterial, is in general distributed with the arterial and will be alike affected, producing, with reference to the blood supply of the various parts, the condition opposite to that produced by interference with the artery.

In general, lesion to the vertebral system will affect the **following structures:** the intra-cranial structures supplied by the circle of Willis, and some parts of the cerebellum and medulla; the spinal canal including the spinal column with connecting tissues and the enclosed nervous structures; the deep tissues of the neck posteriorly. The effects that may result from interference with the several parts of this vascular system are extremely uncertain, numerous, and varied. Especially is this true where the disturbance affects those branches which supply the *central nervous system*. For, as already briefly discussed, the effects from a disturbed metabolism in the nerve cells within the cord are subject to laws but few of which are known, and in any given case *no prophecy can be made as to the nature or even location of the effect that may result from an anæmia or a hyperæmia of a part of the spinal cord.* With reference to the branches distributed to the muscles of the posterior cervical region the same considerations hold, regarding the application of *Hart's explanation* of effects from contractured muscles, as were discussed in connection with the spine. Here these muscles by contracture may cause a secondary congestion in the branches that pass to the cervical part of the spinal cord, since the intervertebral supply and the muscle supply of blood are from the same arterial branches.

A third system of vessels likely to be involved from cervical lesion is the **thyroid**, also coming from the subclavian. The inferior thyroid branch passes upward from the thoracic cavity into the deep tissues of the anterior cervical region, lying in front of the longus colli muscle and the transverse processes of the vertebræ, to be distributed to the thyroid gland, trachea, esophagus, and deep muscles of the antero-lateral aspect of the neck. The other branches from the thyroid axis supply various structures in the cervico-thoracic region. The veins associated with this system ultimately pass with the innominate but those in connection with the thyroid gland are of special importance. Of these the inferior thyroid are the most important, the middle and superior being small and less subject to lesion. Dr. Still emphasizes the importance of the inferior thyroid in conditions of *goitre*, in which the closeness of the tissues at the cervico-thoracic junction may impair the flow of blood from the thyroid gland. These structures lie in close relation to the sterno-mastoid, the sterno-hyoid, and sterno-thyroid muscles and hence contracture of the latter may more or less seriously obstruct venous drainage of the parts.

Effects on Spinal Nerves.

Of the nervous structures that may be interfered with by cervical lesions are the eight spinal nerves, the fifth, seventh, ninth, tenth, eleventh, and the twelfth cranial, and the cervical sympathetic system, including the superior, middle, and inferior cervical ganglia with their branches and connecting cords.

The **cervical spinal nerves** with the exception of the first and second pass from the spinal cord through the intervertebral foramina and divide into anterior and posterior branches which supply corresponding portions of the cervical tissues with fibres of a *motor and sensory* function. The first or *suboccipital* leaves the cord *over the posterior arch of the atlas* in close relation to the vertebral artery, and hence, like the latter structure, is subject to pressure between the arch and the occipital bone. The posterior division of the nerve passes into the suboccipital triangle where it supplies numerous of the adjacent structures lying in close relation to the recti and obliqui and complexus muscles. Tightened conditions of these structures may produce various disorders of a sensory or motor nature from interference with the normal activity of this nerve and its segment of the spinal cord. The *second cervical nerve* with its principal branch, the great occipital, passes from the spinal canal between the posterior arch of the atlas and the lamina of the axis. It passes upward across the inferior oblique muscle through the complexus and trapezius to reach the back of the head whose superficial structures it supplies over a considerable area. Occipital *headaches* in numerous cases seem to be dependent upon a crowded condition of this nerve in its superior cervical course. The posterior branches of the other cervical nerves are distributed in association with the deep cervical tissues where they may be irritated by the posterior cervical muscles, or on the other hand cause disturbance of the latter.

The anterior divisions of the cervical nerves form the cervical plexuses. The upper four which form the cervical plexus proper pass out, with the exception of the first, *from between the inter-transverse muscles*, lying in relation with the upper portion of the scalenus medius; the first of the anterior branches emerges between the two recti muscles. The four branches joining in various ways form the **cervical plexus** which as a whole lies upon the scalenus medius and the levator anguli scapulæ muscles and beneath the sterno-mastoid. Hence in their deeper and superficial relations they are subject to lesion from pressure by contraction of these various structures. These nerves carrying sensory and motor fibres are distributed to the skin and muscles of the cervical and cephalic regions, as well as sending a few branches to reach the upper thoracic tissues and forming one nerve of special importance, the *phrenic*, which passes to the diaphragm and other structures. Descending from its roots of origin the latter passes across the front of the scalenus anticus behind the sterno-mastoid, sterno-thyroid, and sterno-hyoid muscles. In the cervico-thoracic region it is therefore subject to lesion from bony and muscular conditions.

The lower cervical nerves, by their anterior branches, emerge from between the scaleni muscles, and lying upon these form the **brachial plexus** which, passing under the superficial tissues at the base of the neck, courses over the first rib and underneath the clavicle to supply the arm, shoulder, and cervico-thoracic regions with sensation and motion. Distorted conditions of the lower cervical in the regions of the roots of these nerves, muscular contractures in the cervico-thoracic area, and narrowed costo-clavicular spaces may produce disorder of one or more parts of the plexus with a resulting weakness of the arm.

In **general** the effects of lesions upon the cervical spinal nerves are muscular contractures, sensory disorders, and numerous other conditions near and remote, dependent upon a disturbed activity of the segments of the cervical portion of the spinal cord. Especially would this seem to be true of the upper cervical lesions which, disturbing the metabolism of the upper part of the cord may seriously interfere with the activity of the centers in the *medulla*. In all probability it is by lessening the irritation to the medulla through the medium of the suboccipital nerves that treatment in the suboccipital region in numerous cases will lessen general nervous distress, vaso-motor irregularities, and cardiac disorders.

Effects on Cranial Nerves.

The **fifth** cranial nerve being largely distributed to the facial structures and issuing from the cranium in regions well protected is not markedly subject to cervical lesion. A few branches distributed to the *inferior maxillary articulation* and to a few other structures in the lower facial region may be directly subject to superior cervical contracture or inferior maxillary luxation. Through contractured conditions of the facial muscles disordered conditions of the nerve are quite common. Secondarily the nerve may be involved in disorder because of nutritional disturbances of the *Gasserian ganglion* or of its central origin, and through its numerous close connections with the ascending branches of the superior cervical ganglion of the sympathetic. The nerve as a whole may be considered the most important of those associated with the head and face, being distributed in large part to the eye and its appurtenances, the ear, the nose, and the mouth. These structures derive their sensory capacities from the fifth, while motor filaments are distributed to the muscles of mastication. *Neuralgias* associated with the various branches of the fifth are common disorders dependent on inferior maxillary and superior cervical lesions. While through the *vaso-motor* fibres that it carries, having received them from the sympathetic, it is often accountable for congestive and secretory disturbances of the eye and other cephalic organs. The relations between this nerve and the sympathetic system will be discussed more in detail in the section on the sympathetic nerves.

The seventh or **facial** nerve is the principle motor nerve to the face, and hence lesions affecting it are in the nature of spasms and paralyses of the facial muscles. *Bell's paralysis* is a typical example of the latter, in which most of the muscles of one side of the face are more or less completely paralyzed. This nerve is subject to lesion at its exit from the *stylo-mastoid foramen* which is in sufficiently close relation to the inferior maxillary structures and transverse process of the atlas to be affected by disordered conditions of the muscles and connecting tissues of those regions.

The **glosso-pharyngeal** nerve is subject to lesion at its *exit from the skull* and during its course to its distribution to the tongue, pharynx, middle ear, and parotid gland,to which it furnishes fibres of various functions. It is *sensory* to most of the structures named, *motor* to the stylo-pharyngeus and middle constrictor,*secretory* and *vaso-dilator* to the parotid gland. Passing from the skull in company with the tenth and eleventh cranials it courses downward in front of the transverse process of the *atlas*, then deeply passing in relation to the styloid muscles and the hyo-glossus. In these situations it is subject to lesion from atlas disorders or contractures in the anterior upper cervical areas.

The tenth or **vagus** is one of the most important of cranial nerves, from its wide distribution, its diversity of function; and its relation to various structural parts which may act as an irritant. *Atlas* lesions are often found to disturb its function. The nerve passes down in front of the transverse process, and hence subluxated conditions of that structure, either by direct pressure or through the production of congestion and thickenings of adjacent and related tissues, will more or less markedly interfere with its condition. It then passes down the side of the neck in the common sheath of the nerve, carotid artery, and internal jugular vein, underneath the anterior border of the *sterno-mastoid* and overlying the *deep cervical* muscles. In this region it is subject to osseous subluxations and muscular contractions sufficient to produce disturbance. In this region, too, it may be reached more or less directly by pressure against the anterior part of the sterno-mastoid, or in the lower cervical region, reaching underneath the tissues from in front and pressing inward, then outward. In its *cervico-thoracic course* it and its laryngeal branches are subject to irritation from a tightened condition of the inferior cervical structures and from a narrowed *superior opening* of the thorax. A very common disorder, a light hacking *cough*, is often dependent on such a crowding of these tissues which keeps up an irritation to the inferior laryngeal branches. The effects which may follow from lesion acting upon this nerve by the cervical disorders are most numerous and varied. It must be borne in mind that the vagus is in reality a bundle of nerves and is associated with nearly every type of function. It is afferent and efferent, motor, sensory, vasomotor, cardiac inhibitor and probably augmentor, secretory and trophic. Any one or more of a large number of structures may suffer from its disturbance. As suggesting its importance in this connection may be quoted a summary of its functions and distribution, from Quain: "The pneumogastric nerve conveys motor fibres to the voluntary muscles of the soft palate (with the exception of the tensor palati), pharynx, and larynx, these being in part at least derived originally from the spinal accessory; to the unstriped muscle of the alimentary canal—esophagus, stomach and intestine (with the exception of the rectum), and of the air passages—trachea, bronchi, and their divisions in the lungs. Sensory fibres are furnished to the pharynx, esophagus and stomach, to the larynx, trachea and bronchial ramifications, as well as to the dura mater, the external ear and the pericardium. The vagi also supply nerves to the heart, both efferent (inhibitory—also received from the spinal accessory), and afferent (depressor), and possibly inhibitory dilator fibres to the vessels

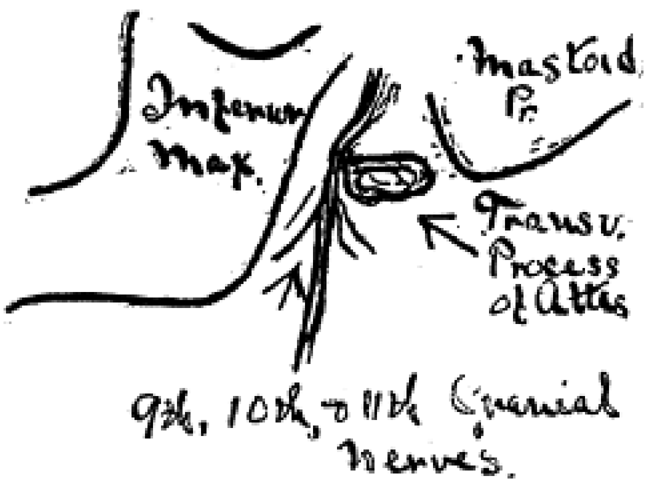


FIG. 22.—Showing relation between transverse process of atlas and cranial nerves.

of the intestine. Lastly, pneumogastric fibres pass, either directly or through the solar plexus and its offsets, to the liver, pancreas, spleen, kidneys and suprarenal bodies. Each pneumogastric nerve is connected with the following cranial nerves—the spinal accessory, glosso-pharyngeal, facial, and hypoglossal; also with some spinal nerves; and with the sympathetic in the neck, thorax and abdomen."

In accordance with this distribution and functioning there are found disorders of the *respiratory tract*,—sensory irritations with cough, excessive mucous secretion, muscle constrictions in the bronchial walls as in asthma, respiratory arrhythmias dependent on the fact that afferent impulses by way of vagus fibres aid in regulation of the respiratory center in the medulla; of the *alimentary tract*—sensory disorders, undue vomiting tendencies either an excess or a deficiency, secretory disturbances of the glands associated with the tract, disturbance of motion by virtue of its motor fibres to the visceral walls producing constipation or diarrhœa (undoubtedly rare), constriction or dilatation of the stomach; of the *vascular system* through interference with the inhibitor function of the nerve on the heart muscle, and vaso-motor function to the coronary arteries, the impairment of afferent impulses by way of the depressor nerve to the vaso-motor center in the medulla, and dilator fibres to vessels of the alimentary wall; of other *systems of nerves* with which the vagus is connected, including the centers in the central nervous system upon which the nerve undoubtedly exercises a greater or less controlling influence.

The eleventh or **spinal accessory** is another nerve which may be subject to the same lesions in the superior cervical region as the ninth and tenth. This nerve after passing from the foramen with the others named, immediately perforates the *sterno-mastoid* and passes across the posterior triangle of the neck to be further distributed to that muscle and the *trapezius*. Tightened conditions of those muscles may affect it and possibly reflexly affect others. This nerve is in large part a *spinal nerve* since it arises largely from offshoots from the upper five or six segments of the spinal cord to pass upward through the foramen magnum and be distributed with its own peripheral fibres and with those which pass to the pneumogastric. It is believed to carry from this region of the cord fibres which correspond to those which make up the *white rami* of the sympathetic in other parts of the cord.

The twelfth or *hypoglossal* issues from the anterior condylar foramen, and from this point is subject to lesion from tightness in the region as it passes to supply the tissues of the tongue and of the hyoid structures, as well as in the region in which it gives branches to join with those of the sympathetic and upper spinal nerves. Disorders directly traceable to lesion of this nerve are apparently not at all numerous or important.

Effects on the Cervical Sympathetic.

The cervical part of the sympathetic system consists of the three cervical ganglia and their connecting cords, branches to the spinal nerves, ascending fibres from the superior ganglion, connecting fibres to the thoracic ganglia, and rami efferentes that pass to aid in formation of the cardiac, esophageal, laryngeal, pharyngeal, and minor plexuses in the cervical areas.

The **superior cervical ganglion** is the largest of all the cord ganglia being from three quarters to one inch in length and an eighth to a fourth of an inch in diameter. It is presumably a fusion of several ganglia, often being constricted and usually connected with the *upper four spinal nerves.* It lies in front of the transverse processes of the second and third cervical vertebræ upon the *rectus anticus major* muscle in a network of connecting structures behind the internal carotid artery. Its *ascending branches* pass to supply the internal carotid artery, forming in the cranium the carotid plexus, and with other branches, the cavernous plexus.

From these plexuses the *following structures* are supplied:

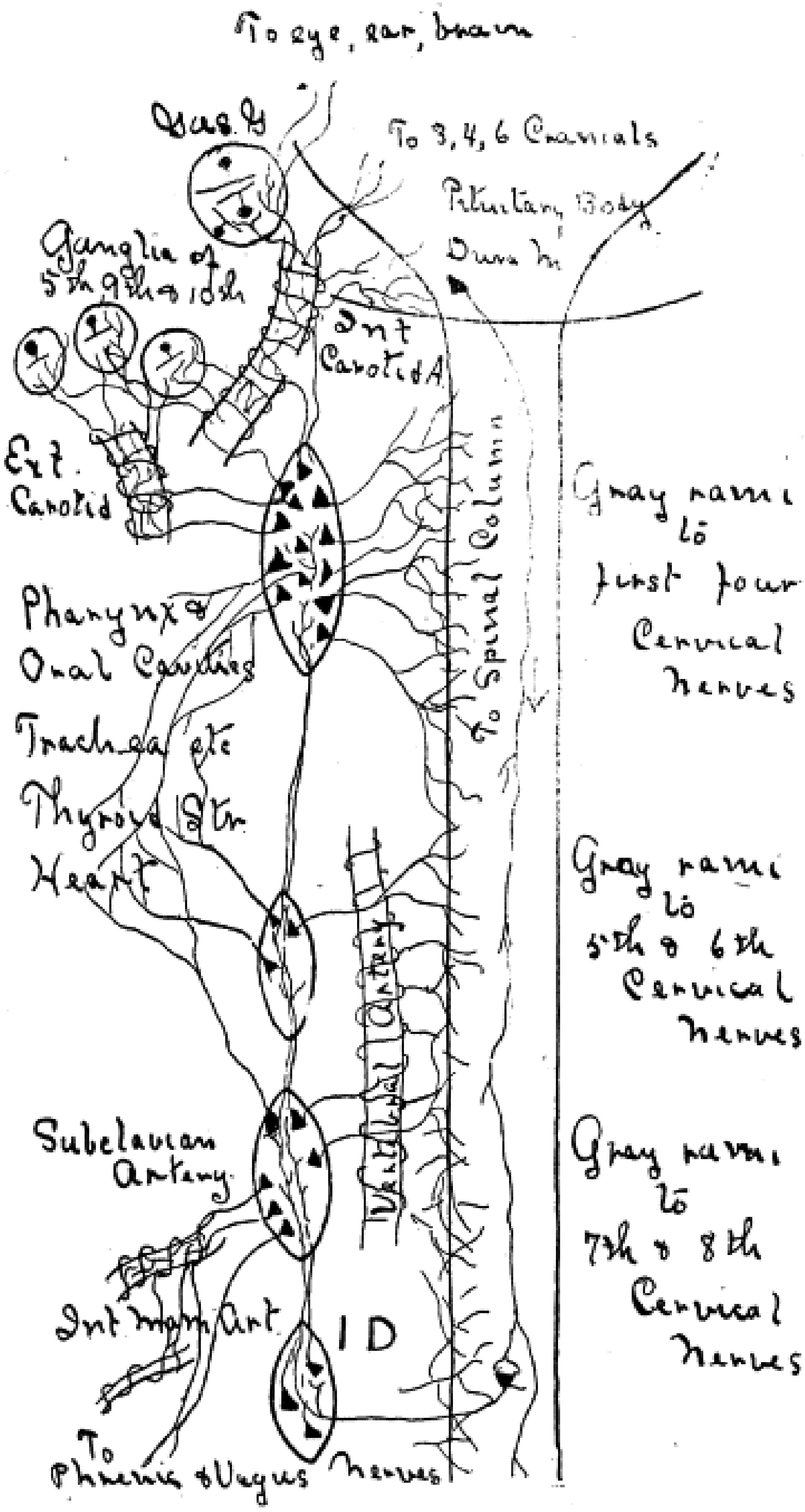


Fig. 23.—Distribution of Cervical Sympathetic.

filaments to the Gasserian ganglion of the fifth cranial; to the third, fourth, fifth, and sixth cranial fibres; by the large deep petrossal nerve to aid in formation of the Vidian; to the tympanic plexus; to the ciliary ganglion from whence fibres pass to the eye; and to the pituitary body. *Lateral branches* of the ganglion are given off that aid in the formation of the *pharyngeal* and *laryngeal* plexuses, from which fibres pass to the mucous membrane and other tissues and make connection with the superior and external laryngeal nerves. A few filaments may pass to aid in formation of the *esophageal* plexus distributed to the mucous lining of that canal. Other lateral branches are given off which unite to form the upper *cardiac* nerve of the sympathetic which passes down lying in front of the longus colli muscle, from whence it passes into the thorax to join the cardiac plexus, giving off in its course branches which connect with the other cardiac nerves and the *pneumogastric* with its inferior laryngeal branch, and giving off a filament to the inferior *thyroid* artery to be distributed to the thyroid gland. Other lateral branches pass to the *external carotid artery* which are distributed with its branches to the submaxillary, otic, and geniculate *ganglia.*

The **middle cervical ganglion** is occasionally absent and when present is the smallest of the cervical ganglia. It lies upon the tissues in front of the transverse process of the sixth cervical vertebra and is connected with the *fifth and sixth* spinal nerves. Its lateral branches pass to the *inferior thyroid artery* to supply the thyroid gland, and make connection with branches of the *pneumogastric* and fibres from the superior cervical ganglia. Other fibres form the middle *cardiac* nerve.

The **inferior cervical ganglion** lying upon the connective tissue associated with the junction of the *first rib* with the body of the vertebra, is often united with the first thoracic ganglion. Fibres from this ganglion form the rami which connect with the *two lower cervical* nerves. Lateral branches form the *lower cardiac* nerve which is usually connected with the middle. Others in company with similar branches from the first thoracic ganglion pass to the *vertebral artery* and form upon it the vertebral plexus from which fibres are distributed to the various spinal nerves and to the terminal branches of the artery. Other fibres form a loop (the annulus of Vieussens) around the *subclavian artery* from which that artery is supplied with a plexus. From this latter plexus fibres are given off which form a plexus upon the *internal mammary* artery. Communications with the *phrenic* nerve are made from this plexus and from branches direct from the lower cervical ganglia.

The **connection** between the cervical sympathetic and the spinal nerves is somewhat different from that in the thoracic region in that there are *no white communicating rami.* The grey rami are, however, equally developed. Fibres arising in the cervical portion of the cord and similar in all structural respects to the white fibres of the thoracic rami, pass out with the roots forming the spinal portion of the spinal accessory nerve, and are distributed with branches of that nerve and with the pneumogastric and parts of the sympathetic with which the accessory is connected.

Thus hurriedly has been given a description of the cervical sympathetic which throws some light upon the numerous disordered conditions that result from lesions to the sympathetic in the cervical region. It remains to take up more in detail these various disorders.

The **eye** and its appurtenances are often involved in disorder from cervical lesions. *Pupillo-dilator* fibres ascend through the cervical sympathetic reaching the Gasserian ganglion and passing to the eyeball through branches of the fifth cranial. Occasionally disorders of the iris muscle results from lesion affecting these. According to many investigators *constrictor fibres* for the pupil arise in the superior cervical and pass through a similar course. *Motor fibres* to the involuntary muscle of the orbit and eyelids pass in a similar manner through the cervical sympathetic. *Secretory fibres* pass to the eye by way of the branches from the fifth nerve, which may be partially under control of filaments from the sympathetic. Through the connection between the sympathetic and the third, fourth, and sixth cranial nerves, disorders of the *muscles* of the eyeball such as strabismus may result. But more important than any of these are the interferences with the sympathetic filaments that are concerned with the *vaso-motor* conditions of the eyeball and of the surrounding structures. For it is true of the eye as of other organs that most of its disorders are associated with a disturbance of its supply of blood. The numerous branches from the carotid and cavernous plexuses are concerned with regulating the supply.

The **ear** may suffer from an involvement of the cervical sympathetic. The *tympanic plexus* which is distributed to the inner surface of the middle ear is made up quite largely from the filaments derived from the intra cranial branches of the sympathetic. The functions of these are not definitely ascertained but presumably are concerned in *secretory*, *vaso-motor*, and in general *trophic* activities of the mucous surfaces which line the tympanic cavity, including the inner surface of the tympanic membrane and the mastoid cells. Through the regulation of the size of the carotid arterioles, the sympathetic probably exercises its greatest influence upon the function of the ear. Disorder affecting the carotid plexus, then, may produce serious disorder of that organ.

The **faucial and nasal** mucous membranes will be affected through interference with the sympathetic fibres that pass with the vessels which supply those regions. In addition fibres are given to the *fifth cranial* which is the principal nerve to the mucous lining. These fibres exercise either directly or indirectly a *secretory* and *trophic* influence upon the membrane. Most *catarrhal* conditions are dependent on lesions in the upper cervical regions which in one or more of these several ways disorder the nutritive condition of the upper respiratory tract.

The cervical parts of the **respiratory and alimentary tracts** are commonly involved in disorder through the irritation to the branches that help form the plexuses distributed to the walls of those channels.

The **heart** is likely to suffer from contractured or other lesion conditions of the cervical region although this is a much less common region for heart lesion than that lower down the spine. Through irritations associated with the cervical ganglia or the fibres forming the cardiac sympathetic, some of which may arise in the ganglia, disturbed conditions of the heart action may occur. These fibres are largely though not entirely *accelerator* in function, i. e., by their influence the heart muscle is kept in a condition of normal tone, irritability, and conductivity. Any or all of these factors may be decreased or increased through the interference with the fibres. Some evidence has been brought forward showing an *inhibitory* function associated with the sympathetic fibres. If such exists it is undoubtedly minor in importance. *Vasomotor* fibres are believed by some authorities to pass also by these nerves to be ultimately distributed to the coronary arteries. Hence disturbances of the nutrition of the heart will result. It has been suggested that *angina pectoris* is due to the temporary spasmodic constriction of the muscle fibres in the coronary system; and in numerous post mortem examinations of individuals afflicted with that disease it has been found that the coronary arteries were more or less thickened and sclerosed. Pressure exerted downward upon the region of the annulus of Vieussens has been suggested as a treatment to inhibit an over-active heart. The treatment is unsatisfactory because of difficulty in reaching the part, an uncertainty in its effect, with a greater probability of stimulation than of inhibition, and hence personally the author is opposed to the treatment.

Through the branches that pass to the **thyroid gland** from the several ganglia that organ may suffer. A very common lesion associated with goitre is a "break" in the cervico-thoracic spine. This will undoubtedly produce disturbance of the vascular and trophic conditions of the organ and various forms of disorder may arise.

From the inferior cervical ganglion the branches that form the vertebral, mammary, and subclavian **plexuses** arise and may after or before their interlacement be subject to disorder from lesion. Hence any or all of the structures which are supplied by these vessels may be made to suffer, i. e., the brain and cord, the arm and shoulder, and the mammary gland and associated tissues.

Finally emphasis is to be laid upon the effects that may result from the interference with the fibres that pass from the ganglia as **grey rami** to be distributed to the general spinal structures in a manner similar to that described in the section discussing the general distribution of the sympathetic system (See Fig. 13). Thus through the lesions affecting those fibres the nutrition of the *cord* itself will be involved and therefore practically all of the structures already mentioned may be disordered because of the changed nature or number of the outgoing impulses from the various segments and through the various pathways. Of these latter some are by way of fibres passing up to the *medulla* and other parts of the brain where they may produce brain disorders proper, or interfere with the impulses that pass out by way of the *cranial nerves*. Others pass out with the spinal roots of the *spinal accessory* and are distributed with that nerve. Others pass *down the cord* and may affect almost any structure connected with the lower segments through the mediation of the law of radiation of impulses. Still others pass down to issue by way of the *white rami* in the thoracic portion, thence in part to pass upward into the cervical cord from whence they are distributed in the numerous ways already described. While still others may issue from the cervical cord through the *grey rami by way of white fibres which are present* in small number. This disturbance of the cord of course need not be dependent upon the irritation to the grey fibres that pass back to the spinal canal from the sympathetic ganglia. In large part it will result as has been before suggested, from *posterior muscle contracture* or other lesion which produces an excess of afferent impulses by way of the spinal sensory nerves.

Notice should further be taken of the fact that with all the **spinal nerves**, both anterior and posterior branches, there pass, through connection by grey rami, sympathetic fibres received from cells in the three cervical ganglia. These fibres are concerned with *vaso-motion* to the vessels of the muscles and superficial tissues; *pilo-motor* influences to the involuntary muscle in the skin; and *secretory fibres* to the sweat glands. Hence lesion to the sympathetic will be accountable for numerous skin and superficial muscle disorder in the facial, occipital, cervical, and upper thoracic areas. Pimples of various kinds, eruptions, dry and scaly skin conditions, excessive or deficient sweat or sebaceous secretion and numerous other states of these areas are common and are presumably related to the cervical lesions that are found.

CHAPTER XIII.

THORACIC AND LUMBAR LESIONS—SPINAL.

Thoracic Lesions—General.

Thoracic lesions involving the spine are among the more common and important, for it is in this part of the cord that most of the efferent impulses for sympathetic life pass from the spinal cord through the mediation of the white rami. A few of the characteristic lesions will be described and later their treatment and effects discussed.

In making the **examination** do so first with the patient in the sitting posture. For purposes of *inspection* the skin should be bared. Note the position in which the spine is held. There should be when the individual sits in a natural and easy position a *posterior curve* beginning with the second and extending to the twelfth with the most prominent part of the convexity at the seventh or eighth spine. In many cases there will be either an exaggeration of this curve or a partial or even complete obliteration of it. Before determining that it is an abnormal condition the patient should be made to vary the curve by sitting over-erect and by "sinking" the spine upon itself to throw it as posterior as is possible. By observation in the several conditions there will be less possibility of error. A very common condition of the upper thoracic spine is the **flat inter-scapular region.** As a result of this flattening there will be presented a more or less typical straight condition of the spine as a whole, owing to a secondary and compensatory straightening in the lumbar region. Further the *transverse* processes should be noted, since a spine will appear straighter, owing to the greater obliquity of the spinous processes in the thoracic region than in the other parts, if examined by reference to its spinous than if examined by its transverse processes. These transverse processes will be difficult to detect by the average student, since the more or less marked protuberance and the depression external to it, as seen in the skeleton, will be quite completely covered by ligamentous and musular tissues in the average living subject. They can usually be detected if care be exercised, about *one and one-half inches* to the side of the spinous process. Remember further that the process of the typical thoracic vertebra will be on a line, not with its own transverse processes but with those of the *vertebra next below* or in some cases the second one below. A faily good *rule* to remember which must not be applied too vigorously is this: if on bending the head well forward the spinous processes of the thoracic vertebra below the second can easily be seen, the flattening is not very serious. If they are not drawn out sufficiently to be noticed on inspection it is fairly good evidence that there is an abnormal flattening. It will be noted further that in such a lesion the *antero-posterior diameter* of the upper and perhaps lower part of the chest will be lessened. This can be best noted by applying a hand on either aspect and then noting the distance between them. Aid will be further given if the patient is asked to respire deeply, noticing the *amount of expansion* possible, and the *freedom of movement* of the upper chest. In many cases but by no means all, with the flat thoracic state will be associated a general thickening of the deep tissue so that undue rigidity may be manifest. In long standing cases of this kind there may be little or no *muscle contracture* apparent but in many if care is taken in palpation, various areas will be detected where not only muscle thickening will be felt but also *tenderness* over certain areas will be experienced by the patient. Especially will the upper part of the thoracic spine be often involved in muscular disorder. In the writer's personal experience very few flat thoracic regions are found unassociated with the contractured state of the rhomboids and deeper muscles on either side of the third thoracic vertebræ.

Difficult as it may be to determine whether the flatness is normal or otherwise, it seems to the average beginner to be still more difficult to **overcome the condition** when once diagnosed. This arises partly from the fact that *in many cases the condition is normal* and hence should not be treated. But it is also true that the spine distorted in an antero-posterior direction is, other things being equal, more difficult to overcome than a lateral displacement, and especially is this true of the upper thoracic. In a few cases an ideal condition cannot be brought about but in most a sufficient return toward normal can be effected to prevent further serious disorder from the lesion. The methods for reducing the condition are numerous but only a few will be indicated. Note that any method which produces a *convexity posteriorly* will tend to force the part back but the method unassisted will avail little. Hence to make the force acting in the posterior direction effective, a movement laterally or in a rotary manner will give opportunity. *One method* consists in strongly bending the head forward thus putting tension on the ligamentum nuchæ which is continuous with the supra-spinous ligaments. Note that the direction of the spinous process of the thoracic vertebra is backward and markedly downward. Hence the force of the upward pull will have a powerful leverage in producing movement at the part. Then while one hand is directing this movement the other is used to manipulate the vertebra from side to side. At the same time the head may be rotated to the side, which will give a lateral tendency to the force. This movement is most satisfactorily executed while the patient is on a low stool with the physician standing at the side. In *another method*, with the patient on the stool, the physician may stand in front with the toe of his shoe on the stool and his knee against the upper sternum, separated from it by sufficient padding to diffuse the pressure and prevent depression of the ribs. Then bending the head forward he he reaches over on either side of the spine and while slight pressure is exerted laterally so as to spring the ribs the vertebræ may be rotated from side to side. This treatment is to be used with *utmost caution* and in any case where there is disorder or weakness in the upper ribs or marked disease in the chest structures much pressure with the knee is contra-indicated. The advantage of this movement lies in the fact that direct backward pressure upon the anterior vertebræ may be exerted through the mediation of the ribs. *Another method* consists in making use of the scapular muscles which attach to the vertebræ. The patient lies on the side, the arm is drawn strongly down and across the chest. This of itself will tend to draw the vertebræ somewhat back and if assisted by the other hand in working the spinous processes from side to side the result will be quite satisfactory. In all such conditions the physician must rely quite largely upon the *lateral movements* of the individual vertebræ to assist the organism in making the adjustment.

Another common condition associated with the thoracic spine is a **lateral swerve**. In many cases this will be on the side of greatest muscular activity and hence perhaps be partly a normal condition. In this lesion the more prominent angles of the ribs on the convex side will be the most striking feature in the *examination*. Along with this there will be a greater noticeability of the transverse processes on the convex and an obscured condition on the other. The *treatment* will consist in exaggeration of the lesion by strong forcing of the spine to the convexity, then by exerting pressure upon that side, with rotation, the part is forced in the opposite direction. This treatment may be made with the patient in the sitting posture or lying upon the side. In most curvature conditions it is more satisfactory to exert pressure upon the *transverse processes* of the vertebra and angles and sides of the ribs as well as upon the spinous processes, since, because of the rotation of the vertebræ which has also occurred, the simple pressure on the spinous process may tend to produce a still greater rotation in the direction toward which it is already displaced.

In case of **thickened ligaments** acting as lesions greater or less difficulty is encountered in overcoming the disordered structure. It must be remembered that the thoracic part of the spine is the least movable owing to the attachment of the vertebræ to the ribs forming a continuous wall which gives the chest the mechanical form of a cylinder—a form presenting greater resistance to distortion and permitting of only a slight extent of movement. When, therefore, the already close articulations have been supplemented by a thickening of their connecting structures by a previous long continued state of congestion or inflammation, there will be a marked resistance to the production of any movement between the adjacent vertebræ. In overcoming a tightened condition of any part of the spine *diagnosis* must be made between the conditions due to simple muscle contracture and those associated with definite and substantial change in the ligamentous and other articulating tissues. In most cases the distinction will not be very difficult owing to the fact that the rigidity dependent upon muscle contracture will vary from time to time and can temporarily be overcome by methods calculated to relax the muscles. Further, simple contractured conditions are usually of recent production while the thickened ligament condition is one dependent upon irritation continued through a long period of time. The two conditions may both be present in which the diagnosis will be more or less difficult. Again, the ligamentous condition may follow the muscular disorder since both conditions are dependent upon some kind of spinal irritation. As a matter of actual observation it would seem that by the time the ligamentous rigidity has become established the muscular contracture will have to a greater or less extent disappeared. In overcoming the rigidity due to muscle contracture it is only necessary to bear in mind the methods of reducing contractures which have been referred to in a previous chapter. Various rotations of the spine in the region of innervation of the muscles involved will serve to open up the deeper tissues and allow of greater freedom for vascular and nervous interchange. With the patient on the ventral aspect or on the side, direct pressure may be applied to the spinal muscles for temporary relaxation. Usually the tissues are manipulated by the *flat of the hand* and not the tips of the fingers. If the latter are used irritation may result through excessive pressure over a small area. By the process of quietly applied but deep pressure with a very slight movement of the tissues underneath the fingers, and by torsion of the spine and other methods designed to separate and approximate the origins and insertions, the muscle tissues will usually yield without any great difficulty. It is not to be expected that these temporary relaxations will result in a cure, for in numerous cases the contracture is but a condition dependent upon some further cause, and until the latter be determined and removed little can be expected in the way of a permanent cure. Where the rigidity is due to the thickened ligaments the quiet pressure treatment of the muscle is of little avail. This is a condition which must be more or less forcibly broken up and absorbed and hence rather vigorous methods must be employed. Theoretically the various "breaking up" treatments which are in common use might seem to be illogical in their application. For if the congestion and the later overgrowth and contraction were due in the first place to irritation it would seem that those treatments that tend to stretch the ligamentous and other connective tissues would result in still further irritation and hence further congestion and overgrowth. But from actual observation of cases it seems that the fear of further thickening is not well grounded and that the good resulting from tbe treatment is far in excess of any noticeable harm that may be possible. The treatment is largely the same in principle as that employed in the preliminary treatment in case of a long standing dislocation of the hip where the muscles and other structures have become structurally shortened. In such cases rotation of the limb and other manipulations are employed in order to lengthen these tissues by stretching processes sufficient to permit of the reduction of the dislocation. In applying the various "breaking-up" treatments it is very essential that the physician shall know the *amount of pressure* he is exerting and the *efficiency of his leverages.* Otherwise he is likely to produce rupture of the connecting tissues rather than a simple yielding of them. Especially is this true with reference to the more anterior ligaments, i. e., those associated with the bodies of the vertebræ. If an examination is made of the skeleton it will be seen that the spine, especially throughout its thoracic and lumbar portions, is not so articulated as to permit of appreciable anterior convexity. The structural conditions are such as to allow of a posterior convexity, lateral inclinations, and somewhat of torsion movements, but inappreciably a direct anterior convexity. Hence *any forcible attempt to bend the spine in this direction is to be condemned.* There is a method of treatment designed to stretch and separate the more anterior structures which is in common use, but which is associated with considerable danger. With the patient on his ventral surface the lower half of the body is raised from the table by inserting the arm underneath the thighs, or by supporting the latter in a suspension apparatus. Then as this lower half of the body is swung from side to side pressure is brought to bear with the free hand upon the spine where it is desired to produce the breaking effect. The pressure with the thumbs while exerted downward is also exerted laterally in a direction opposite that of the swing of the body. This treatment may be efficient and harmless *if applied with judgment*, but unfortunately there are a large number of students and practitioners devoid of a sufficient amount of that useful faculty, and hence harm is likely to result in occasional cases. Especially will this be the case when the limbs are supported by a suspension apparatus and the physician has all his strength free to devote to the local pressure. He is likely, therefore, to use his strength and weight to a disadvantage to the patient. A good *rule* to remember in this connection is that the weight of the body itself while in this position is sufficient for the spine to bear, and any additional pressure applied to local points in the spine should be applied in a lateral direction as much as is possible. For effects upon the *lateral ligaments* and other structures the patient may lie upon his side with the physician standing in front. The latter with one hand on the hip or the shoulder and the other reaching over and grasping the spinous processes, produces a torsion of the body by exerting force with each of the hands but in opposite directions. This will tend not only to affect the lateral but also the anterior structures and intervertebral cartilages. A variation of this treatment consists in making use of the arm by drawing it across the chest and up by the face, in this way exerting a lateral tension upon the spinous processes through the medium of the trapezius and other muscles, at the same time assisting at the local point by the free hand. Or with the patient on the side and standing in front or behind a simple strong bearing down upon the spinous processes will more or less efficiently *spring the spine*. For affecting the posterior structures any method that produces a greater posterior convexity will be efficient. The method referred to in connection with the flat thoracic lesion by bending the head strongly forward thus exerting tension upward on the spinous processes may be employed to advantage. Similarly, with the patient on the back, the method of "rolling him upon his shoulders" by strongly flexing the limbs on the body and then lifting the lower part,may be of some value.

In cases where the **posterior convexity** is increased, thus constituting a lesion, there are a number of methods that may be applied successfully. The *diagnosis* of such a condition is usually not difficult. The abnormality will usually be found in the lower part of the thoracic spine though occasionally the upper part is the one to suffer. While the patient is sitting in his usual position the spine will appear quite convex. If on assuming a forcibly erect position the convexity disappears, it suggests, not a posterior curvature, but a weakened and *lax* spine. If the convexity still remains while the patient is forcing himself to sit erect, it is quite good evidence of an abnormal condition. In most cases there will be associated a lessened state of mobility. Further, the condition of the *lower ribs* will be noticeable, the usual condition of these being a depression of the anterior extremities, especially marked in the last two whose ends may be so depressed as to occupy a position nearly on a level with the ilium. Such cases usually are dependent on the continuation of the posterior convexity throughout the lumbar portion of the spine.

A method for **overcoming the posterior curvature,** and one which is, with variations, equally applicable to lateral curvatures and numerous other lesions, consists in the *following:* with the patient on the table or stool the physician stands in front, reaching around with a hand on either side of the spinal column, the patient meanwhile leaning forward easily against the chest of the operator in order to take off any tension of muscles otherwise present and to furnish a chance for rotation by movement of the body of the physician; then by a direct forward and lateral pressure on the spine, at the same time lifting up and rotating, a very powerful force is brought to bear. *Another method* which is a valuable one is used with the patient in the same position on the table or stool. In this the physician stands *behind* with one hand on the shoulder for purposes of rotation, the other with thumb or fingers on the lateral aspect of the vertebra. Then the shoulder is made to outline a circle whose plane is in an antero-posterior direction. As the shoulder is brought backward the hand at the vertebra on the opposite side of the spine is held immovable. Consequently the weight of the body acts as the force to drive the part in its normal direction. Note that the force is not a directly anterior, but an antero-lateral one, which is always advantageous. Then reversing the hands, the other shoulder is used and the part is forced forward and laterally but the last in a direction opposite to that in the first case. The actual movement will be more complex than would appear from the description, and *at some time during the circuit every part of the articular structures will have been acted upon* in a more or less advantageous manner. Further, at one part of the circuit exaggeration of the lesion is affected, for as the shoulder goes forward pressure is exerted downward which tends to throw the spine more posterior. This treatment is equally applicable to lateral and to almost any condition with the exception of the anterior luxations. With the patient lying *prone*, direct pressure downward may be made upon the transverse processes, but unless lateral movement is also produced it will not be quite satisfactory. Similarly the patient may be treated in the position lying on the side.

A method of special value requiring special apparatus has come into use within recent years. A stool with a back provided with a sliding part arranged to fit closely on either side of the row of spinous processes, and a seat bottom unyielding in nature and with a wedge shape piece to prevent the ischii from lateral sliding, constitutes the apparatus. These are provided for in the **Dr. Still's Chair.** With the adjustable piece at the point of lesion and the physician in front or behind, the shoulders are gasped and by a figure-of-eight movement the body is rotated, the only movable part of the body being that above the fulcrum, the remainder being held by the pressure against the latter and downward upon the stool. In this treatment the spine above the fulcrum represents the lever arm, the "breaking" occuring more or less entirely at the fulcrum. By sliding the movable part up or down each of the involved vertebræ may be acted upon. Owing to the interference presented by the arms of the standard supporting the movable fulcrum, there is little possibility of drawing the patient too far posteriorly and hence doing harm. A method of getting a fixed point by applying the *knee* or knees to the part has long been in use, and where applied with caution is of much value. With the patient on a low stool and the physician standing behind, the latter places the toe of his shoe on the stool and his knee at the side of the spinous process. Then by movement of the shoulders the body is rotated about the knee as a fixed point. With the physician sitting, both knees may be used except where the scapulæ are too closely approximated to the spine. In this treatment there is always *danger* from the fact that the physician is not aware of the amount of leverage he is using. It is necessary to emphasize the point that *the knee knows nothing of pressure.* In case of the fingers and hand there is developed by training a sense of pressure and of weight. Hence with the fingers as the fulcrum the judgment of the physician is enhanced. Not so with the knee. True, the hands are placed on the shoulders when the knee is used and hence are in a position to judge of the pressure; but in most cases the physician will be thinking of keeping the knee in place and will ignore the hands. It is further true that the tissues over the knee as well as those over the spine are quite movable; unless care is taken during the application the knee may slip to the side and shock be produced or even greater injury done. Altogether, if the knee treatment is used at all it is to be done with full knowledge of the cautions necessary.

Thoracic Lesions—Local.

In addition to these several forms of general thoracic spinal lesions there are many of a distinctly local character. Of these, **torsion** between two adjacent vertebræ is common. In such a case there will be lateral deviation of the spinous process; differences between the prominence of the two transverse processes and between these and similar adjacent ones; greater prominence of the angle of the rib on one side; local contractures and sensory disorders. In *overcoming* the condition pressure is exerted laterally upon the spinous and anteriorly upon the prominent transverse process at the same time that rotation is being effected by any of the numerous methods that have been already suggested.

In many cases **separations** (See Fig. 10) between adjacent spinous processes will be detected. This is perhaps more likely to occur in the upper than in the lower thoracic. A rotation about the part and other methods for producing re-adjustment of muscular disorders will usually be effective.

Anterior luxations of single vertebræ are occasionally noted by the deeper situation of the spinous and transverse processes and the pair of ribs with which the vertebra articulates. Backward and inward pressure upon the sides and angles of the ribs will assist the rotary manipulation in drawing or forcing it back. Various other conditions may be met with and will be detected and corrected by methods similar to those indicated above.

Lumbar Lesions.

The lesions affecting the lumbar portions of the spine are in general the same as those associated with the thoracic portion. Owing to the absence of ribs the muscular structures are relatively more developed and hence in this part muscular lesions as a rule will be more noticeable because of the greater amount of tissue involved. In **noting the condition** it should be remembered that the *normal curvature* of the lumbar region is an anterior one beginning with the lower thoracic and ending with the prominence of the sacrum. Care should be taken to determine whether the *position* assumed by the patient represents a normal condition. For instance with a good many individuals a habit is formed of sitting in a rather lax condition which causes the lower part of the spine to protrude posteriorly. In the examination the patient should be requested to sit in as nearly a normal position as he can; then by comparison of this condition with that of an extreme erect and extreme lax posture, more nearly correct judgment can be made. It is in this portion of the spinal area that the *median furrow* spoken of by Holden becomes of most importance. In numerous cases this groove, at the bottom of which will be found the row of spinous processes, beginning with the lower thoracic region and extending to the sacrum will be found to vary in depth, width, and symmetry of outline. These changes are always suggestive of spinal lesion, either osseous or muscular. In many instances the lower boundaries of the groove will be decidedly prominent and tense, more noticeable when the patient is in the sitting posture. At the same time the groove may be appreciably narrowed. This usually is dependent upon a condition of contracture of the more bulky portions of the erector spinæ muscle, and in most cases this again is due to deeper lesion associated with the lumbar spine, the sacrum, or the innominate bones. The correction will therefore be dependent upon the adjustment of those deeper tissues. A further point to note in the examination of this part is the condition of the *spinous processes.* These are directed *horizontally,* which marks a distinct difference between them and the typical thoracic vertebra. Further, these are extremely *strongly developed* and in many cases palpation along their prominences will suggest a continuous, irregular, bony ridge, rather than a series of separate processes. This will be especially true of those cases where lesion is present in the form of thickened ligaments, or in those individuals who are strongly developed naturally. The condition of the *transverse processes* should be noted. These in comparison with those of the thoracic region are longer and more developed otherwise. They are also *much more subject to variation.* Cases are on record where the process of the first lumbar was mistaken for the twelfth rib, and by individuals who were fairly careful diagnosticians. Usually the *mobility* of the rib will prevent any such mistake. These processes are often found quite *tender to touch* through the overlying muscular and other tissue. In such cases it is quite good evidence that something is wrong, either a contraction of these tissues, which, in contact with the prominences, produces sensory disorder; or because of a twisted or otherwise subluxated vertebra the process is more or less forcibly pressed into the parts and in that manner produces irritation. Further, the fact should be remembered that there is in the average individual, a *greater separation* between the spinous processes of the last thoracic and first lumbar, and also between the last lumbar and spine of the sacrum. While this condition seems to be a normal one in many cases, yet experience would seem to show that these two points, especially the latter, are more than the others subject to lesion conditions.

Curvatures, lateral, anterior, and posterior, similar in kind and extent to those found in the thoracic spine are common in the lumbar, and will in general be diagnosed and adjusted in the same way. In most cases the lumbar region will *compensate* for a thoracic condition, and the reverse may be true. Hence in treatment of a lumbar curvature reference should be made to the condition of the thoracic spine and the treatment regulated in accordance therewith. In most cases it is not a matter of absolutely vital importance as to which condition is the primary one and in many cases such determination will be impossible. Both curvatures are attended to in the *treatment* and are corrected at the same time. It is probably true that if the primary curvature alone were corrected the secondary condition would to a marked extent disappear, but unquestionably the adjustment will be brought about much more quickly and efficiently when both are treated.

Slight luxations such as lateral, anterior, posterior, and twisted conditions of **single vertebrae** are, owing to the greater amount of muscular tissue overlying, usually more difficult of detection in the lumbar than in the thoracic portion of the spine, and hence reliance must be made quite largely upon the contracture and other disturbance of the softer tissues. This latter condition will in most cases be quite well marked. For instance in the case of a *torsion* one transverse process owing to its considerable development, will be forced quite prominently into the softer tissues and hence a marked contraction and congestion will result which will be comparatively easy of detection. *Anterior* and *posterior* luxations, if more carefully diagnosed will fortunately often be found to be mere angular antero-posterior changes, consequently throwing the spinous process more or less prominent. This is especially true of the *fifth lumbar*. While the statement that the fifth lumbar cannot go anterior is one that is not substantiated by the facts, yet it is a condition much less common than was formerly believed. An extreme *anterior bending* at the junction of the fifth with the sacrum is a much more common condition than is the real anterior displacement. The angular condition causes the spinous process to be more or less obscure and gives rise to the belief that the vertebra is displaced anteriorly. In most of these cases if the patient is placed in such a position that the lumbar spine may be drawn posteriorly the spinous process of the fifth will become apparent. Further, if the direction of the upper portion of the sacrum be noted the real condition will become obvious, for it will be found that the upper portion of the sacrum also has receded anteriorly. But that there are many cases which may with all propriety be spoken of as anterior fifth lumbar conditions, we are entirely persuaded. The extreme cases of this kind that are met with would show, if the pathology could be determined, that there had been a more or less considerable change of the articulating structures as a whole, including the osseous parts.

For purposes of **overcoming** such anterior structures two or three methods may be suggested. With the patient sitting on a stool the physician stands at the side facing in the opposite direction while with the adjacent arm he reaches across the chest and grasps the body underneath the axilla. Then strongly bending the patient forward so as to throw the spine posteriorly, rotation and lateral movement is given while pressure is exerted with the free hand upon the tissues lateral to the vertebra involved. *Another method* which has long been in use and productive of much good is one which is rather wearing on the physician. With the patient lying on his side the physician stands in front and strongly flexes the thighs upon the abdomen. Then reaching over with one hand underneath the buttocks, the lower half of the body is lifted slightly from the table thus allowing the weight of the body to bend the spine laterally in the lumbar region. With the other hand the physician reaches over and grasps the spinous process of the fifth on its under surface, at the same time lowering the buttocks. By repetition of this movement a considerable effect is produced in opening up the tissues while the position in which the patient is held compels a continuously acting posterior force.

In all of the luxations associated with the lumbar region, as also true of other parts, it may be necessary to overcome a part of the muscle contracture previous to adjustment of deeper structures. This may be accomplished in any of the several ways which have been mentioned.

CHAPTER XIV.

THORACIC AND LUMBAR LESIONS—COSTAL.

It is not very common that a serious thoracic spinal lesion will be present without a corresponding rib lesion, the intimate anatomical and physiological associations existing between the two making them more or less interdependent with reference to their lesions. It is much more true that the rib is dependent upon the spine than that the spine is dependent upon the rib for the normal condition. It is quite often that a rib or several of the ribs will be found in a subluxated condition without material disorder of the associated vertebræ, but only rarely that the spinal lesion leaves the normal condition of the rib intact. It is to be noticed that the ribs are suspended from their anterior ends and are supported from their vertebral ends. This support is the spinal column, through the double articulation between the rib and the vertebra. Hence any material lesion of the support will almost certainly involve the rib.

EXAMINATION.

In no region of the body is it more necessary to bear in mind the value of **examination in different positions** than in case of the chest region. Unlike the vertebral column the ribs are in continuous and obvious activity easily observable on inspection and palpation. Hence in the examination of the part during its functional rest it is a matter rather of degree, since the resting phase of the respiratory cycle is a definite movement. The examination will in either case be made while the part is moving. But by causing the patient to *respire deeply* the action will thus be increased above the normal and any abnormal condition associated with the part will likely be made more prominent. This may not only be noticeable to the examining physician but the patient himself will probably experience an increase in the *subjective* symptoms associated with the disorder. In numerous cases of recent rib subluxations considerable amount of pain will be manifest and this will be markedly intensified if the patient is made to thus inhale. But on the other hand in producing this forced activity, part or all of the lesion condition may be obscured. Hence the examination must be made with the part in as completely a *relaxed* condition as is possible. In many cases thus associated with pain the patient will indicate it by the *position he voluntarily assumes*, favoring the side associated with the lesion by sitting in a peculiar position or by a voluntary lessening of the depth of respiration. For purposes of *comparing* the movement of the ribs inspection and palpation both have their advantages. The rise and fall of the chest wall is easily noticed on inspection. In many cases the patient will not be able to produce very marked movement of the upper ribs even though the effort to do so costs him no discomfort. In such a case the upper ribs have become more or less permanently fixed. In many cases the rise and fall of the chest will be more easily detected by palpation in applying the palms of the hands over the anterior chest region. While making the examination by inspection or palpation comparison of lateral halves of the chest is of much value. In certain disease conditions there will be an appreciable difference in the *amplitude of movement* between the two sides. This is especially true of certain lung disorders in which a greater or less degree of consolidation has occured. In pneumonia where a complete lobe of a lung is involved there may be practically no movement at all on the involved side while on the normal side through a process of compensation there will be an increased activity, usually not of depth but of rapidity. The *general shape* of the chest should be noticed with reference to the presence of depressions or prominences either of which indicates a disturbed condition. The *size* of the chest as well should be noted. In some cases one lateral half of the chest will be so depressed as to materially lessen its circumference. It should be noted in this connection that with most individuals, on the side of the body which is used the most there will be a greater chest development, e. g., right handed individuals will usually show a greater circumference of the right hand half of the chest.

Some General Types.

Any practitioner of experience will undoubtedly have been impressed by the fact that the general shape and conformation of the chest as a whole varies remarkably with individuals both with reference to normal and abnormal states. In relation to the normal shape the cylindrical chest of the young child is characteristic, while that of the adult shows a marked difference between the transverse and the antero-posterior diameters, together with the noticeable change from the roundness of outline dependent upon the development of the angles of the ribs and the more oblique position of the latter with reference to the spinal column. This latter will partly account for the abdominal type of breathing in children and in male adults as compared with the thoracic type associated with the female adult in whom there is usually a more depressed condition of the anterior ends of the ribs. These facts are of considerable value to the student since a failure to recognize them may lead to a serious error in both diagnosis and treatment. Of the general types of abnormal chest conditions there are recognized three which are characteristic: the first is the **flat chest** which is a condition commonly found associated with disorders of the lungs. This form is remarkably often associated with tuberculosis of the lungs. In a good many cases it would seem to be a question whether the flattened condition were primary or secondary. It is undoubtedly true that a wasting away of the lung tissues which is common in consumption will result in the gradual depression of the chest especially in the upper part. It is equally certain that in many cases the flat condition exists prior to any infection of the tissue. Indeed we are persuaded that the so-called hereditary transmission of tuberculosis is little else than the transmission of a narrowed thorax. In this case the condition of the lung tissues is such as to render them more susceptible to the influence of the tubercle bacillus. It is a *significant fact* that the pulmonary lesion usually begins near the apices of the lungs which is the principal region involved in the flattening. This flattening is a condition that prevents the normal nutritive processes and hence the ill-nourished condition furnishes the favorable soil for the propagation of the micro-organism. As a modification of this type there is the *tapering* chest in which the difference in the diameters is not so marked while the cavity of the chest partakes of the nature of a *cone* the apex of which is at the cervico-thoracic junction. This condition is also a common one in pulmonary disorders of various kinds.

A second type is the **barrel-shaped chest**. This is what might be termed a modification of the infantile or cylindrical type. It is much less common than is the flat chest and is perhaps as often secondary as primary to the disease condition associated with it. This type is most markedly noticed in a chronic *asthmatic* condition and especially where that disease has terminated in *emphysema*. Asthma is a disorder in which considerable bronchial constriction is present due to an irritant effect upon the nerves distributed to the muscle tissue in the bronchial walls. Under these circumstances the air is only with extreme difficulty forced into and out from the alveoli. Owing to the extreme force that is brought to bear upon the alveolar walls there ultimately results an exhausted and stretched condition of the tissue. We know that one of the principal forces in producing the expiratory phase of respiration is the normal elasticity of the lung tissue which has been put upon the stretch during the inspiratory phase when the diaphragm is lowered and the chest wall lifted upward and outward. Normally this together with the other elastic structures is sufficient to produce the expulsion of the air in quiet respiration. When, therefore, this elastic condition has been partially or completely destroyed the tendency of the more or less unopposed inspiratory muscles will be to keep the lung tissues permanently distended through a permanent condition of lifted ribs. With less elastic tissue to draw the chest walls downward and inward the position of the rib is gradually changed from a greater to a less oblique condition, which partially accounts for the typical and characteristic barrel shape. In addition to this there is undoubtedly a disturbance in the articulation between the rib and the vertebra and especially at the costo-transverse articulation. This latter fact is undoubtedly true in the asthmatic attack in which the barrel shape is quite often manifest while during the intervals of the disorder the general shape of the chest may not appear abnormal.

The third type of the abnormal chest is one dependent upon nutritional disorders of the bony tissue itself and is of such a character as to give it the partially descriptive name of **box-shaped chest**. This is the type that is found associated with *rachitis* commonly spoken of as rickets. The disorder in this condition is not apparently dependent upon disturbance of the articulation of the rib but upon the change in shape of the rib during its growth. The box shape in due to a flattening of the sides of the chest and with production of a rather abruptly angular condition at the costo-chondral junction. This change in shape is due to the yielding nature of the abnormal bony tissue which is influenced by the respiratory action. The nutritional disorder is not confined to the ribs but is noticed in connection with other osseous tissue, especially the cranium and long bones.

SINGLE RIBS.

The **landmarks** for examination of a single rib are the angle, the costo-transverse articulation, and the anterior end. While these are the parts which will give the most information with reference to the condition of the rib it is always advisable to follow with the fingers the outline of the rib throughout its entire extent. With the possible exception of the first, the head and neck of the rib are too deeply situated in their anterior relation to the transverse process and the antero-lateral relation to the body of the vertebra to be detected. In order to better understand the lesion conditions that are found it is advisable to get a complete picture of the normal articulations and the normal movements that take place in connection. The rib has but the two typical **articular mechanisms,** namely, the costo-central and the costo-transverse—the junction of the anterior end of the rib with the costal cartilage and the latter with the sternum or other cartilage not being a typical articulation. Each rib with the exception of the first, eleventh, and twelfth, articulates with the bodies of *two adjacent vertebræ* in a wedge-shaped manner and is bound thereto by ligaments sufficiently strong to prevent any great possibility of serious luxation, a definite capsule being present which attaches the rib to both vertebræ and the intervertebral disc. This articulation permits of a *pivot* movement. The articulation with the transverse process is one which permits of considerable freedom of movement and which is the one more commonly involved in subluxation. Movement of the rib at this articulation is of a complex nature. *Two movements* are recognized, one of which consists merely in a rolling of the rib upon the articular surface of the transverse process. In this the *axis of rotation* passes through the two articulations. A second movement is of a gliding character in which the *axis of rotation* is represented by a line passing from the costo-central articulation to the chondro-sternal junction. By virtue of this double movement not only is the antero-posterior diameter of the chest increased by the lifting up of the anterior end of the rib from a less to a greater angle with the spinal column, but also the transverse diameter is similarly increased by the lifting up of the lateral portion of the rib, thus causing it to slide as well as to roll upward upon the transverse process. In the vast majority of cases it will be found that the *lesion* consists in an extreme condition of the rib in its relation to this articular surface. In some cases the rib will be felt rather prominently above the transverse process, in others it is apparently on a level. In either case the relation it bears to the immediately adjacent ribs should be noticed. In examining for the rib at the *costo-transverse* articulation the student will find considerable difficulty in locating the part. While in the skeleton the prominence of the end of the transverse and the depression just external to that prominence are easily noted on palpation, it is not true of the living subject, for the depression will be largely filled with connecting structures and the prominence overlaid with muscular and other tissue. If care is taken in the examination the prominence of the transverse process will usually be noticed; then with careful palpation just external the rounded outline of the rib may be detected. Passing on externally or laterally the fingers will note the rather abrupt bend which the rib makes at its angle. This part of the rib is the most easily detected by the student and, fortunately for diagnosis, disturbances in the position of the rib will usually produce obvious change in the relations existing between adjacent angles. The *angle* of the rib, as already emphasized, is of value in diagnosis because of its greater comparative *prominence*. It is of further interest in that it marks a distinct change in the direction of the course of the rib. Note that the rib at the angle is bent and *twisted upon itself* so that when laid upon the table the isolated rib will not touch at all points, i. e., all parts are not in the same plane. This fact makes possible a very different general shape of the chest than would otherwise be. It further permits of a more complex

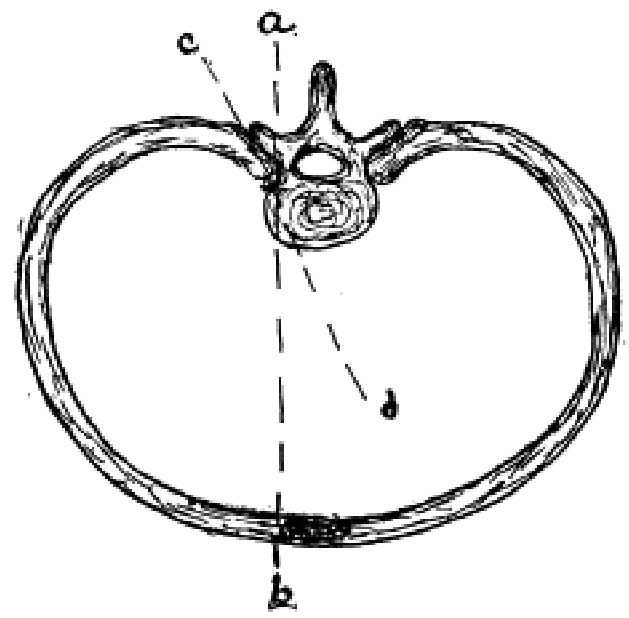


Fig. 24.—Showing axes of rotation in movement of rib. (After Kirke.)

change in position of one part of the rib when another is displaced, e. g., a slight rotation about the axis passing through the two articulations at the posterior part will cause a different change in the position of the anterior end than would otherwise be the case.

The various **forms of lesions** have been given names which are more or less provisional. We may speak of a *downard subluxation*. It is manifest that several ideas might be conveyed by such a term. The rib as a whole may be thus subluxated. This is the condition that should be associated with the term. In such a case the disorder will be detected by reference to its relation to the immediately adjacent ribs. The intercostal space above will be increased through out its whole extent while that below will be decreased. In the region of the angles the depressed rib will seem to be in direct contact with the one below. In this condition the space throughout its extent will be more uniform than in other forms of disorder. In another case of downward displacement the rib is said to be *depressed*. This has reference usually to the anterior and not to the posterior part of the rib. For in many cases the antero-inferior condition will be associated with a postero-superior change. In such a case the rib at its articulation with the transverse process seems to be resting unusually high upon the upper part of the articular surface. This is but an exag-

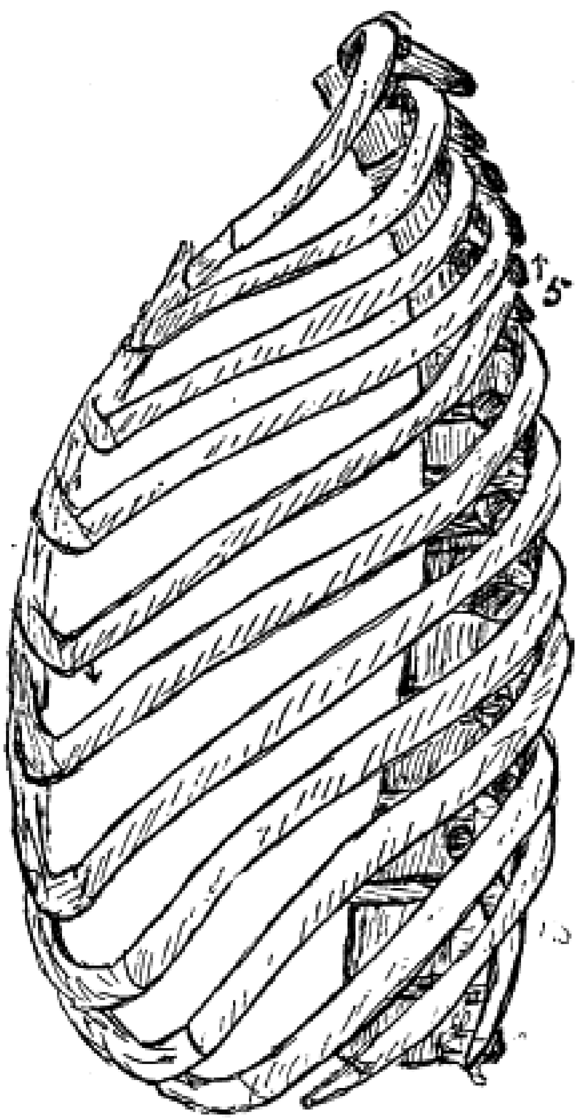


Fig. 25.—Subluxation of first, fifth, and twelfth ribs.

gerated upward gliding of the rib which in less degree constitutes a normal movement. In this condition it will be noticed that the space above the anterior part of the rib will be markedly widened while that below the posterior part, i. e., from angle to transverse process, will be in the similar condition. Further, at the anterior end, most noticeably at the costo-chondral junction, the depression in the chest wall will in many cases be apparent, while at the angle it will be unusually prominent due to the throwing outward of the inferior margin of the rib in that region. This condition is perhaps the most common of all rib luxations and is the form commonly referred to as a *twisted* rib. It may be noticed in passing that the latter term is often used where the actual displacement is so slight as to render certain diagnosis impossible.

The **tenderness on pressure** is a valuable aid in diagnosis of any of the ribs. This will often be the fact most easily detected. Most osteopaths have met cases where the tenderness was practically the only evidence of a disturbed condition. In a typical rib lesion the *area of tenderness* will be quite well outlined and will be found to follow the course of the rib throughout its whole extent. In many cases the tenderness will be uniform along its course but in others there will be local areas of increased soreness, suggesting the *typical intercostal neuralgic condition*. If pressure is exerted on any part of the subluxated structure the pain will be increased.

In most cases of rib luxations there will be in addition to the above named indications, various conditions of **muscular contracture** and changes in temperature and color of the parts involved. The more bulky muscles that are found on the posterior part of the thoracic region are usually easily detected in their abnormal condition. The intercostal and others of the deep muscles may not be sufficiently deranged to be detected by the inexperienced. Other evidences being detected, it may usually be assumed with little possibility of error that such a condition is present. Occasionally one's attention will be called to a marked difference in the *temperature* between the tissues associated with adjacent ribs. If care be taken in inspection it will also be found more highly *colored* in the area of greater temperature, suggesting that the latter condition is due to an excess of blood from vaso-dilatation or other cause of congestion.

SPECIAL RIBS.

The above considerations are given with special reference to the typical rib. It should be noted that there are several which are **atypical**. Of these the first, eleventh, and twelfth are important. In these the common peculiarity of a lack of the typical angle is noted, while in the latter two there is but the one articulation with the spine and that the costo-central, and no attachment to sternum or upper ribs in front. Hence various points of difference are found in the nature, diagnosis, and treatment of lesion conditions associated with these special ribs.

In case of the **first rib** several new factors must be noted. It is without the typical angle, articulates with but one vertebra, and with absence of inter-articular ligament a greater possibility of *vertical gliding* of the vertebral end is presented. This will help to explain the common condition of an upward subluxation behind. It must be further remembered that the costo-central articulation is not, in this case, the peculiar wedge mechanism which is characteristic where the rib makes union with two adjacent bodies. The third peculiarity is worthy of mention since it has to do with the *cause of subluxations*. The mass of shoulder muscles together with the presence of the shoulder girdle prevents much possibility of direct violence to the rib. Hence in most cases the disorder may be traced to a disturbed muscular condition. This is usually associated with the *scaleni*. The function of these muscles is to fix the rib against the action of the intercostal and other muscles in respiration. They are usually in a more tense condition than the average muscle, whether in the inspiratory or expiratory phase of respiration and will therefore usually prevent a downward displacement of the rib. On the other hand they are the prime cause of the upward displacement. Undue contraction of these muscles will produce disturbance of either the cervical vertebræ or the first rib. Usually it is the latter that is disturbed. It must constantly be borne in mind that the scalenal disorder *will not persist without a cause acting more or less continuously.* In most cases there will be a deeper lesion which affects the innervation to the scaleni, i. e., in the cervical region. It was said that owing to the strength and continued tension of the scaleni the first rib will seldom be displaced downward. But note the following: *nearly every first rib subluxated upward is subluxated posteriorly which permits the anterior end as well as the whole upper anterior part of the thorax to fall posteriorly*, and hence lessen the antero-posterior diameter of the chest and produce crowding on the structures passing through the superior opening of the chest. Occasionally cases are met which seem to indicate a *downward displacement* of the rib as a whole in which the cause may have been traumatic force from above or muscular tension from below, in either case sufficient to cause the scaleni to yield. Other disorders of the upper rib may result from the undue contraction or relaxation of the muscles attaching to the anterior part of the clavicle and upper part of the sternum. Among these are the sterno-mastoid, sterno-hyoid, sterno-thyroid, omo-hyoid, and thyro-hyoid. The more anterior fibres of the clavicular portion of the trapezius may also assist in an elevation of the first rib through the attachment of the latter to the clavicle by the subclavian muscle.

In case of the **floating ribs**, i. e., the eleventh and twelfth, still other differences from the typical condition present themselves. These have but the *one vertebral articulation* and are attached only to one vertebra each, and hence lack, as in case of the first, the *inter-articular ligament.* Owing to their practical freedom from attachment to the transverse processes behind and cartilages of the superior ribs in front, these two have the greatest amount of *mobility* of the ribs. This fact is one of functional importance since the region of the body which they occupy is one where much crowding of tissues is necessary in the various flexions of the body which are continually taking place. As a consequence of their looseness of articulation and extreme mobility in general, they are easily subluxated, and, fortunate circumstance, easily reduced by the organism itself. Owing further to their practical *suspension between muscular tissues* they are largely dependent for position upon the play of forces concerned with the muscles. Direct violence will easily displace them. Tightened clothing will force them inward and downward. But unless a considerable subluxation takes place at the loose vertebral articulation they will in all cases return to a normal position if irritation be removed from muscular tissue. Among the most common of the displacements is that in a *downward* direction (See Fig. 25). By this is usually meant a downward depression of the anterior end although it is by no means rare that the posterior part may also be depressed. This condition may be much more extreme than the average student would believe possible until he has examined personally a number of cases. It is hardly an exaggeration to say that the twelfth rib may be almost *vertical* and parallel to the vertebral column. Many cases have been noted where the anterior end was almost if not quite on a level with the highest point of the iliac crest. The explanation of such a condition may be difficult. Normally the rib ends in a small point of cartilage which lies between the aponeurotic structures of the *oblique and transverse* muscles of the abdominal wall, connected to these by areolar tissue. In the extreme downward forcing of the rib in most cases it would seem to be a tearing loose from this areolar tissue and forcing down of the end between the layers of the muscular and aponeurotic tissue. In some cases it will be noted that there will be a general atonic condition of the *abdominal walls*, in which case the rib is simply carried along with the yielding tissue. The wearing of corsets and other tight clothing is one of the most common causes for this downward depression. From this cause the rib will only gradually be depressed and hence it is a gradual yielding of the tissue, not a tearing that results. The tightened clothing will not necessarily produce a depression downward but may depress the parts inward which is a condition equally as faulty. Another cause of the depressed rib is that of over-active *infra-costal muscles*, i. e., abdominal and quadratus lumborum. The attention of the writer has several times been called to a depressed rib condition where the entire trouble seemed to be a *subluxated innominatum* producing the condition through irritation to the nerve distribution of the muscle or as likely to direct tension on the connecting tissues of the latter with a consequent downward displacement of the rib. Correction of the iliac bone has in a large number of cases very materially aided if not entirely accomplished reduction of the rib condition.

In **examination** of the depressed rib the anterior end of the twelfth will usually be found at a point about on the mid-axillary line, i. e., the rib reaches about half way to the median line in front. In most cases its end can easily be felt on careful palpation but where it is disturbed in its relations especially if the case be a recent one, much tenderness of tissue will be encountered, hence care must be exercised or additional irritation and contracture will result. The rib can then be followed around to a point near its central articulation and further data secured for diagnosis. The anterior end of the *eleventh* will be found above and more toward the anterior than the posterior part of the body. In noting the condition of either, the point should be remembered that these are *atypical* ribs and hence more subject to differences in normal size, shape, and position than the others. In many cases the twelfth will be so short as to make possible the mistake of calling it the transverse process of a lumbar vertebra. Similarly, we have known of the latter being mistaken for a twelfth rib. Simple attention to the fact that the rib may thus vary in length and mobility will make it extremely improbable that a careful diagnostician will be mistaken. Yet such has been the case. Further, the *ilio-costal space* should always be examined to determine whether it is widened or narrowed. Naturally this space varies with individuals. In a medium sized man it will be equal to the breadth of two to four fingers. Where an inequality between the two sides exists it is always a fact for suspicion that something is wrong. Care must then be used to determine whether it be due to a faulty innominatum, lumbar spine, or rib.

Nearly as often there is found an **upward displacement** of the anterior end of the rib. This will be noticed from the narrowed space between the anterior end of the rib and the one next above. In occasional cases the tip of the twelfth seems to be held by a lock of some kind underneath and behind the anterior part of the eleventh. We have personally examined several cases where we could follow the course of the rib anteriorly till it disappeared underneath the one immediately above. Just the relation the tissues here bear to each other it seems impossible to determine. Such cases will usually be quite obstinate ones to overcome.

Then there are numerous cases where the **posterior end** has been displaced upward or downward, or the whole rib has been forced from its location. In a few it will be found luxated directly forward and situated so deeply in the tissues as to make its palpation quite difficult.

Reference has been made in most part to the conditions associated with the last rib. The same considerations hold with reference to the *eleventh* which is similar in its formation, location, and relations. Occasionally the *tenth* will be also a floating rib, since its cartilaginous extension is usually not very perfect and often becomes broken loose from the cartilage of the ninth. In most of such cases by movement of the anterior end a definite *crepitus* may be felt and sometimes heard. This seems to be the friction between the broken cartilage and surface to which it was formerly attached.

Adjustment of Ribs.

As a general proposition covering the treatment of rib lesions it may be stated that the chest must be **considered as a whole.** Each rib is so intricately connected with the adjacent one that a considerable subluxation of one is altogether unlikely unless associated with some disorder of one or more of the others. This does not mean that one rib may not be subluxated and the others remain normal. The author has seen numerous cases where no abnormal condition whatever could be detected in the ribs on either side of the one involved and yet the one showed marked evidence of its perverted condition. As a matter of fact the larger number of cases with which the osteopath meets are those where only the slightest amount of actual displacement is present, though the effect of such may not be at all slight. But it is manifest that where the ribs are normally so closely approximated and are held between two sheets of muscular and other connective tissue, a very marked actual disturbance of one rib must produce an appreciable change in the next. This is of practical value when the application is made to treatment. For the tension exerted on one rib must be propagated to the next. Hence in adjusting any one of them an efficient force can be exerted by working upon another, preferably that next to it. *For instance* in an upward and inward crowding of the anterior end of the eleventh, by tensing the quadratus lumborum and lower abdominal muscles a successful tension is exerted on the eleventh although the principle effect is upon the twelfth. Similarly, lifting the upper ribs will assist very materially in overcoming a depressed condition of those lower down.

Before beginning the treatment of any rib condition, especially if it be one involving several ribs, care must be given to determine whether the rib disorder is not dependent on a **vertebral disturbance**. For in many cases the perverted rib condition is *normal to the existing spinal condition*. Hence the treatment to the ribs as a primary consideration is illogical and will likely be inefficient. The condition and position of the ribs is far more dependent on that of the vertebræ than is the position of the latter on that of the former. Yet it must be noted that the last named case may be a real one. A rib disturbed from its normal position and maintained thus will quite likely effect some change in the vertebral relations. In cases where the rib disorder is thus dependent, the logical treatment will be directed to the vertebral disorder. That overcome, the ribs may adjust themselves. Yet it is found in actual practice that treatment to both structures is more satisfactory in point of time and efficiency than that alone to either part and it is entirely reasonable that such should be true.

So far as **specific movements** are concerned a few only will be mentioned—enough to illustrate the principles which underlie practically all of the manipulations which are employed. With reference to the *position* for treatment osteopaths differ. But either in the erect or horizontal posture the ribs are quite satisfactorily adjusted. *Any manipulation that will pull the rib forward and out from the articulations with the spinal column* will be effective in greater or less degree. In most cases the disturbance will be associated with the posterior part of the rib, and that obstruction released, the anterior part will be self-adjusted. But additional movement given to the anterior part will add to the efficiency of the treatment in most cases. The *parts made use of* in adjustment are usually the angle and the anterior end, the latter either directly, as may be done by laying the flat of the hand upon the chest and exerting tension through sufficiently close approximation to prevent slipping of the tissues, or by acting through the medium of one or more of the various muscles which are attached to the anterior and lateral aspects of the ribs. The latter is perhaps the more common and effective method. *Exaggeration* of the lesion is made use of as in most osseous disorders. Hence if the rib be depressed in front and lifted behind, downward pressure is exerted on the anterior end and an upward thrust posteriorly as a preliminary to the essentially corrective treatment. With patient on the left side, in case of right rib luxation, the physician stands in front and with the left hand reaches over to the angle of the rib where pressure may be made in the appropriate direction to either exaggerate or adjust. Then the patient's right arm is grasped, drawn downward across the chest and face, and up over the head. *The movement should be executed slowly.* For muscle as well as connective tissue under normal conditions will yield to a stretching force if gradually applied more satisfactorily than to the same force quickly applied. In the latter case the sudden motion will act as a stimulus to additional contracture and that condition is already too much in evidence. Further, owing to this latter fact, the tissue is in an irritable condition and will respond with greater contracture to a lesser stimulus than would be necessary if the tissue were normal. *Note the reason for the movement.* The hand on the angle of the rib exerts pressure forward as well as in a direction to exaggerate or adjust. This pulls the rib away from its articulation sufficient to release the deepest structures associated with the articulation. At the same time the same effect is being produced by drawing the arm downward across the chest and face through the mediation of the costo-scapular muscles. As the arm is lifted over the head a direct upward traction is made on the rib through the pectoral and scapular muscles which powerfully loosens the structures associated with the rib. Then as the arm is freed but with pressure still applied posteriorly, the rib will tend to settle back to its normal relations. This is a type of a large number of manipulations in common use in which practically the same principles are made use of. For instance the same effects are gotten with the physician standing behind instead of in front of the patient who is in the lateral horizontal position. In this the *knee* is sometimes placed at the angle of the rib and the free hand reaching over is laid flat upon the anterior part and in this way additional force and control may be gotten. Bear in mind the *danger* always associated with the knee treatment. Until the student has become fairly familiar with handling himself and his patient he should leave all knee treatments alone. Another *method* in common use and one which is quite effective is used with the patient in the dorsal position. If a left upper rib be involved the physician stands at the head and to the left of his patient. Then the patient's left arm is placed between chest and right arm of the physician while the right hand of the latter is passed beneath the cervico-thoracic junction to reach the angle of the rib. At the same time the physician's other hand may re-inforce the fulcrum underneath or be employed in direct work upon the anterior end of the rib. In this position the physician, by allowing his weight to be carried backward and downward drawing the patient's arm strongly with it, may get a very powerful and satisfactory leverage, especially in those conditions where there is a generally depressed upper thoracic region The treatment is unsatisfactory when applied lower down. With the patient *sitting* the physician stands in front and reaching around underneath the axilla places his fingers on the angle of the rib distal to the spinal column. With the free hand the arm is grasped and passed in the usual manner over the chest and face. Or standing behind, the fingers or thumb may be used as the fulcrum while the arm is rotated. For making a fixed point at the anterior end of the rib so as to *produce movement only at the vertebral part*, various methods are employed, all based on the same principle as the following one which is made use of quite commonly by Dr. Still. The patient stands with chest against the wall or post which prevents material movement of the anterior end. Then making use of the shoulder girdle to lift on the rib through the serratus magnus and other scapular and rib muscles, the posterior part of the rib is forced and guided by the free hand. The same forces are concerned when the patient lies in the ventral position. With an apparatus, such as Dr. Still's *Chair* with its sliding fulcrum, additional advantages are gained. The patient sits, the fulcrum rests against the angles on each side of the spine and a fixed point is thereby gained. Then with appropriate movement of arms or body, standing in front or behind, the ribs are quite markedly under control. Standing in front the thumbs may be inserted so as to grasp the pectoral muscles on either side. Then by lifting and rotating the ribs may be quite satisfactorily adjusted.

In the case of the **first rib**, owing to peculiarities already referred to, a few new and different factors must be considered. It has already been noted that the upward subluxation is the more common and that it consisted in a sliding of the rib at both its transverse and central articulation in an upward direction, owing in most cases to the tension of the scaleni muscles. Naturally the treatment will be the removal of the tension of the scaleni. Hence in all such cases the cause of the latter should be sought and removed. Nevertheless it is found that in most cases this will not be sufficient since the rib will have become partially adjusted to its new position and must be directly worked upon for its correction. A *method* much employed consists in making use of the scaleni muscles themselves. It is manifest that for a downward displacement of the rib this treatment will be entirely appropriate, since by flexing the head to the opposite side a direct upward traction can be exerted on the muscles and hence on the rib to which they are attached. But in the case where the rib is already too high it must be looked at from another standpoint. The flexion of the head is used in the same way but this merely amounts to an *exaggeration* of the lesion. Thus as the head is returned to its normal erect position or passed on to the side of the luxation, downward and forward pressure is made upon the postero-superior aspect of the rib through the muscular tissues, and the rib is thus lowered to its normal situation. For acting upon the *anterior end* of the first rib the sterno-mastoid muscle may be made use of by bending the head back and to the side. Direct lifting of the anterior part of the clavicle or an upward lift of the shoulder girdle as a whole, will, through the subclavian muscle, assist in the manipulation of the rib through its anterior extremity. Note that the anterior end can only be *palpated* over a small area since the clavicle covers all but a small portion. In case of the posterior half of the rib little difficulty will be found in detecting the part. Reaching in front of the muscular mass formed by the trapezius muscle as it passes down over the cervico-thoracic junction, the hand is pressed gradually downward and backward and with care the unyielding rib tissue will soon be felt. The posterior border of the rib will usually be too deeply situated to be readily detected unless it occupies an unusually high position.

The **floating ribs** require in many cases different treatment from that employed in correction of the others. Owing to the fact before referred to, that these ribs are largely at the mercy of the muscle tissues between which they are suspended, the logical treatment would be directed toward producing an equalization of the tension of these tissues. It is manifest that if the rib be luxated downward because of contracture of the quadratus lumborum due to a slipped innominatum, replacing the rib by work upon it directly, while it may be temporarily effective, will seldom be permanently so. The rational treatment would consist in overcoming the distorted pelvis. This further fact should be noted: in very few cases of a downward subluxation of the twelfth and eleventh ribs, *will the other lower ribs be in an entirely normal condition.* In most cases if care be taken in diagnosis there will be a generally depressed condition of the lower part of the chest. Hence the problem will not be simply that of reducing the luxated twelfth but the overcoming of the chest condition as a whole. Even though the other lower ribs be in a normal condition aid can be given toward the adjustment of the twelfth by the methods used to raise the others. In case of a condition where the lower rib lies *up and under* the one above, it is often helpful to elevate the upper ribs as well as to give direct treatment toward depressing the lower. In this way a tendency toward separation of the locked parts will be produced. Granting that the treatment of the other ribs may be effective to a marked extent, it is found that a *direct application* to the rib involved is usually still more so. This may be done in various ways. By a torsion of the body when the patient lies on his side, produced by exerting pressure forward on the lower ribs and traction backward on the ilium, the rib is acted upon through the mediation of the attached muscles. Still more direct effects may be gotten by appiying the thumb and fingers directly upon the rib. The latter is usually easily found and in most cases *spanned* by the thumb and fingers. Then as the arm is rotated to draw the upper ribs away from the lower, pressure may be exerted on the latter in a direction toward the normal situation. Usually the hand is applied to the rib along its course rather than upon the extreme anterior end. In most cases of an abnormal condition of the rib the tissues overlying its end will be quite *sensitive* to pressure and hence any direct work upon the extreme end is to be condemned. Especially any careless "digging" attempts should not be made. In an occasional case it may be necessary and possible to get the fingers inserted somewhat under the anterior ends and an upward and outward lift be given. If so, great care must be exercised and time must be taken to sufficiently relax the tissues and insinuate the fingers deeply. In most cases this treatment will be entirely uncalled for.

By making use of the facts in relation to the peculiar condition associated with these lower ribs and applying the generel rules of exaggeration, rotation, and pressure, the student will be able to do effective work in overcoming rib lesions in any position of the body and in any condition of the rib. The above suggested movements are representative of a large number that may be employed to advantage.

Sternum and Cartilages.

It is occasionally noticed that the sternum as a whole or in part is prominent or depressed in relation to the ribs and their cartilaginous terminations. In such cases we may speak of them as lesions in so far as they are producing additional disturbance. It must not be supposed that such are necessarily **primary disorders**. In most cases a rib subluxation will be responsible for the abnormal condition of the sternum. Note that the *only articulation* of the latter is with the clavicle above and the rib cartilages laterally. Hence it is dependent upon these structures. *Direct violence* of course may cause a depression, in which case there is likely to be a fractured cartilage. Occasionally the row of cartilages on one side will be more prominent than that of the opposite side. The *junction* between the rib and cartilage is not a typical articulation and permits of no appreciable movement. Quite often movement will be noticed but it will be found to be a fracture. A bending at the costo-chondral junction takes place to a greater or less extent during the respiratory actions, but not a gliding movement.

The fact should be remembered that the sternum consists of *three parts* more or less independent—parts which may be made to appear more distinct by lesion conditions. The *ensiform* is occasionally abnormal, either lateral, anterior, or posterior. In such the fault is a nutritive one in which the part has grown into its abnormal position. The *junction* of the gladiolus and manubrium should be noted. This is usually easily detected from its greater prominence and from the fact that the junction between these is the *landmark* for the second rib. In "pigeon breast" this junction is quite angular, though the union is efficient and will permit of little if any movement.

The **treatment** for such irregularities is directed to the adjustment of the ribs and to a gradual pressure applied frequently to the prominent parts of the cartilage structures. Where the rib has been broken from its cartilage, as is frequently the case with the tenth, little likelihood of union is present. *Cartilage is an inert structure* and unless perfect approximation be maintained no union is probable. Fortunately the failure to unite does not seem to present great disadvantage, although in occasional cases a continued *sensory irritation* will be a source of annoyance. In a few cases exquisite pain will be brought out on pressure over the part. This is true also of cases where the cartilage has seemingly been wrenched. Usually a freeing treatment in connection with the rib as well as the part immediately involved will be efficient.

THE CLAVICLE.

The clavicle is a structure which is occasionally found in a disordered condition. Numerous **slight subluxations** occur either as a result of direct violence or as a result of inequality in the tension exerted by the attached muscles. The same possibilities for lesion are present in the clavicular articulations as exist in reference to other osseous structures which present definite articulating surfaces. *Complete dislocation* of the clavicle is common enough in surgical practice and presents its typical symptoms. It is not with such a condition that this work deals, as that is sufficiently emphasized in the works on surgery. But the large number of patients who present themselves complaining of various pain and other symptoms seemingly related to the clavicular structures makes it necessary for the osteopath to examine carefully into such. A surprisingly large number of slight and serious disorders have been absolutely cured by overcoming some hardly appreciable disorder of one or both articulations of the clavicle. The following *typical case* illustrates the conditions met with: a young man in lifting the corner of a wagon box over his shoulder, permitted it to fall, striking him near the acromioclavicular junction. For a few days thereafter some soreness of the tissues and pain on movement of the arm was manifest but within a few weeks no disturbance was noted. Shortly, however, interference with the free movement of the shoulder was noticed. Pain was felt on lifting the arm while weakness of the latter became apparent. On presenting himself to the physician some two months after the accident a diagnosis of downward subluxation of the acromial end of the clavicle was made and treatment given accordingly. The actual change in position of the part was almost inappreciable though there was much tenderness and some contracture in close relation to the articulation. The only treatment given consisted in separating the two articulations and a lifting upward of the clavicle. Two such were given resulting in a complete and rapid recovery of normal conditions. This case is typical of a large number of very slight subluxations which, as in the one described, are produced by traumatism or, as in numerous others,results from a disturbed equilibrium of the muscle tension. Such cases are very common in practice and are among the most satisfactory to practitioner and patient alike.

The **treatment** for clavicular lesions is usually a matter of no great difficulty. Naturally, if the disorder be due to some fault in the musculature of the bone, the nerve supply for such must be investigated. In a few such, overcoming the muscle disorder will be all that is necessary but in most a direct application to the part is helpful if not essential. Any method which tends to *increase the distance between acromion and sternum* will be helpful. The function of the clavicle is in part to form a brace for the shoulder girdle, and hence normally there is a continued pressure exerted at either articulation. Separation of the two parts will therefore be advantageous in lessening the points of contact and thereby permitting muscular tension as well as the direct work of the physician to re-adjust the disturbed relations. In order to *directly grasp* the clavicle the physician may stand behind the patient who sits on a stool. If the left clavicle be involved, the right hand is passed in front of the patient the thumb is placed in the supra-clavicular fossa. Then with the left hand the operator lifts the shoulder girdle in a direction upward and forward by means of the elbow of the patient. This relaxes the tissues associated with the clavicle and allows the thumb to sink in behind the bone, after which the part may be grasped between thumb and fingers. Then by drawing the arm back the articular structures are separated, and the clavicle can be guided into its normal situation. In inserting the thumb behind the clavicle care must be exercised or *exquisite pain may be caused.* By lifting the shoulder girdle and in that way *raising the clavicle in front of the thumb which is held stationary*, less pain and greater effeciency will result than by forcing the thumb down behind the part. This same treatment, so far as principles are concerned, may be used with the patient in the dorsal position. In this case the fingers rather than the thumb are used to insert under the clavicle. For purposes of *separation of the articular structures* a good method consists in placing the knee in the back between the shoulders; then with hands on the latter they are pulled directly backward. The freeing of the articular surfaces and lessening of tension of associated tissue resulting will often be sufficient to overcome slight lesion of either or both ends of the bone.

THE SCAPULA.

The scapula is never luxated in the usual sense of that word since the only articulation it presents is with the acromial end of the clavicle and with the head of the humerus. But in occasional cases there is noted a **change in position** of the scapula which may be quite marked. The scapula, like the hyoid bone, is merely suspended between muscular and ligamentous structures, and hence any disorder in position that it presents merely indicates that a disturbance in the equilibrium of muscular tension exists, due to a weakness of one muscle or set of muscles or an undue tonic condition of others. The condition referred to as *winged scapulæ* is a typical case of this kind. In such the latissimus dorsi which crosses the inferior angle, and other muscles which attach to the posterior margin of the scapula are in a condition of loss of tone. This permits the more anterior and unopposed muscles to draw the part forward and cause the marked projection of the angle which is characteristic. In other cases the scapula will be seen to occupy a position too *closely approximated* to the spinal column. This always suggests an irritation to the rhomboids and posterior fibres of the serratus magnus. Normally there is a space equal to a hand's breadth between the vertebral edges of the two scapulæ. This fact will enable the student to determine a probable displacement. Caution must be used since the distance varies within wide limits.

The **treatment** for the displaced scapula will depend on finding and removing the irritation that keeps up the undue contracture or that has exhausted the tissue in its atonic condition. The student should be able to determine from his knowledge of the musculature the appropriate methods of directly relaxing the tissue, and from his knowledge of nerve origin the lesions likely to be responsible for the irritation.

CHAPTER XV.

THORACIC AND LUMBAR LESIONS—EFFECTS.

Direct Pressure.

Disorders resulting from direct pressure of the spine upon the organs are not common, since it is only an extreme anterior condition that would sufficiently crowd the structures to produce disorder. But in many cases associated with a **flattened chest** the flat upper thoracic spine may interfere directly with the activity of various of the thoracic viscera. In the lumbar portion the spine is occasionally so noticeably anterior as to be easily palpated from the ventral aspect. Such may, in a way, produce effects by direct pressure.

Vascular Obstruction.

Interference with vessels is largely limited to the branches associated with the spinal column belonging to the **intervertebral system.** The arteries given off from the intercostals pass directly back to supply in part the spinal canal structures through the intervertebral openings, and in part the muscles and superficial tissues on the dorsal aspect. Lesions of the vertebræ or deep ligamentous structures may, therefore, cause a lessening of the nutritive supply of the spinal cord, which will produce any form and number of effects dependent on interference with the nerve impulses passing from the particular spinal segment involved. These effects will be discussed more in detail in a succeeding section. In the same way the venous drainage being impaired, the venous congestion resulting will seriously impair the nerve discharge. The *muscle contracture* by interfering with the normal flow through the softer tissues of the spine may not only cause disorder of their own nutrition but collaterally produce disorder of the next immediate branches, i. e., those passing to the cord, if the condition is maintained sufficiently long. In the lumbar part of the spine the **lumbar vessels** passing in close relation to the *psoas muscle* may be interfered with by abnormal conditions of that structure, in addition to crowding of the branches that lie in their relation to the spine similar to those in the thoracic portion. In the upper thoracic region the closeness of the upper thoracic spine to the sternum and anterior part of the clavicle and first rib may more or less seriously obstruct the flow through the large vessels in that region. These are more properly discussed in connection with the rib lesions because it is usually the rib structures which are mostly at fault.

Spinal Nerves.

The nerves likely to be involved from lesion of the spine in the thoracic and lumbar portions are the same in kind as those in the cervical portion except that the cranial system will not be involved. Of the spinal nerves proper the **twelve thoracic** and five lumbar are situated in positions where marked luxation may produce irritation. The anterior branch of the first thoracic nerve aids in formation of the *brachial plexus*, that of the second sends an offset to supply the cutaneous tissues of the arm, while from the last a branch is sent to the tissues overlying the *hip*. With these exceptions the anterior branches are continued over the chest and abdomen as the *intercostal* nerves. So far as the spine is concerned these nerves will only be impinged at the intervertebral regions. The effects from such are varied in number and intensity. Intercostal *neuralgias* are common. These suggest purely an interference with the afferent spinal fibres. If a pair of nerves be involved it indicates a more *central disorder*, i. e., involvement of the segment of the cord with which the nerve is connected. If a single side be disturbed it is more likely interference with the nerve or its ganglion cell body on the one side of the spine. Other disorders of sensation may be present. The *motor* organs may be involved. Tightenings of the chest wall or of the abdominal parieties, either tonic or spasmodic may occur, while the atonic condition of the abdominal walls is a fairly common disorder. These spinal nerves, through their connection with the thoracic and lumbar sympathetic systems, carry fibres subserving the various functions associated with the latter system and will be spoken of later. It must further be noted that there is possibility of disorder of the thoracic viscera from involvement of the intercostals. This is true not only because of the disturbance of the action and condition of the chest wall, or through the reflex mechanism, but by virtue of the fact that the terminals of the nerves have been traced across the space between the wall and the *pleuræ* and into the latter structures. Hence pleuritic disorders may be partly dependent on spinal nerve irritation. The *posterior branches* of the thoracic and lumbar spinal nerves are distributed to the dorsal structures both superficial and deep. Irritation to them will produce muscular contracture, sensory disorders, and disturbance of associated sympathetic functioning. The "stitch" in the back, lumbago attacks, and many so-called kidney pains are in most cases disorders of the sensory nerves in these regions dependent on vertebral lesion or muscle contracture. Similarly those structures of the *limbs* supplied from the posterior branches of the lumbar nerves, which include the superficial tissues of the buttocks and upper thigh, may be involved in numerous forms of disorder.

With respect to the anterior divisions of the lumbar nerves numerous facts must be borne in mind. These branches passing from the foramina with the exception of the fifth enter the *psoas muscle* to form the **lumbar plexus**. This muscle lies in front of and is attached to the transverse processes of the lumbar vertebræ. In this situation, therefore, we find a very reasonable possibility for irritation, not only from distorted conditions of the vertebræ themselves thus initiating muscle contracture or directly affecting the nerves, but from contraction of that muscle from other causes the plexus may be disordered in all or any of its parts.

The **sacral plexus** is in part formed from the fourth and fifth lumbar nerves. This plexus lies upon the pyriformis muscle and enters into the great sacro-sciatic foramen where it continues as the *great sciatic* and *pudic* nerves to be distributed to the limb and various of the pelvic structures.

In discussing the effects of lumbar lesions it is advisable to mention a few of the more **important nerve trunks** having their origin in the lumbar portion of the spinal cord, and trace in brief various of the more common disorders with which the practitioner comes in contact. One set of fibres from the lumbar plexus passes to supply the lower *abdominal* and *genital areas* and to some of the structures on the anterior aspect of the upper *thigh*. Contractures of the psoas muscle or lesions of the lumbar region may therefore cause various curvatures and muscular disorders. Another set pass to be distributed to the antero-internal areas of the thigh. Among these are several of special importance. The *external cutaneous* passes anteriorly and externally to supply the skin and other cutaneous structures as far as the knee. The *obturator* is of special importance inasmuch as it often by pain conditions suggests hip or other lesions. It is cutaneous, muscular, and articular in its distribution, supplying both hip and knee joint and various of the structures between. The *anterior crural*, the largest of the more anterior nerves, is distributed to the antero-internal aspect of the thigh and in addition sends a few filaments down the leg and foot. It supplies cutaneous, muscular, vascular, articular, and osseous tissues. Numerous forms and intensities of disorders may therefore arise from a lesion in the region of the lumbar spine or other part in connection with this nerve. In many cases a severe *neuritis* similar to involvement of the sciatic nerve is associated with the anterior crural. Disturbances of the *knee or hip* to which it sends articular branches are common. Disorders of the *sciatic* nerve may result from the lumbar lesion, since the lumbar nerves are concerned in the formation of the sacral plexus. One of the most common causes of sciatica is a disordered condition of the lumbar spine. Since the sciatic nerve supplies the remainder of the thigh and leg not before mentioned, the possibility of a large number and variety of effects from lesion affecting its origin is obvious.

In case of all these spinal nerves described it must be constantly borne in mind that they carry in addition to fibres properly of a spinal origin, others derived from the **sympathetic ganglia**. Hence various of the sympathetic functions will be interferred with in lesion to the nerve.

SYMPATHETIC NERVES.

The division of the sympathetic system which is associated with the thoracic part of the spine is of importance from the fact that it comprehends the *area of exit of the white rami communicantes*, and in large part, which is principally dependent upon the former fact, comprises the area from which efferent impulses pass from the central system. We have already discussed the various functions of the sympathetic filaments distributed from the **cervical ganglia**. It remains to show that in large part *the impulses distributed from these cervical ganglia are dependent upon other impulses received from the spinal cord through the mediation of the thoracic ganglia.* For instance fairly good evidence is presented to show that the *pupillo-dilator* fibres that ascend from the superior cervical ganglion leave the spinal cord by the white rami in the upper thoracic region. Similarly though not so noticeably it is true of the constrictor fibres. The *vaso-motor* fibres that pass with the carotid and cavernous plexuses to reach the eye, the ear, and the meninges of the brain, leave the cord in the thoracic region. It is known that the *cardiac accelerators* that are given off from the cervical ganglia by the cardiac nerves all issue from the thoracic cord in the upper two or three of its segments. The *vaso-motor* fibres that supply the vertebral, subclavian, thyroid, and other cervical vessels are also derived from this region. Hence the general statement is not far wrong that *any* *disorder produced by a cervical lesion may be duplicated by an upper thoracic disturbance.*

In addition to the effects upon the fibres that are distributed by way of the cervical sympathetic, however, there are numerous additional effects from the upper thoracic lesion. The **heart and aorta** may be involved. There already has been suggested a way in which the heart may be disordered through disturbances of the accelerator nerve on the one hand or of the cardiac vaso-motors on the other. These fibres pass out of the upper thoracic segments and in large part are carried to the cervical ganglia from whence they are distributed to the *cardiac plexus*. Some few fibres may pass directly from the upper thoracic ganglia and join with that plexus. It is

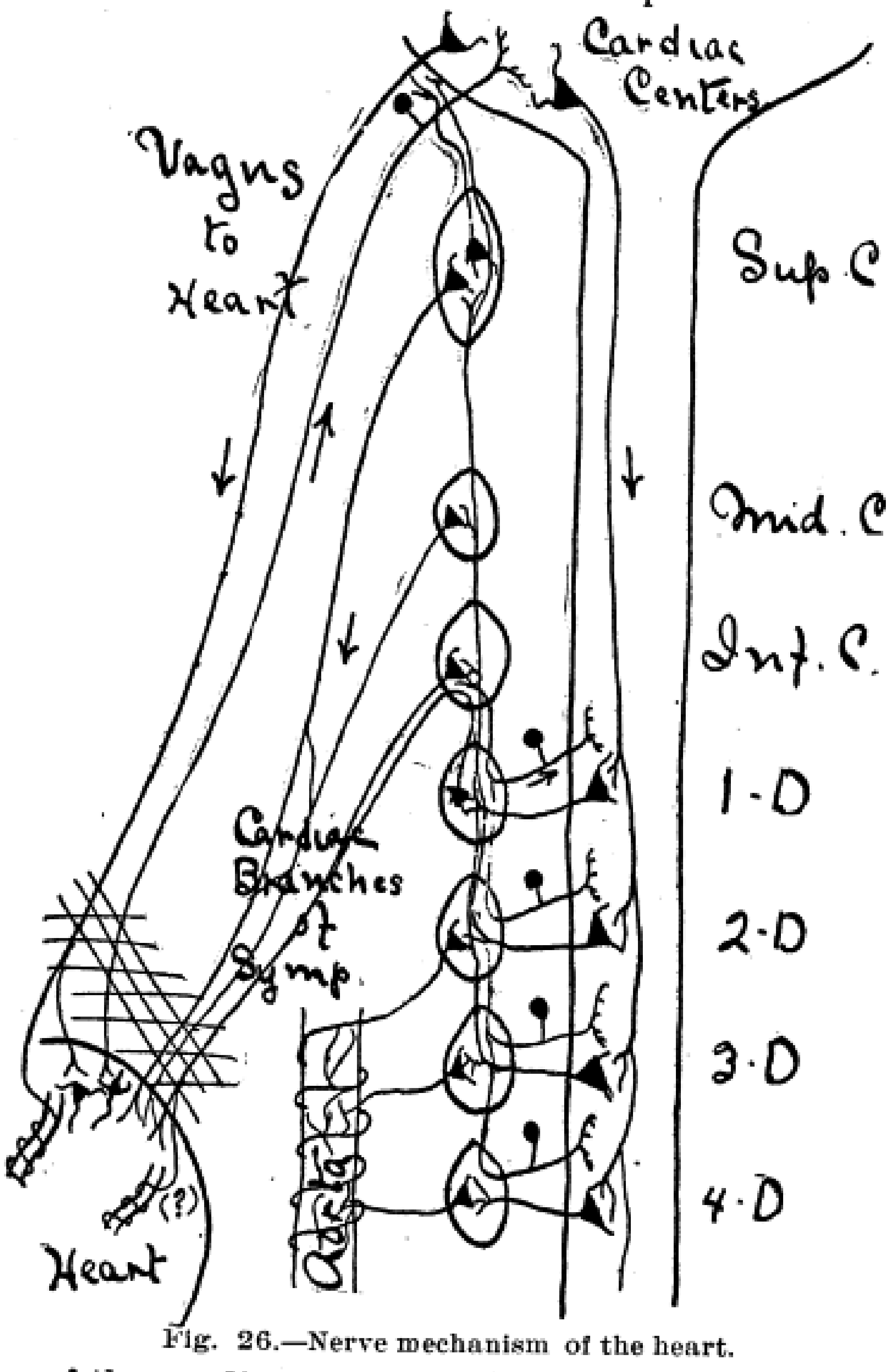


Fig. 26.—Nerve mechanism of the heart.

known that fibres passing from these upper ganglia make a *direct connection with the thoracic aortic plexus* in close association with the heart. It is reasonable to assume though perhaps difficult to demonstrate that these fibres have a vaso-motor function in connection with the thoracic aorta. This is interesting as throwing light on the recoil of the aorta following each systole of the ventricle, for according to Hunter and others the force of the recoil is greater than the force necessary to cause the distension in the first place. Disturbances of this condition of the *aortic tone* may quite materially produce disturbances of the heart's action. The cardiac disturbance resulting from the very common upper thoracic lesion is more likely dependent upon the cardiac accelerators that pass out from the cord in this region and upon the coronary vaso-motors that probably do so. A lesion acting as a stimulus to these fibres or their cell bodies in the cord will in the first place produce increased tone of the cardiac and arterial muscle, but if kept up sufficiently long, which is true of most lesions, an exhausted condition will result which amounts to inhibition and this ultimately means a failing heart. The upper three or four segments of the spinal cord represent then the typical cardiac area of the cental nervous system and the *typical region* for spinal lesions affecting the heart.

This same region is one common to lesions affecting the **arm** and may be spoken of as the *vaso-motor center* for the arm. The sympathetic fibres reach the tissues of the arm by at least *two pathways*. The fibre passing out by way of the white ramus is conducted from the thoracic ganglion upward into the inferior cervical ganglion from whence the nerve impulse is carried by the grey fibre into the cervical nerves forming the *brachial pelxus* and is distributed with those fibres to the arm. Or instead of passing from the inferior cervical ganglion to connect with the spinal nerves, fibres are given off directly from the ganglion to form the plexus distributed to the *subclavian artery* and its continuation.

Hence it is possible that either of these two courses may be the pathway for disturbed vaso-motor impulses to the upper limb. Cases are on record where a lesion as low as the fifth or sixth was directly responsible for disturbance in the arm. In such case the presumption is that the fibres constituting the vaso-motor mechanism originated in the cord at this level. Usually the lesion will be considerably higher. Various kinds of effects will be noticed in connection with such lesion. Superficial disturbances, such as *eczema* and other eruptions; *sensory* disorders in the way of definite pain sensations, or tinglings and numbness; or deeper disorders may be present, such as *malnutrition* of the muscles and other tissues, congestion and inflammation.

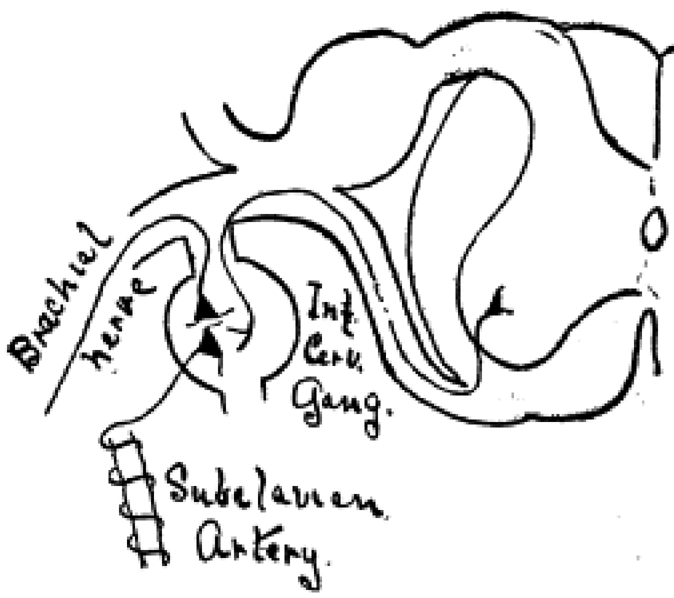


FIG. 27.—Showing double pathway for sympathetic nerve fibres to the arm.

The upper portion of the thoracic spine is also a typical region for **pulmonary disorders.** The area from the second to the seventh thoracic is the vaso-motor center for the lung and its associated structures. That is, from this region white fibres leave the cord ultimately to carry impulses to the muscle fibres in the pulmonary arterioles. These fibres are not as numerous as are those to some other of the viscera but are fairly easy of detection. They pass directly from the upper thoracic ganglia to reach the *pulmonary plexuses* which are made up by them with additional fibres received from the *cardiac plexus* and numerous filaments derived from the *vagus.* These direct fibres carry *vaso-motor* impulses to the lung vessels and *sensory* impulses from the tissues back to the cord. It has long been known that there are *tender areas* posteriorly between the shoulders in many diseases of the lungs and this fact of the sensory distribution helps to explain that condition.

Various congestive and inflammatory conditions of the lung tissues will result from lesion in this spinal area. *Bronchitis* following exposure of some kind depends upon irritation to vaso-motor distribution in the bronchial mucosa; *congestion* of the lungs both simple and where complicated by pneumonia are dependent on similar disorder; *pleurisy* and affections of the more superficial parts of the chest wall are similarly caused; *asthma* has its usual lesion in the thoracic spine and the ribs, while other disorders of the respiratory mechanism too numerous to detail are continually met with, and in large part depend on irregularities in the spinal areas concened. Not only these efferent nerves may thus cause disorder but afferent filaments leading from the lung and chest regions may be sufficiently irritated to produce disorder. For it has been shown that the respiratory center in the medulla is easily affected by stimuli from the sensory fibres contained in the *intercostals*. Every one has experienced the spasmodic effect produced on the respiratory apparatus by a sudden cooling of the cutaneous tissues of the chest region, and all obstetricians know that a smart blow on the cutaneous tissues will tend to initiate the automatic action of the respiratory center in the case of a newborn child when simple exposure to the air is not a sufficient stimulus. Hence it is not unreasonable to assume that an increased number of afferent impulses from this region dependent on chronic muscle contracture or other lesion may be an efficient factor in causing a disturbance of the respiratory rhythm and hence producing greater liability to other influences of a deleterious character.

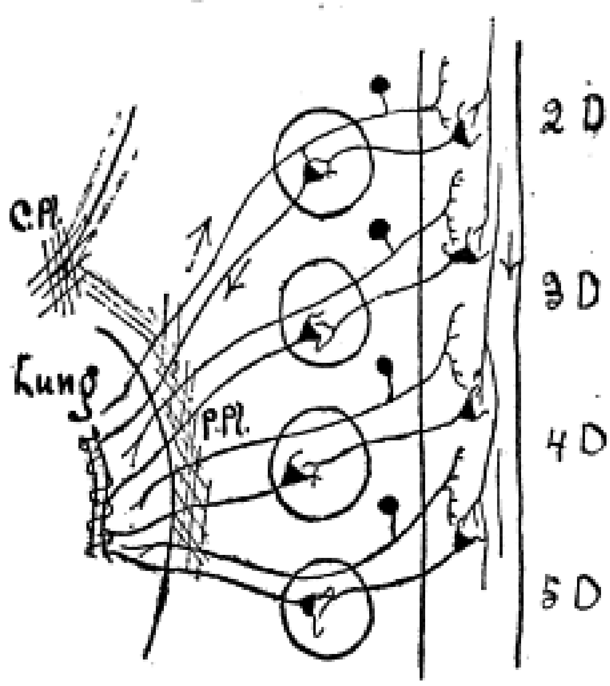


FIG. 28.—Sympathetic innervation of lung.

The middle and lower part of the thoracic spine is a region of importance since it represents that part of the cord and sympathetic system which is in direct control of the digestive processes. From the thoracic ganglia including the fourth to the tenth are given off efferentes which make up the greater or lesser *splanchnic nerves* whose importance to the

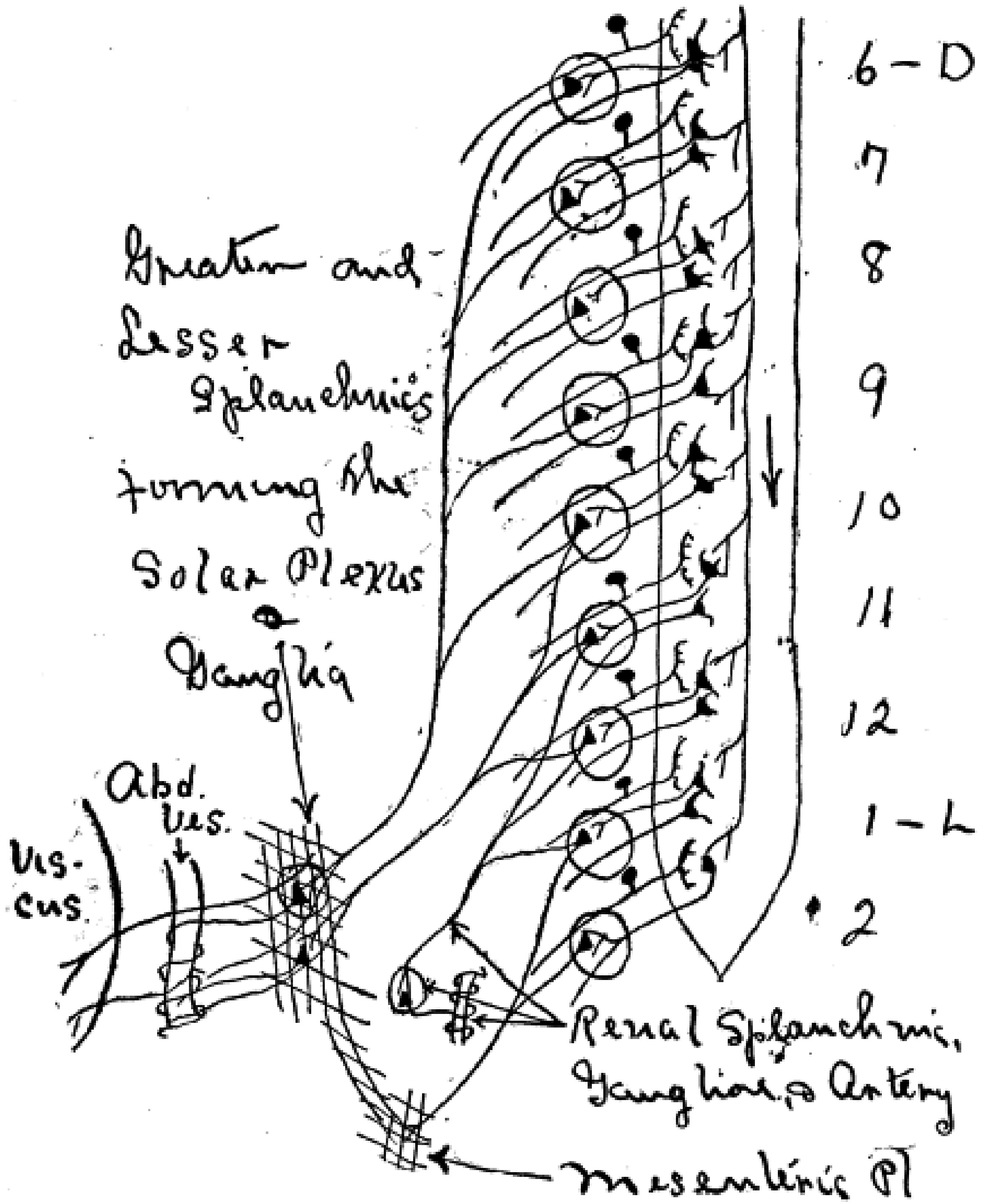


Fig. 29.—Sympathetic nerve supply of abdomen.

physician all osteopaths recognize. The least splanchnic is more concerned with other than the digestive functions and hence is not considered in this connection. It is unsafe to put any absolute limits to the splanchnic area since both physiological experimentation on the lower animals and osteopathic experience in connection with human diseases show that the *area varies within very wide limits.* For instance lesions as high as the second thoracic and as low as the tenth have been known to cause stomach disorder. Whether such indicates that the splanchnic filaments passing to the stomach in these cases issued from the cord in these regions of course is not proven, but the assumption is not unreasonable. The fibres that pass by way of the splanchnic nerve and solar plexus to reach the **stomach** are concerned with numerous functions. It is known that *sensory* fibres subserving the purpose of pain pass by this route to reach the spinal cord and ultimately the sensorium. Disturbance of these fibres from spinal lesion may create not unly sensory reflexes but by increasing the impulses to the cord segments create local metabolic disorder which will result in excess of outgoing impulses to the stomach. These fibres contain numerous forms of efferent nerves. The *vaso-motors*, both constrictor and dilator, pass to the gastric arterioles. One of the most common of stomach disorders is a temporary congestion or *inflammation* (gastritis) of the mucosa. This is readily produced by lesion affecting the vaso-motors. A *sour stomach* is a common disorder. It is usually dependent, not on an excess of the normal acid of the stomach, i. e., hydrochloric, but upon a fermentation process with liberation of lactic and other organic acids from changes in the foods present. It is not sufficient to reply that this fermentation is due to the presence of various forms of micro-organisms. The normal condition of the stomach precludes any activity of such bacteria as are not beneficial to the body. An ill-nourished condition of the stomach dependent on a deficient nutrient supply is present, and is usually dependent on interference with these nerves. The same interference may result in excessive, deficient, or changed secretions, since one of the important controlling factors in secretion is the blood supply. Whether there are any proper *secretory fibres* to the gastric glands through the sympathetic system remains yet to be satisfactorily demonstrated. There is quite good evidence that the pneumogastric filaments exercise such a direct control and it is not unreasonable to assume that the sympathetic by disturbance of the other conditions may likewise interfere with the normal secretory activity of the vagus. Further the general statement is made that the sympathetic carries *viscero-inhibitors* to the alimentary tract including the stomach, while the vagus carries the viscero-motors. This is undoubtedly true in so far as the most marked action is concernned, i. e., the usual result of experimental stimulation of the peripheral end of the cut sympathetic is an atonic condition of the muscle tissue in the gastric walls. Hence a lesion acting as an irritant to such fibres may produce atony of the stomach wall through overstimulation of the inhibitors; what is much more likely, through an exhaustion of the forces associated with the nerve, there will be an unopposed action of the tissues and hence a final condition of weakness with dilatation. It has been said that there are special *osteopathic centers* for controlling the cardiac and pyloric orifices, situated respectively in the upper and the lower gastric areas, i. e., fourth to ninth thoracic. Physiological evidence is not entirely satisfactory in this respect though most investigators are agreed that the sympathetic fibrils from the upper area do exercise a relaxing function in case of the cardiac orifice while less evidence is obtainable in case of the pylorus.

The thoracic region from the seventh to the tenth or eleventh is the vaso-motor region for the *liver*, *spleen*, *and pancreas*. The area for these viscera is not very definitely marked out but sufficient evidence has been secured to show that this part of the cord gives off fibres which supply these accessory glandular structures. It is further known that the portal system of veins is innervated by similar fibres from the same region. Hence various conditions of disordered digestion may result from interference with the blood supply to these structures.

Obstructive *jaundice* is a fairly common condition met with in practice and is due to swelling and infiltration of the mucous lining of the bile duct which in turn is dependent upon the interference with the blood supply. Congestion of the liver substance or hypertrophy following such congestion, or an atrophy following the hypertrophy, are also met with and are dependent upon disordered blood conditions part of which may come from spinal lesion. The *spleen* is occasionally congested dependent upon disorder of its vaso-motor mechanism. Since the spleen represents a part of the circulatory apparatus and is directly concerned with the formation and disintegration of red blood corpuscles the importance of a lesion to its nerve supply is obvious. The spleen as a whole is merely an expanded and many-chambered blood vessel and undergoes a special rhythm of its own through the periodic contraction of the strong muscular fibres in its capsule and trabeculæ. A disorder of the *pancreas* may be the occasion for various symptoms dependent on obstructed nutritive conditions. These symptoms are usually not peculiar and are not often referred to the pancreatic disorder. It is entirely reasonable, owing to the fundamental importance of the pancreas to the digestive processes, to assume that the organ is often responsible for presence of digestive disorders. Recent investigations relating to the glycogenic function of the pancreas tend to emphasize more and more the importance of this organ, its normal action being essential for the transformation of glycogen into sugar and of sugar into glycogen. Disturbance of this normal action may account for many of the cases of *diabetes mellitus* formerly supposed to be due to liver or even to kidney disorder. This same region of the cord in all probability may in addition to supplying these structures with vaso-motor fibres give off fibres of a definite and direct *secretory* function, i. e., exercising an influence directly upon the secreting cells without reference to the control of the amount of blood. For this belief there is but little direct experimental evidence. Inasmuch as certain other glandular structures of the body are known to be supplied by sympathetic secretory nerves, e. g., salivary glands, it is not unreasonable to assume a similar control for these digestive glands. It has further been shown experimentally that this region of the spine receives fibres directly from the viscera through the sympathetic system carrying *sensory* or afferent impulses. Hence lesion in this part may interfere with the normal flow of impulses from the viscera to centers and reflexly produce various sensory and motor disorders of immediate or more remote organs.

The region of the spine from the middle thoracic to the coccyx represents the area of innervation for the **intestines**, and hence lesion of any part of this area may reasonably produce the various disorders which are common to the intestinal tract. And experience indicates that it is not theory but fact. For instance lesions producing *constipation* have been found as high as the fourth dorsal and as low as the coccyx. A consideration of the distribution of the function of the sympathetic filaments in this region throws light upon the question. It has already been stated that in the splanchnic nerves are to be found fibres subserving the function of motion to the abdominal blood vessels. Among the latter must be included those distributed to the mesenteries and thence to the bowel walls. It is further stated that *vaso-motor* fibres have been shown to pass from the solar plexus to supply the portal system of veins. Hence both the arterial and venous systems of the intestinal structures are more or less subject to vaso-motor control. An excess of blood from vaso-dilatation will cause one or both of *two effects*, i. e., increase of intestinal secretion and stimulation of the motor organs in the intestinal walls. In these walls in connection with the submucosa and muscle layers are found the double set of ganglionic structures, *Meissner-Billroth's and Auerbach's plexuses.* It is believed that these act as local distributing points for secretory and motor influences respectively. An increase of blood to these regions, therefore, may easily produce excess of secretion and of motion with a resulting over-active peristalsis in which both factors are usually concerned. Hence a condition of *diarrhœa* with or without inflammation is often the result. It must not be assumed that the excessive activity will be the constant accompaniment of the excess of blood. It is not unreasonable that a venosity of the blood resulting from the continued dilatation may cause a final exhaustion of the functioning powers of the bowel wall and the opposite of diarrhœa, i. e., *constipation* will result. Naturally, other than these two conditions may occur as an effect of the local disturbance of blood. It is safe to say that *any pathological condition* possible to a similar structure will result, depending alone on the cause above mentioned, or by making conditions which are predisposing to other factors in producing disease. Interference with the *constrictor filaments* in the splanchnic will cause effects at least temporarily more or less opposite to those associated with dilatation, i. e., ischæmic states which lessen secretion and motion. But in either case *the ultimate condition is likely to be congestion* since the nerve mechanism will at length become worn out, leaving the inherent elasticity of the vessel wall as the only factor to limit the amount of blood present.

There are in addition to to the vaso-motor fibres also the **viscero-inhibitors.** It is usually stated that the sympathetics are inhibitors to the muscle tissue in the walls of the alimentary tract and that the cranial (vagus) and spinal (sacral) are motor. While the view is largely correct there are evidences showing that both the cerebro-spinal and sympathetic systems are motor and inhibitor. This latter fact is not by any means proved from the common experience of osteopaths that a so-called stimulating treatment to the spine is more favorable in constipation while the inhibitory application is most successful in diarrhœa. There are too many associated factors in the problem to make such a generalization. In this connection it is advisable to note that the *crossed inervation theory* of Basch has been disproved. This theory is one which has been incorporated in various text books and conclusions have been drawn from it for which there is no justification. In brief it is that the cerebro-spinal and sympathetic systems both send motor fibres to one coat and inhibitory fibres to the other, and that the two are opposite in action in each of the coats. Along this line a quotation of two paragraphs from Langley recorded in Schafer's *Text Book of Physiology* may not be amiss: "It has been asserted that in the gut, the internal generative organs and the bladder, there is an essential difference in the character of the nerve fibres received from the sympathetic and of those received from the vagus or from the pelvic nerve, of such sort that the sympathetic fibres cause contraction of the circular muscular coat and inhibition of the longitudinal muscular coat; whilst the vagus and pelvic nerve cause inhibition of the circular muscular coat and contraction of the longitudinal muscular coat. A considerable number of observations which have been made on the several organs, show that this is not the case. And in the course of investigation into the innervation of the pelvic viscera by Anderson and myself, results were obtained entirely inconsistent with this theory. Thus for example stimulation of the sympathetic causes the most striking longitudinal contraction of the vas deferens, and in the rabbit the most obvious inhibition of the longitudinal coat of the descending colon; and on the other hand stimulation of the pelvic nerve causes in the rabbit, in certain circumstances, complete and powerful contraction of the circular coat of the descending colon and rectum. In one case only is there *prima facie* ground for the theory. The pelvic nerve causes great contraction of the recto-coccygeal muscle; and the sympathetic, if it has any effect at all, which is not quite certain, has an inhibitory effect." (pp. 692-3, Vol. II.) "Recent observations have strengthened the general conclusions arrived at in the next, that the cranial autonomic system sends motor fibres to both coats of the gut, and that the sympathetic system sends inhibitory fibres to both coats. With regard to this it is to be borne in mind that the motor effect produced by stimulating a particular nerve strand varies somewhat in different animals, in different parts of the gut, and in different circumstances. The observations strengthen also the view that the cranial system sends some inhibitory fibres, and the sympathetic system some motor fibres to both coats, but it is clear that these fibres vary in number in the nerves to the different parts of the gut and in different animals; and although it is perhaps probable that such fibres occur generally in animals, further evidence is required to place this view on a sound basis." (pp. 695, Vol. II.)

From the foregoing it will be manifest that **no definite rules** can be given with regard to the effect of any particular lesion upon the motor activities of the hollow viscera, and as a matter of fact from actual experience it is found that the same lesion in different individuals will produce different effects, or in the same individual a lesion will produce different effects at different times. Further it is rather unsafe to make definite rules regarding the *part of the bowel* likely to be affected. In general both anatomical and physiological facts and clinical experience suggest that the *higher the lesion in the spinal area the higher will be the pathological condition in the intestinal canal.*

Ovarian and uterine disorders are quite often resulting conditions from muscular contracture or vertebral lesion from the ninth to the twelfth, as well as from regions lower down. The explanation is not particularly difficult since fibres forming the *ovarian plexus*, which is one secondary to the solar plexus, have been traced back to the ganglia of the sympathetic cord in this region. These fibres are largely *vaso-motor* in function and hence control the amount of blood to the ovary and uterus. In *ovarian colic* it is quite common to find marked muscle contracture in these spinal tissues which may be either primary or secondary. *Inflammatory* conditions of this organ will also be associated with similar lesions while disturbances of the *menstrual period* and various other uterine disorders are quite commonly dependent upon the lesion. Through this same channel pass *sensory* fibres from the uterus and ovary.

From the tenth thoracic to the first or second lumbar is represented the typical region for **kidney disorders.** From the lower two or three thoracic ganglia more especially from the last and occasionally from the upper lumbar ganglia, arise fibres that pass to form the least splanchnic. This nerve is distributed in large part to the renal vessels from whence they are carried to the arterioles in the renal substance. They exercise a control over the lumen of the arterioles and thus regulate the rapidity of the *excretory function* of the kidney, for it is known that the excretion varies directly with the blood flow and blood pressure in the arterioles. Lesions in this region of the spine will therefore produce congestions, disturbed urinary secretion, inflammations, and other disorders associated with a disturbed blood supply. Further some of the sympathetic fibrils have been traced into the membrane supporting the epithelial cells of the tubules which suggests a direct control of the *secretion* process, although little experimental evidence for such a control has been presented. Some of the fibres associated with the renal plexus are also afferent and convey the sensations of *pain* which are common accompaniments of kidney disorders, and also subserve the function of afferent pathways for the *kidney reflexes.* It has been found that strong quiet pressure in this region of the spine is often effective in reducing the pain associated with *renal colic.* In this condition the renal calculus is passing through the *ureter* and it is the irritation from its presence that causes the extreme distress. Quain states that sensory nerves from the ureter pass through the last three thoracic and first lumbar ganglion.

In the lumbar portion of the sympathetic system are found numerous fibers given off to supply the abdominal aortic plexus through which they are continued downward into the formation of the **hypogastric plexus,** which also

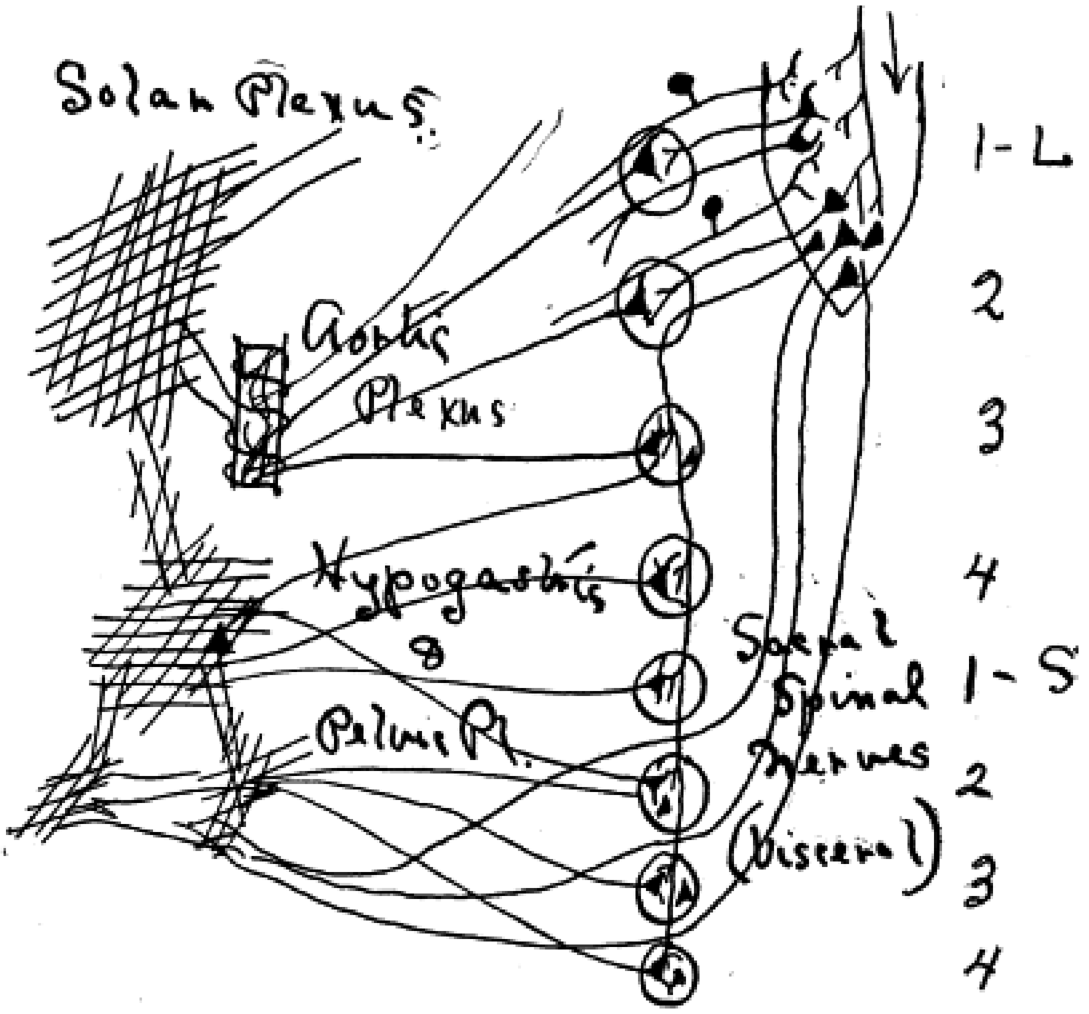


FIG. 30.—Showing innervation of pelvic structures.

receives filaments direct from the lumbar ganglia. Through interference with the action of these fibres various diseases of the *pelvic structures* may result. Motor fibres to the *bladder* are among those given off from the hypogastric plexus as well as their antagonists, the inhibitors. Lesion, therefore, could reasonably produce a disturbance of micturition. Note that the capacity of the bladder and hence the frequency of micturition *depends in part upon the tone of the bladder wall.* Where this is excessive there will be the symptom of increased frequency of discharge. This suggests a hyper-activity of the motor fibres. On the other hand an exhausting lesion to these fibres will produce loss of tone and hence an incomplete and infrequent discharge. Disturbance to the fibres that supply the sphincter mechanism will produce *incontinence of urine.* This latter condition is one very commonly found associated with children and is usually dependent upon lesion in the lumbar region. This lesion may interfere with the outgoing impulses or with the center which is located in the terminal portion of the cord. There is some evidence also that *vaso-motor fibres* are distributed to the bladder from the lumbar sympathetic. Interference with these may reasonably produce various disorders of nutrition including congestions and inflammations.

Disorders of the **generative organs**, both internal and external, are common accompaniments of lumbar lesions. These are dependent upon the fact that *vaso-motor fibres* to some of the structures and *motor fibres* to others pass through the hypogastric and pelvic plexuses to reach the organs.

Throughout the entire lower thoracic and lumbar regions impulses are given off by the sympathetic fibrils which keep up the normal chemical and muscular tone of the various abdominal and pelvic structures. Among these must be included the **supporting tissues**, i. e., the ligamentous and peritoneal tissues and the abdominal walls which are concerned in affording mechanical support to each of the several organs. If through spinal lesion, either general or local, the nutrient influences be in part withheld these supporting structures must of necessity become lax and either a general or local *ptosis* will result. In a typical case of enteroptosis this appearance of weakened support is striking. The abdominal walls are flabby, the abdominal contents lax, yielding, and prolapsed, all suggesting a condition of more or less complete loss of tone. Hence in addition to the effects resulting from the primary lesion there will be added consequences from a general crowding of abdominal contents downward toward the pelvic cavity. This naturally will result in any one or more of a vast number of disorders such as constipation, bowel obstruction, or appendicitis; ovarian and uterine disturbance; interrupted excretory functioning and the like. (For a comprehensive study of this problem the reader is referred to the chapter on "The

Abdomen," in Dr. Still's *Philosophy and Mechanical Principles of Osteopathy*.)

Finally through the connection between the lumbar sympathetics and the spinal nerves, various disorders of the **lower limbs** may result. *Vaso-motor* disturbances of the skin producing eruptions and irritations, disorders of *secretion* of sweat and sebum; while *inflammatory* lesions of the sciatic and other nerves are common.

Direct Pressure from Ribs.

It is necessary to note that so far as both experience and abstract theory are concerned a rib lesion may be responsible for the same kind of disorders that are known to be associated with lesions in the thoracic spine. Not only that but the results are largely produced in the same way, i. e., through the mediation of disturbed sympathetic connections and interference with the spinal nerves. But there are other possible and common disorders associated with rib subluxations that are not produced so commonly by the vertebral disorder. Various of the thoracic organs are occasionally involved in disorder through a direct pressure condition. Reference has been made to the condition of a *flat chest* as one type of general rib disorder. This flattening, in so far as the organs are unable to adjust themselves to the changed shape, must of necessity interfere with their normal activity. There is provided for each thoracic organ a certain amount of room in which to perform its function. When that space is encroached upon by an approximation of the thoracic walls disorder will almost certainly result. Typically we find resulting from the flattened chest some disorder of the **lungs**. The majority of individuals who are afflicted with *pulmonary consumption* present this flattened type. Along with the lessening in the antero-posterior diameter there will also be a limited chest expansion. This will be due in part to a loss of vitality in the respiratory mechanism itself but in part to a lessened pliability of the chest wall dependent on a proportionately increased amount of non-elastic tissue. While such a condition is not entirely a direct pressure on the lung structures, yet in so far as it prevents a normal expansion of the lung tissue it is the same in effect. In connection with this flattened condition associated with tuberculosis it is a significant fact that the apical portion of the lung first becomes involved. In part this may be explained on the fact that there is a lessened exercising of this region of the lung whenever the flat condition is present. It is noted, however, that it is *not the extreme apex* that first is involved, but a point an inch or two below the apex. This corresponds to the region *across which passes the upper part of the sternum and anterior ends of clavicle and first rib*—a fact which is quite suggestive.

In the same way various disorders of the **heart** may arise. Normally the heart, a trifle above its apex, lies in direct contact with the chest wall with only the pericardium interposed. This point is in the region of the fifth rib below and internal to the left nipple. It is manifest that a narrowed chest in this region may interfere with the normal action of the heart. As a matter of clinical experience it is found that such a condition is fairly common. The author has seen case after case of palpitation and other irregular heart action, as well as disorders of a more serious nature, temporarily and permanently relieved by the simple expedient of opening up the chest cavity by various of the methods for elevating the ribs. It has been stated that the fifth rib is more commonly involved in such cases where a single rib produces the pressure effect. From personal experience the author is not ready to assent to this proposition though it may reasonably be true. In most cases where a true direct pressure effect is produced it is a condition involving a *series of ribs* rather than a single one. There is at present (1903) a case in the clinic department of the American School presenting all the evidences of *angina pectoris*. The lesion is a distinct depressed thorax and relief is usually obtained by attention to increasing the chest capacity. Another case which came under the personal observation of the writer was one of *bradycardia*. The case was one of long standing and little discomfort seemed directly traceable to it. The heart rate when first examined was about fifty. No lesion aside from a generally lessened antero-posterior diameter of the chest could be detected and it was decided that, provided the condition was not a normal one, it was due to this depression. Treatment was directed to the elevation of the ribs with a result rather surprising as well as gratifying. Within three months the heart rate was increased to sixty-five. Treatment was then discontinued but the heart rate remained at this figure while the patient's general condition was considerably improved.

The **abdominal organs** may suffer as a direct result of the thoracic depression. While the practice of tight lacing has been in recent years very considerably modified it is still indulged to a sufficient extent to furnish a large number of cases presenting deformed lower thoracic regions with consequent disorder of abdominal and pelvic viscera. It is perfectly apparent to one who knows the structural conditions involved that any force that continually depresses the lower part of the chest must of necessity produce a *ptosis* condition of the abdominal organs. As a result of this, ill effects on the pelvic viscera are sure to follow. Dr. Still, in his *Mechanical Principles of Osteopathy* has emphasized the importance of the abdomen and the effects of a crowded condition of its viscera upon the pelvic structures. We are personally persuaded that a large number of the diseases affecting the latter are directly traceable to visceral displacements in the abdomen due to depressed rib conditions. Case after case presents itself in which all varieties of abdominal and pelvic disorders are undoubtedly due to the weakened lower thoracic and abdominal structures. The liver is often found occupying a position much below its ordinary situation. This usually results in disturbance of its own metabolism and various digestive disorders result. But owing to its displaced condition the more serious effects are found in connection with the other viscera which become affected secondarily to the liver disorder. This is strikingly true of kidney disorders. Statistics show that the majority of cases of *floating kidney* are associated with the right side. Normally the right kidney occupies a lower level than does the left on account of the contiguity of the liver. Downward displacements of the latter will therefore help to explain the greater frequency of displacement of the right kidney. It is entirely likely that with more careful observation such cases will present a fairly typical depressed chest in the lower half of the thorax. The *relation of the last rib to the kidney* should be noted. Generally the rib crosses the junction of the upper with the middle third of the kidney, the latter lying directly in front and only separated from it by adipose tissue and the margin of the diaphragm at the attachment of the latter to the rib. Hence a marked luxation of this rib, which is not at all uncommon, may be of itself sufficient to severely impair the position or condition of the organ. Occasionally cases are met with showing more or less serious interference with the renal function which are most satisfactorily explained in this way.

The **stomach and intestines** may suffer from direct pressure conditions. Not that the rib or cartilages are sufficiently close to exert the pressure on the walls of these organs. For it must be remembered that in the quiet and empty condition the stomach does not lie in contact with the abdominal or thoracic wall. Only when it is considerably distended does it crowd the associated viscera aside and come into relation with the anterior wall of the abdomen. But through the general crowding of the viscera in the narrow chest, the stomach as well as other of the abdominal organs will suffer. In the same way disorders of the intestines are often caused. Enteroptosis is a condition very often associated with the tapering chest. This may be in part due to a crowding but it is altogether likely that spinal lesion will also be found which interferes with the innervation and hence the tonicity of the bowel and its supports. Constipation or diarrhœa may result and will only be permanently overcome by attention to the elevation of the ribs.

Rib Pressure on Vascular Channels.

Rib subluxations are undoubtedly responsible for numerous disorders dependent on interference with the vascular structures. Owing to a similarity in effect, clavicular lesions will be included in this discussion. Among the vessels interfered with are those passing into or through the superior opening of the thorax, namely, innominate, carotid, subclavian, internal mammary, and superior intercostal arteries, the innominate and thyroid veins, and the thoracic duct. These with their branches and tributaries are all more or less subject to pressure from a narrowed antero-posterior diameter of the opening, the *average diameter* of which according to Gray, is about two inches. Hence in order that there shall be no impairment of function of any of the forty or more structures which pass through, this opening must be maintained in its diameter. It is necessary to bear in mind that the effect from pressure on the vessels may be **double**, i. e., an effect on the part to which the vessel carries its contents and the part from which it passes. For instance if the pressure become obstructive to the flow through the carotid artery the neck and cephalic structures will suffer from lessened nutrition while the heart will be irritated because of a greater resistance to the blood flow. In like manner pressure on the jugular veins will produce a congestion in the parts which they drain as well as lessening the total inflow into the heart with a possible lowered general blood pressure.

From the lessened diameter lesion therefore the physician may find occasional disorders of the *heart* and of all those structures which are associated with the distribution of the vessels which pass through the **superior opening**. Hence disorders of the head and neck, of the arm and shoulder, and of the upper chest and mammary regions are common. We have known of congestive *headaches* relieved by lifting up the anterior upper chest structures. Affections of the thyroid gland have been caused by a closeness of structures in the region of the inferior thyroid veins. The writer knew of a case of vascular goitre temporarily reduced in size nearly one-half by a single treatment designed to lift up the anterior end of the clavicle and first rib. In most cases of *goitre*, however, there will be increase in parenchymatous or connective tissue and hence the student should not expect the swelling to disappear immediately. In a large number of cases of goitre, whether of the vascular or increased tissue forms, there will be found a tightness, primary or secondary, which on removal will give much relief if not effecting a cure. In the dropping back of the anterior end of clavicle and first rib in many individuals there will be an approximation of these two structures near the point where the subclavian artery passes over to become the axillary, An obstruction of the blood flow to and from the *arm* will likely result and greater or less impairment of nutrition follow. This will partly depend upon the effect of pressure back against the subclavian vessels as they pass upward from the chest cavity. A branch of the subclavian, the vertebral, may likewise suffer and hence disorders of the *spinal column* and associated tissues result. *Mammary disorders* are often found associated with a lessened antero-posterior diameter of the opening, and if not caused by such lesion, will undoubtedly be aggravated by it or prevented from immediate recovery of function. Stagnation of lymph from pressure upon the *thoracic duct* may occur. This duct, carrying the lymph received from the greater part of the body, passes into the cervico-thoracic region, bends over and empties into the subclavian vein or the internal jugular at the junction of the latter with the former. This structure like the vein has little resisting power and hence less pressure from without will be required to impede the flow than would be true of the artery. Dr. Still continually emphasizes the importance of the lymph flow for normal conditions of nutrition and elimination, and in this connection the relation of the principal vessel of the system to the cervico-thoracic structures becomes of increased importance.

The **intercostal system** of vessels is of much importance in connection with rib subluxations. When it is remembered that a depressed thorax means an obstruction to more than twenty arteries and as many veins, all of comparatively large size, the significance becomes at once apparent. These are concerned with the nutritive condition of the greater part of the body walls as well as to structures closely associated with the latter. Any number and variety of superficial chest disorders have been caused by various of the rib lesions discussed in a previous section and it is an entirely reasonable assumption that they are at least in part dependent on impaired blood flow through both artery and vein, by pressure thereon from a subluxated rib or contractured intercostal tissues. The significant fact that many cases of *anæmia* present markedly disturbed chest structures should be noted. The cancellous tissue within the rib is the seat of formation of red corpuscles. This activity is necessarily dependent on a free delivery of blood to the ribs and a drainage from them, both of which are subserved by the intercostal system. It is known that in anæmia there is a lessened number of the red corpuscles and usually a lessened total amount of blood. It is not unreasonable that the depressed chest is a factor bearing a causal relation to the anæmic state. These vessels further supply the areolar tissue between the chest wall and pleura as well as distributing branches to the structure last named. Hence *pleuritic affections* may be caused by the obstruction, or more likely a weakness be caused which renders the tissue more susceptible to other factors. Disorders of the *mammary gland* are very commonly associated with rib subluxations. Slight soreness, considerable inflammation, simple tumor, and even cancerous conditions have been found. We are not prepared to affirm that a true condition of the latter has been cured by overcoming the rib lesion. But a number of cases diagnosed as such have without question been overcome by attention merely to the rib disorder, while numerous cases of simple growths and congestive and inflammatory conditions have been successfully overcome. Lessened *secretion of milk* undoubtedly has resulted from rib subluxation. A few cases are on record where extensive experimenting along lines of dieting failed to produce a flow of milk sufficient for the nourishment of the child where simple adjustment of rib disorder permitted a marked and sufficient increase. The intercostal system of vessels has its bearing on all such cases and it is not unreasonable that directly as well as indirectly the blood flow has been disturbed by the rib lesion. Note that the supply and drainage must pass *between the ribs* to affect the gland. Hence contractured conditions of the intercostal muscles as well as subluxations of the ribs themselves may reasonably affect the flow.

The vessels associated with the **diaphragm**, according to Dr. Still, are among the most important in their relation to disease conditions. A prolapsed diaphragm could undoubtedly produce greater or less disturbance of blood flow to and from the heart. Note that the *aorta* does not pass through but behind the diaphragm, between the two crura of that structure as they pass to their attachments to the bodies of the lumbar vertebræ. In case of a marked disorder of the diaphragm there could be produced serious impediment to aortic flow. The *vena cava inferior* does not pass through the muscular part of the diaphragm but through the central tendon. Contracture of the structure would therefore interfere with the vein by tightening the fibrous tissue around the opening or drawing the opening to one side. It must be remembered that the diaphragm in so far as it is striate muscle tissue is subject to the same conditions of contracture as are other such muscles. If but a part of the muscle be involved in a hypertonic or an atonic condition this will of necessity produce distortion of the structure as a whole, by virtue of which the various structures which pass through may be interrupted. Naturally the *position of the diaphragm* is dependent on the condition of the six lower ribs to which it is attached. Hence if a luxation of one or more of these be present a greater or less disturbance of the diaphragmatic tension will result, and effects immediate or remote be produced through impairment of blood or nerve flow through the several openings. Further since the *abdominal structures* are in part dependent upon the diaphragm for their normal position displacement of these may result as a consequence of impaired nutritive conditions plus the loss of mechanical support. (For an exhaustive discussion of the osteopathic considerations of the diaphragm the reader is referred to Hazzard's *Practice of Osteopathy*, p. 196.)

Rib Pressure on Nerves.

The nerves that may suffer from lesion of the ribs are the same as those referred to in connection with the spinal lesion. In addition those which pass through the **upper opening of the thorax** are likely to be involved in the crowding which is associated with the lessened antero-posterior diameter of the chest. Notably is this true in case of the *pneumogastric.* The statement is often seen and heard that a backward luxation of the inner end of the clavicle or the associated rib will impinge the nerve. This is not entirely true since the nerve is situated rather too deeply to be immediately reached by those structures. *But it is essentially true* since the crowding of all the structures will involve this nerve equally with the others. From both abstract reasoning and clinical observation the probability of such a condition is made manifest. Many cases which present a dry, hacking *cough* are seemingly entirely dependent on this crowded condition. The writer has seen several such cases temporarily and permanently relieved by adjustment of this superior thoracic condition. Evidently the crowding either directly or reflexly produces the irritation to the inferior laryngeal nerves which are responsible for the cough. This is but a type of the conditions that may result. Any of the other functions with which the vagus is associated may be similarly involved. The *phrenic* also passes through this opening and might be equally involved. But so far as actual clinical observation shows, it does not seem to be so frequently disturbed as is the vagus. The *sympathetic cords* both pass through this same region and are subject to the same pressure conditions. The numerous effects resulting therefrom have already been referred to in discussing the cervical and thoracic spinal lesions.

Along the course of the ribs the **intercostal nerves** are subject to obstructive lesion in a manner similar to that spoken of in connection with the artery and vein. Sensory disorders such as *neuralgias* are common. These and other conditions that cause an excess of impulses to pass to the spinal cord may there initiate changes which will have far-reaching effects. *Motor* disorders are frequently noticed. These are contractures and spasmodic conditions. Through irritation to the fibres which have been derived from the sympathetic various *nutritional changes* will manifest themselves in the chest wall and mammary gland. In connection with the latter it should be noted that while experimental physiology gives little evidence for any direct control of *mammary secretion* by the nervous mechanism the histological findings together with the known conditions in analogous structures make it extremely likely that such direct control is exercised, and an interference with which will most certainly produce greater or less disorder. In all likelihood most cases with vascular obstruction are equally with that obstruction dependent on irritation to the nervous mechanism of the gland.

CHAPTER XVI.

PELVIC LESIONS.

An understanding of the structures comprising the pelvis becomes of special importance when the practitioner realizes the variety and almost infinite number of disorders that may result from lesion in this region. Disorders not only to the organs immediately involved but through the reflex those remotely situated. Every physician of experience will grant that any organ of the body may suffer as a result of a disturbance of the generative organs. This is more noticeably true in case of the female. Gynecologists are becoming more and more convinced that *uterine displacements* and other interferences with the condition of that structure are accountable for a large number of diseases that afflict women. While the author is personally convinced that the claims of many of the gynecologists are quite extravagant in this respect, it is granted that there is sufficient evidence for the general proposition to make it advisable to give special attention to the consideration of female diseases. But there is an unfortunate tendency on the part of many to stop their investigation of causes with the determination often little less than pure assumption, of a reflex connection with the genital disorder. *This is greatly to be deplored.* While it is without question true that the excess of impulses from a hyper-irritated organ may be responsible for disturbance of another viscus in close nervous connection, yet in most cases where the effect on the second organ is intense in degree and prolonged in time the reflex is not the only causal factor. In many cases it is but an exciting cause acting upon an already weakened organ. Osteopathic gynecologists insist that in their experience those cases of uterine disorder which always affect the heart will almost invariably be found associated with a lesion condition in the various regions typical for cardiac lesions. This will be the experience of most osteopaths who are sufficiently careful in their diagnosis, and will be true of other organs besides the heart.

While the effects from pelvic lesions are more commonly related to the generative organs, these do not by any means constitute all of the possible conditions; but owing to their unquestioned paramount importance special emphasis is laid upon them.

Examination and Diagnosis.

The **pelvis** is composed of that part of the body whose *walls* are made up from the sacrum and coccyx posteriorly, the innominate bones laterally and anteriorly, the perineum forming its floor, and a plane passed horizontally through the spines of the pubes in front and the upper level of the sacrum behind forming its upper boundary. Note that the region above this plane bounded laterally by the flaring ilia is not properly a part of the pelvis though often spoken of as such, but constitutes the lower part of the cavity of the abdomen.

The important **landmarks** serving as guides to the diagnostician are the following: crest of the ilium, anterior and posterior spines of the same, the sacro-lumbar junction, the ischia, the pubic junction, and the coccyx. In making a diagnosis of the lesion associated with almost any part of the pelvis the condition and position of *several* of these structures will be taken into consideration. It is quite true that there is little likelihood of a marked disorder of one part of the pelvic framework without an involvement of some other part. A luxated innominatum will usually produce disorder of its fellow or of the coccyx, and distorted conditions of the coccygeal tissues are common accompaniments of sacral lesions. It is further true that numerous disorders of the *spine and ribs* result from pelvic lesions, the reasons for which are sufficiently obvious. Hence in the discussion of lesion to individual parts of the pelvis reference must continually be made to associated lesion of other parts.

In the **examination** of the pelvis the sitting posture is, all things considered, the most satisfactory. In this position the tuber-ischia are supporting the body and any disturbance in their relative levels may be indicated by the position assumed. If one of the innominata, by virtue of an upward luxation at the sacral junction, is at a higher level than its fellow there will in all likelihood be a *double lateral swerve* of the spine to compensate for the condition in order to maintain body equilibrium. In long standing cases of such a disorder the lateral swerve in the lumbar region will become more or less permanent, thus constituting the secondary and compensatory spinal curvature. Resulting from this lumbar swerve there will be in many cases a further compensation in the thoracic spine. In noting the levels of the two innominata comparison must be made with several points. The *crest of the ilium* in normal average conditions is on a level with the fourth lumbar spine. By comparison of the two crests with this spine some data may be gained indicating the nature of the lesion. Similarly comparison is to be made between the anterior and posterior spines of the ilia as well as the levels of the ischia.

In speaking of an **upward subluxation** of the ilium reference must be made to the direction of displacement. In many cases of such lesion of the innominatum we are persuaded that the condition is really a rotation of the bone *about an axis passing horizontally through the pubic articulation.* Usually the cause of the subluxated innominatum is a strong jarring of the bone transmitted through the femur, as in the case of stepping abruptly and unconsciously upon a lower level; in this case the force is transmitted by the *weight of the spinal column* through the sacrum. In either case the tendency will be for an upward sliding of the innominatum upon the sacro-iliac articulation but without necessarily a similar upward sliding at the junction of the two parts. Bear in mind the fact that the sacro-iliac articulation is an arthrodial or *gliding joint* and in most younger individuals is supplied with the typical articular structures including the synovial membrane and fluid. This fact suggests a fair degree of normal movement between the parts and a considerable pos-

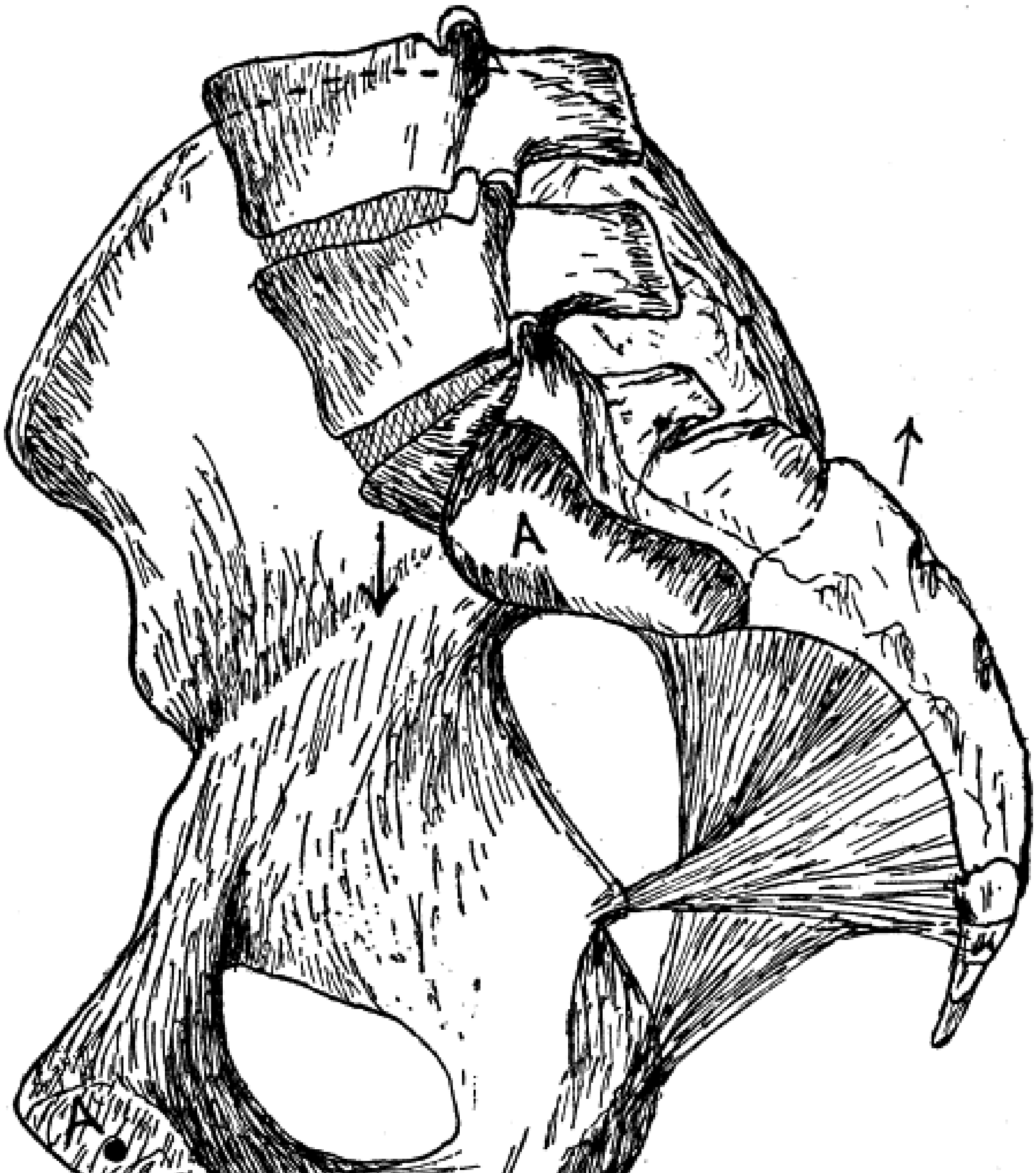


Fig. 31.—Showing axes of rotation of innominatum (A. A.). Also effect of body weight on position of sacrum and coccyx.

sibility in the way of abnormal relations. On the other hand the *junction of the pubes* admits of relatively little gliding movement, the articular cartilages being joined not by synovial structures but by strong fibrous connections. In the condition of upward subluxation there will be a twisting of the inter-pubic softer tissues, which is usually associated with tenseness and tenderness of surrounding tissues but with little relative change of levels, although in some cases the rotation may be sufficient to produce a noticeable difference in the relative antero-posterior positions of the spines or other prominent parts of the pubic bones. Owing to the further fact that the center of rotation of the acetabular articulation is but *slightly in front of a vertical line dropped from the center of gravity of the body*, most of the force of the shock will be received by the sacro-iliac rather than the pubic articulation, with a consequent tendency to produce an exaggeration of the normal movement of that articulation. But it must not be assumed that all such upward subluxations are rotations about the pubic axis. For in many cases there will be a noticeable difference in the levels of the corresponding parts in the two pubic structures which suggests either an upward gliding of the entire innominatum or a rotation about an *axis passing horizontally through the sacro-iliac articulation.* A simple rotation about the latter axis can only be slight in degree since, owing to the long arm represented by the extension forward of the ramus of the pubic bone, much rotation must result in extreme movement of the forward end of the arm. We know that such changes as are found in the levels of the pubic structures are *measured in millimeters or fractions* thereof rather than centimeters, and hence the rotation about the sacro-iliac axis must of necessity be quite infinitesmal. *It is not to be assumed that the infinitesmal rotation will produce infinitesmal effects.* For slight as it may be, if it be "off its center," through continued tension and other irritation which results disorder of the first magnitude may follow. A simple twisting strain of this articulation is often found to result in quite serious disorder.

With reference to the effect of a subluxated innominatum upon the **length of the limb** much might be written and still the subject remain open to dispute. It is manifest that the upward movement of one innominatum will tend to produce a shortening of the corresponding limb. But this certainly is not an invariable rule. In some cases where the upward tendency is quite manifest in the various diagnostic points there will be little if any change in the apparent length of the limbs, and even in occasional cases there will be an actual lengthening on the same side. The rule would hold if other things were equal. But in any case of subluxation other things are likely to be quite unequal. Note this fact. *Any change in the pelvic articulations will almost invariably produce a disturbance in the tone of the muscles and other softer tissues.* In the laboratory it can be shown that section of the sciatic nerve produces a distinct difference in the length of the limb of the animal experimented upon. This is explained from the known facts relating to the tone of muscle tissue. Such tone is largely dependent upon impulses continually passing to the muscle over its nerve. And not only the efferent nerve but afferent impulses are essential to the normal tonic condition. If the dorsal (afferent) root of the spinal nerve be cut and the anterior (efferent) left intact a marked loss of tone is produced. This suggests that any interference with the sensory nerves may produce a disturbance of the tone sufficient to make a difference in the length of the muscles. That the length of the limb may be increased by the lax conditions of the muscle tissue is proved in the case of certain of the lower animals. It is reasonably true of man and numerous cases have been noticed which tend to substantiate the assumption. We have personally seen cases where the limb could actively and passively be shortened a very appreciable distance. In these cases it is necessary to consider *all of the articulations* as being involved in the production of the condition, i. e., the hip, the knee, and the articulations associated with the ankle and foot. An examination of the cadaver does not usually cause one to arrive at the conclusion that the head of the femur may play up and down appreciably, but the cadaver is not a sufficient proof that such is impossible. On the other hand an irritating lesion of the pelvis may increase the tone of the tissues with a consequent shortening of the limb as a whole. This condition would explain the shortened limb associated with a downward luxation—a case exceptionally noticed.

In **determining the comparative length** of the limbs several methods may be employed. The usual one is a simple comparison without tape line measurement. With the patient on his back the body is straightened, the limbs equally disposed, and complete relaxation secured as far as is possible by the patients own volition. The rotation of the limbs to secure additional relaxation for purposes of diagnosis is contra-indicated, since the relaxation thus secured tends to partially, though temporarily, remove the lesion and make its detection less easy. With the patient thus disposed and sources of error eliminated as far as possible, various prominences on the limbs are compared, the most satisfactory of these being the *internal malleoli*. Comparison of the heels of the shoes is not as free from error and hence is not advised. The further method of *tape-line measurement* has its advantages. Various points are used in such determination, i. e., from the teeth, the points of the shoulders, the umbilicus, the anterior-superior spines of the iliac bones, or the pubic articulation.

Having by various means determined that there is an appreciable difference in the length of the limbs due to other than hip, knee, or ankle disturbances, it remains to determine **which limb** be the one involved. For it is manifest that the shorter or longer one may be the abnormal part. Usually there is little difficulty in making the distinction. The *tenderness and contracture* of the tissue will be the best sign where the change in position is not palpable. In the average case the soreness will be on the side of the lesion and with it the contracture and tightening of muscle and ligaments. There are *three* more or less distinct regions of the pelvic areas where such soreness is most manifest, the sacro-iliac articulation, the tissue along the crest of the ilium, and the pubic articulation. One or more of these regions will almost invariably present marked tenderness to pressure. Occasionally similar tender areas will be present on the opposite and less involved side, but in most cases it will be less in intensity. The contracture and tightening will be *most noticeable* just median to the posterior superior spine where muscle and ligamentous structures pass from innominatum to sacrum.

The **posterior superior spines** of the ilia are important factors in diagnosis of the relative position of the innominata and sacrum. In an upward subluxation or a forward rotation around either of the axes referred to there will be a corresponding upward lifting of the spine. Where the ilium has been displaced directly forward the spinous process will appear less prominent, while if backward it will seem unduly so. An upward subluxation may produce a *greater depression* median to the spine owing to the rapid forward as well as upward trend of the posterior surface of the sacrum.

The **anterior superior spine** of the ilium is a landmark of less value in diagnosis of innominatum disorders than is the posterior. In disturbed relations there may be a difference in the distances between the spine and the umbilicus which suggests a lesion of one of the innominata. The *relative level* of the two is also an important guide.

An understanding of the **lesions of the sacrum** necessitates a consideration of the mechanical conditions which accomplish the support of the spinal column. In the first place note that practically the entire weight of the body with the exception of the lower limbs is supported upon the upper part of the sacrum. This necessitates an extremely strong mechanism associated with the junction between the sacrum and innominata. The sacrum does not fit in between the two iliac bones in such a manner as to permit of a perfect wedge action, owing to the fact that its *upper half slopes markedly forward* thus permitting the spine to act upon it at an angle. Hence the natural tendency of the weight of the body will not simply be the forcing of the wedge between the iliac bones, but will continually tend to *force the upper part of the bone forward.* (See Fig. 31.) This, as is pointed out by Quain and others, will be prevented to a considerable extent not only by the posterior sacral ligaments but also by the great sacro-sciatic ligaments which anchor the lower half of the sacrum strongly to the ischia. Nevertheless osteopathic experience has been sufficiently extensive to show that in numerous cases there can be an appreciable disturbance in the relation between the bones. The most common of these consists in a *downward displacement* of the sacrum as a whole and a forward dipping of its upper portion. This latter action will, owing to the necessity from its structural relations, cause a *prominent posterior tendency in the lower half of the sacrum* including the articulation between the sacrum and the coccyx. It is quite a common matter to find in the case of the sacrum this marked anterior displacement of the upper part and a posterior lower displacement. The cause of this condition is quite apparent in most cases—a strain of the lumbo-sacral junction resulting in a relative weakness which then permits of a bending forward at this point with a consequent gradual forcing downward of the upper part. In some cases one side of the sacrum will have yielded more than its fellow and as a result there is a *twisted* condition of the sacrum. In occasional cases the opposite sacral condition may be noted. Instead of the anterior dipping of the upper part of the bone an unduly straight condition is presented. This is often associated with the typical straight spine and in many cases would seem to be secondary and compensatory.

Adjustment of Pelvic Structures.

The treatment of pelvic lesions, in so far as it is concerned with the sacrum and innominate bones, is almost entirely the adjustment of osseous tissues with comparatively little attention being paid to the muscle contracture. Dr. Still argues with reason that in most cases the treatment of sacral and innominatum lesions may be simplified to one or two methods designed to make use of the fact that the sacrum has been driven downward between the iliac structures. It is manifest that if the innominate bones be made immovable while the body including the sacrum is free, direct use of the latter can be made in **withdrawing the wedge-shaped sacrum** from its bound condition by a simple lifting of the body from side to side while the innominata remain fixed. It is obvious that when a wedge is driven into a log it can be withdrawn with much greater ease by working it from side to side than by exerting a straight simple traction force. That is true also with reference to the sacral wedge which has been driven downward into the space between the innominata. Hence one of the most satisfactory methods for overcoming the condition consists in placing the patient in the erect position on a stool or other hard-bottomed structure. Then, while the ischia are held strongly against the seat bottom, the patient's body is grasped, one hand is placed on the iliac bone and with a side-to-side movement with some rotation the patient is literally lifted up from between two of his own bones. This treatment may be used on the chair specially constructed by Dr. Still but may be used upon any convenient stool or other structure *where the pelvis can be held solidly against the seat.* Further it is equally applicable to all forms of sacral and innominate disorders. With the innominate held immovable any lateral to-and-fro movement of the body which acts upon the pelvis tends to release it from its strained condition.

A **second method** which has long been in use is more especially applicable to adjustment of single innominatum lesions. With the patient either upon his side or lying prone the limb may be grasped in the region of the knee and drawn backward. This exerts a downward traction as well as a forward one upon the anterior portion of the innominate bone through the attachment of various muscles but more especially the strong Y-shaped *ilio femoral ligament* which attaches below to the great trochanter and anterior portion of the femur by the two limbs of the Y, and above to the anterior inferior spine of the ilium. This ligament is the structure which normally prevents a hyper-extension of the thigh. In most cases a distinct resistance can easily be felt when the limb is drawn back beyond the straight line a short distance. And this point represents the *danger line*. By this is meant that in making use of this manipulation only a trifle more pressure should be used after that resistance is felt, since there is some danger of injury to the structures. It is especially needful that this caution should be emphasized because of the *long power arm* and comparatively short weight arm, and hence by its use a powerful force can be applied. This treatment of course applies more especially to posterior and upward luxations of the innominatum and to anterior conditions of the upper part of the sacrum, in addition to its use for purposes of *exaggerating the lesion*. For the opposite kind of lesion a similar treatment is used but with less powerful effect owing to absence of the unyielding white fibrous tissue that is found in the ilio-femoral ligament and to the fact that conditions permit of extreme flexion of the thigh upon the abdomen. In this treatment the patient lies upon his side or upon his back while the physician strongly flexes the limb upon the abdomen, which results in putting tension upon the posterior thigh and iliac muscles and tends to draw the part downward and backward. If in addition to flexion and extension of the limb in these movements abduction be also employed, additional effects will be gotten upon the pubic and the ischiatic portions of the bone through the adductor and the postero-internal thigh muscles.

Another method in common use is spoken of as the **wheel-and-axle** movement. With the patient on his side and the physician in front one hand grasps the crest of the ilium while the other reaches underneath the thigh and is placed strongly upon the ischium. Then with the force of the two hands applied in opposite directions the innominatum may be rotated or lifted in any direction. In this case a double leverage is secured in which the lever arms are not so long as in the case of the methods above described.

For direct work upon the sacrum the **knee** may be employed at the prominent parts in either the erect or horizontal posture. Strongly flexing the body at the sacro-lumbar articulation at the same time exerting forward pressure upon the iliac bones will be helpful for an anteriorly receding sacrum.

Where the **pubic articulation** shows a difference in level on the two sides, direct pressure here may be advantageous; but in most cases the direct work upon this part of the pelvic structures is unsatisfactory.

Lesions of the Coccyx.

The normal condition of the **coccygeal articulation** permits of considerable motion in an antero-posterior direction and an appreciable amount of lateral movement. This is more true of younger individuals since with increasing age the parts tend to become ossified. In females there is relatively more motion than in males and in case of pregnancy this junction like that of the pubes becomes quite yielding. The position of the coccyx should normally be such as to *continue the curve* of the sacrum. Departures from this curve usually suggest an abnormal condition.

The most **common subluxation** of the coccyx is the *anterior* displacement. Usually this is but an increased angularity between the sacrum and coccyx or between adjacent parts of the latter. If in palpation along the course of the bone an abrupt anterior bending is noted, it is quite indicative of abnormality. This will be more certainly decided if there is noticed soreness and contracture of the lateral structures. In many cases there will be a *lateral subluxation* which will be easily determined by noting the space on either side of the coccyx. In other though occasional instances the coccyx will be too straight and hence constitute a *posterior con-*

dition. The amount and nature of these various lesions may be further determined by *palpation from within the rectum.* In many cases the insertion of the finger will be associated with more or less pain which of itself is suggestive of disorder. In making the examination some non-irritating oil should be used, the nail of the finger cleaned, and soap or vaseline used to thoroughly fill up the crevice underneath the nail. Bear in mind that the canal of the rectum for its first inch or two passes forward as well as upward before bending backward to follow the course of the sacro-coccygeal curve. With the finger thus inserted the tissues can be grasped between the thumb and finger and the exact postion of the coccyx more accurately determined. This method need only be resorted to in occasional cases. It is never free from the possibility of producing harm, and in most cases sufficient data for judgment can be gained by external palpation.

As to the **treatment** of coccygeal lesions a few notes with reference to their cause are imperative. Dr. Still has made emphatic the statement that in many cases the disorder of the coccyx is *secondary to sacral subluxations.* When that is true work upon the coccyx without reference to the sacral condition will in many cases be wasted effort. While it undoubtedly will assist in overcoming the disorder in some instances it can never permanently cure until the sacrum be adjusted. The coccyx is *suspended from the sacrum* by its articulation and by the sacro-coccygeal ligaments and muscles; from the innominata by fibres of the sacro-occygeal ligaments passing from the ischia along the lateral aspects of the sacrum to ultimately blend with the coccygeal structures. If the sacrum be driven downward or backward these fibres, unyielding in their nature, *will prevent the coccyx from passing with it,* with the result of strongly drawing the coccyx anteriorly. In other cases where one side of the sacrum is more markedly involved a lateral condition of the coccyx will also result. In cases of this kind, while it is the coccyx that seems to be disturbed, in reality it is the sacrum and hence the treatment must be applied to the latter rather than to the former.

In other cases the **coccyx alone** may be disordered. Such will depend on *direct violence* as in falling and striking the part or from direct blow otherwise. Undoubtedly many a luxated coccyx has resulted directly from the abominable practice indulged in by boys and young men, of using the toe of the boot in this region when engaged in various forms of sport. In addition occasional cases may result from *muscular contracture* of the associated tissues dependent upon some irritation to the muscle or its nerve mechanism. In these primary subluxations direct treatment to the coccygeal tissues will be necessary. Usually enough pressure can be gotten by external manipulation to effect adjustment but occasionally *internal treatment* may be necessary. With finger inserted as above described the coccyx may be grasped and quietly but strongly lifted backward toward its normal position. In such treatment it is an *almost invariable rule* that the frequency should not be greater than once in a week, while in most cases *once in two weeks will be all that is permissible.*

Effects of Pelvic Lesions.

Effects of pelvic lesions have already been suggested in large part. The only considerable possibility of disorder from **direct pressure** of a luxated structure is in connection with the coccyx, which may by an anterior condition exert direct pressure upon the posterior wall of the *rectum* and the external and internal *sphincter* muscles. In this way there may result various disorders of the lower bowel. Occasional cases of this form of lesion seem to offer a direct obstruction to the passage of the feces but in most of these there will also be a local exhaustion of the nerve force to account for the lessened activity. Disordered condition of the sphincter muscles in the way of undue contractures or atonic conditions are met with. These appear to depend upon the continual irritation produced by the luxated coccyx. The same condition of coccygeal lesion or other disturbances of the pelvic bones which limit the diameters of the pelvis may offer serious obstacle to the expulsion of the fetus at *parturition.*

The **vessels** which are likely to be involved in impingement are relatively few and unimportant. Various branches of the *internal iliac* arteries which pass to supply the spinal muscles may be pressed upon by contractured tissues. The sacral portion of the spinal canal receives filaments from the *lateral sacral arteries* which lie anterior and internal to the row of anterior sacral foramina. These arteries give off branches which *pass into the anterior and out of the posterior sacral foramina* giving off as they pass, divisions to supply the sacral canal and passing beyond the canal are distributed to the posterior sacral tissues. In various situations these vessels may be impaired in their carrying powers and produce disorder of the tissues with which they are associated.

Effects on Nerves.

The nerves subject to disorder from pelvic lesion are the spinal and sympathetic. The **sacral plexus** of nerves lies in front of the sacrum on the anterior surface of the pyriformis muscle from whence it passes out of the pelvic region through the sacro-sciatic foramen where it is continued as the sciatic and pudic nerves. In this region and where the nerves forming the plexus have their exit from the spinal canal, there is possibility of irritation owing to associated muscular and connective tissue. The *sciatic* nerve passing on throughout the length of the leg is distributed to muscular, cutaneous, and vascular structures in its various areas of distribution. Numerous kinds of disorders of the limb in any of its parts are known to result from sacral and coccygeal lesions. Vaso-motor disturbances, secretory abnormalities, and sensory perversions are common accompaniments of the sacral lesion owing to the presence in the nerve of fibres of the spinal system and of the sympathetic as well. An almost endless number of cases of sciatica have been shown to be due to some form of sacral or innominatum lesion. Edematous tissues and varicose conditions partly due to contracture of muscle and fascia overlying the saphenous and other veins and partly dependent upon irritation to the nerve mechanism of the vessels, are often found to be dependent upon pelvic disorder.

The **sacral spinal nerves** are of more than usual interest from the fact that they are both somatic and visceral, being supplied to various parts of the organs of generation. The same branches that form the pudic nerve which supply the more superficial tissues of the generative organs, give off filaments that pass directly into the pelvic plexuses and are the representatives in this region of the *white rami* of the sympathetic in other parts of the spine.

The **pelvic plexuses**, two in number, represent the

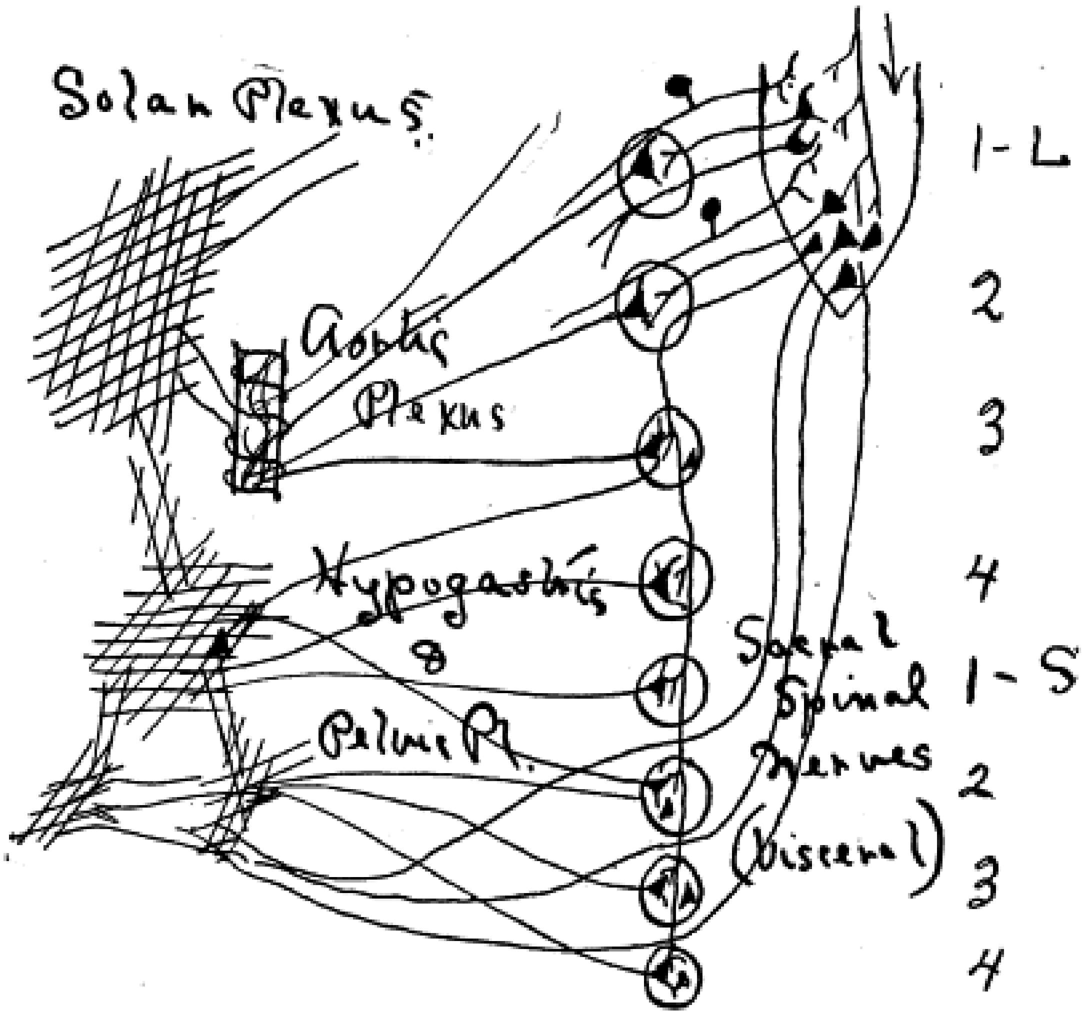


Fig. 32.—Showing innervation of pelvic structures.

centers for distribution of nerve influence, both spinal and sympathetic, for the pelvic structures. These plexuses are formed from descending branches from the hypogastric plexus, from branches direct from the sacral ganglia, and from the spinal branches referred to above. From these plexuses the various pelvic organs are supplied with secondary plexuses. Disturbance therefore of the plexus through spinal or sacral lesion may produce any one or more of a number of effects. *Motor and inhibitory* fibres pass by way of the sacral nerves to reach the rectal wall. Interference with these will produce perverted activities in the movement of that part of the intestine. In many cases on examining the rectal walls they will be found in a marked *atonic condition*. This is usually indicative of a condition of exhaustion of the nerve force that is normally distributed to that part. On the other hand in some cases we find a *hypertonic condition* which is suggestive of a more recent lesion which is producing an excitement of the local nerve mechanism.

Motor fibres to the **bladder** are also associated with the plexus. These are not only concerned with the rhythmic action of the bladder wall and with the expulsive action in micturition, but are also concerned in keeping up the tonic condition of the sphincter of the bladder. Hence irritation to these structures may produce too frequent discharge or a retention or incontinence of urine. By way of the sacral nerves *afferent fibres* pass to the micturition center in the lumbar region. This center is concerned in sending out motor and inhibitory impulses and in conjunction with the afferent and efferent pathways constitutes the reflex mechanism for micturition. Lesions to the pelvic structures may reasonably produce impairment of one or more of the essential parts in this reflex. *Vaso-motor* influences are probably regulated through these plexuses, and hence disorders dependent on disturbed blood supply are common.

Uterine disorders may result. These are dependent upon the important nerve supply to the uterus received from the pelvic plexuses. *Motor* fibres and perhaps *vaso-motor* are distributed thereto, keeping the organ in its normal state of tone, and in addition maintaining the closed condition of the cervix. The integrity of this mechanism becomes of supreme importance in the *pregnant state*. Lesions to these parts have been known to produce abortion. Osteopathic experience as well as anatomic and physiologic experiment would seem to indicate that tonic influences were continually sent to the cervix of the uterus by way of the sacral spinal nerves, hence lesion to the latter will reasonably lessen the resisting power of the muscle tissue in the cervix.

Disorders of the **external organs of generation** may result because of the fact that through the sacral branches *vaso-motor* fibres are carried to the vessels that supply those structures. In the case of the male the fibres further furnish influences of a secretory as well as vaso-motor nature to the *prostate gland*. This latter structure is quite often found to be more or less markedly disordered especially in elderly men. The disorder is usually an enlargement of the gland. This may be sufficient not only to keep up a continual irritation to the afferent nerve terminals and hence be concerned with a *general nervous condition* but often will be sufficient to offer mechanical obstruction to the passage of the urine through the prostatic portion of the urethra. A few cases are on record in which a considerable *retention of urine* was a direct result of such enlargement and obstruction.

A discussion of the numerous **secondary disorders** that are associated with the prolapses and other disorders of the pelvic viscera which in turn are dependent on the various lesions above described would lead us too far afield. Hence with this brief reference the subject is left to the special efforts of the gynecologist.

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