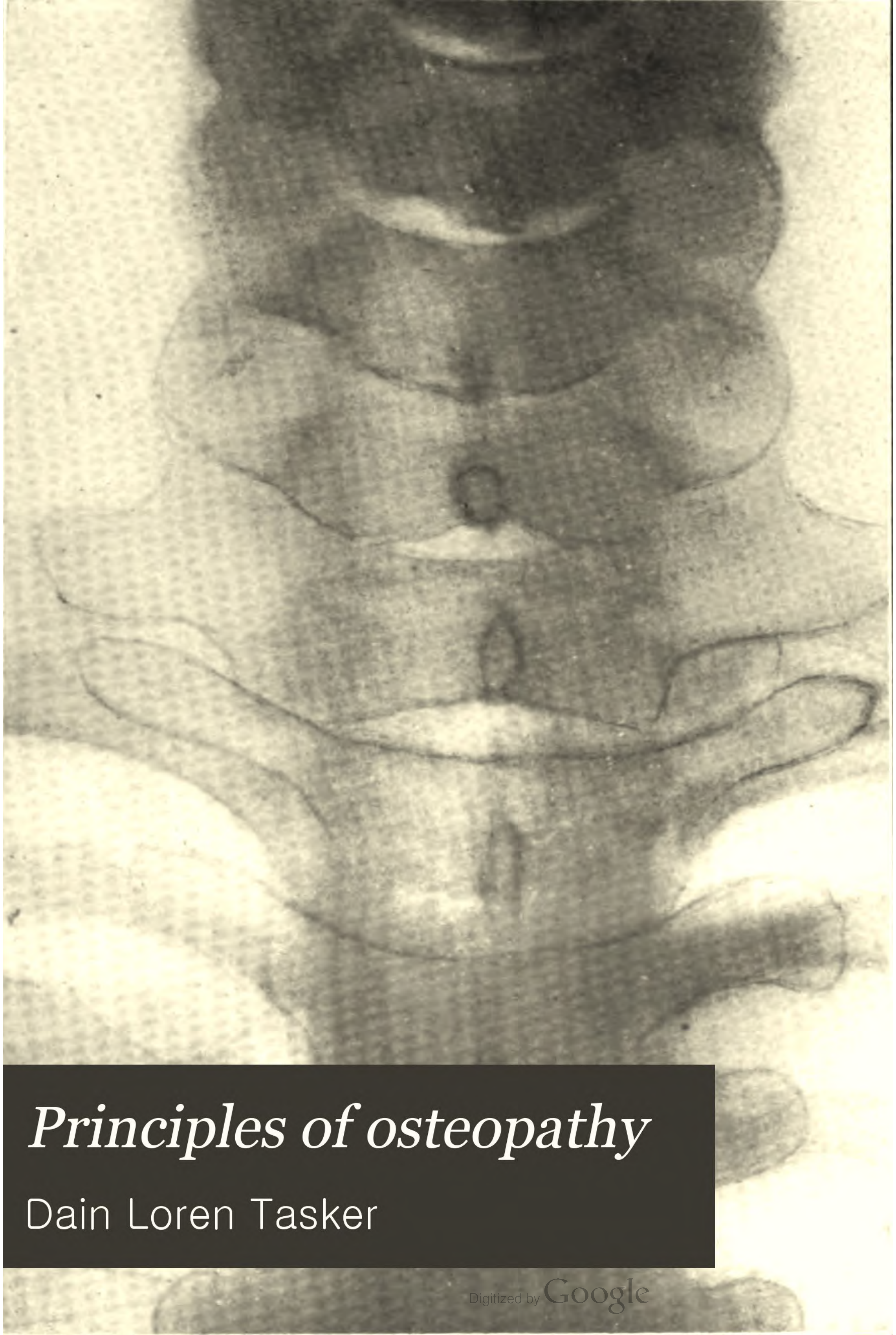

Principles of osteopathy

Dain Loren Tasker

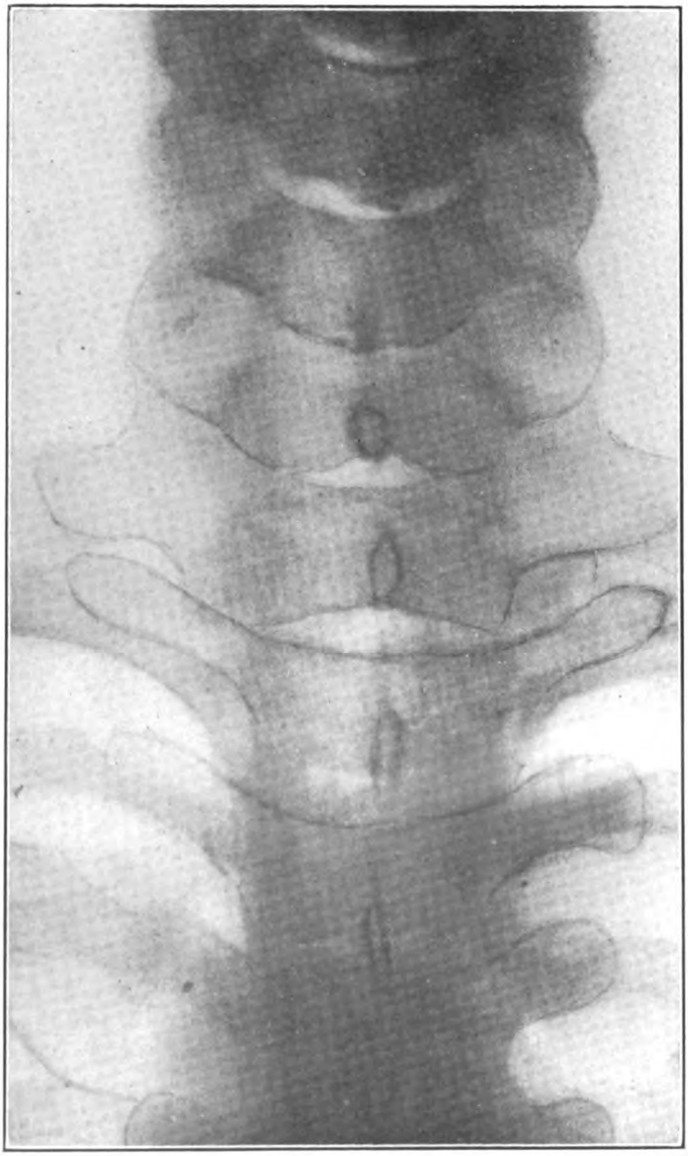

FIG. 1. Radiograph of a lesion of the second dorsal vertebra. Note the approximation of the left transverse processes of the first and second dorsal vertebrae. Case of exophthalmic goitre following traumatic strain in this spinal area. Recovery.

PRINCIPLES *of* OSTEOPATHY

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1898-1907

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Third Edition Revised—Illustrated

PUBLISHED BY
BIRELEY & ELSON PRINTING CO.
LOS ANGELES, CAL.

PREFACE.

This book on the Principles of Osteopathy is intended as a manual for the use of students and practitioners. There has been no effort on the part of the author to do more than give a short, terse exposition of the essential facts underlying osteopathy. Realizing fully the great effort required to keep pace with the rapid progress of medicine in general, we have tried to include in our chapters only that which will be solid food for our readers. We have long since learned that the hurried student and busy practitioner have no time to read long dissertations on any subject. Time is an essential factor in covering the necessary studies of an osteopathic curriculum.

In order that the student may read these chapters intelligently he must have concluded at least ten months study of Biology, Histology, Anatomy and Physiology. These subjects form the basis of the science of osteopathy.

The author has kept in touch with the growth of osteopathy from year to year through careful perusal of its published books and periodicals.

The contents of this book are the condensed results of the author's study of recognized medical text books on Anatomy, Physiology, Histology, Pathology, Bacteriology and Diagnosis, of the works of the founder of Osteopathy, Dr. A. T. Still, Hazzard, Riggs, Henry and McConnell; of six years' experience in the clinics of the Pacific School of Osteopathy, and the Infirmary in connection with this college, and six years of continuous teaching, two of which were devoted to Anatomy and Physiology and the remaining four to Theory and Practice of Osteopathy and Physical Diagnosis.

To enumerate the books from whose pages facts have been gleaned for corroborative testimony concerning the Principles of Osteopathy is impossible. Books have been read and laid aside and what is here written may be the result of something which caught the author's attention for a moment only and then became a maverick.

The illustrations to elucidate the text have been furnished principally by the laboratories and clinics of the Pacific School of Osteopathy. Without the hearty and efficient aid of my associates on the faculty of this college much of the concise detail of this book would have been impossible. I am indebted to several osteopathic physicians for drawings of histological tissues which they had prepared during their college work. They are given credit under their drawings.

The large number of excellent photographs of microscopic structures, patients and movements is the result of the skill of J. O. Hunt, D. O. A few of the photographs were made by M. E. Sperry, D. O., who also took great care to see that we had the best of photographic lenses with which to work. I am also greatly indebted to C. H. Phinney, D. O., and J. E. Stuart, D. O., for their accurate demonstration of osteopathic movements.

My thanks are extended to Miss Louisa Burns, B. S., for reading the manuscript and suggesting corrections therein, also to Miss Gertrude Smith for preparing the manuscript for the publisher.

DAIN L. TASKER, D. O.

PREFACE TO THIRD EDITION.

A long time has elapsed since the second edition of this book was sold out. The present edition is, in reality, a new book instead of what is ordinarily understood as a revision. The material which was developed for the first and second editions was entirely destroyed by the dynamite explosion and fire which wrecked the great establishment of the Los Angeles Times and killed more than a score of its employees.

The demand for this book having grown steadily more insistent and the more important fact that, during the time since the publication of the second edition, there has been a great development in every phase of osteopathic teaching and practice, has led us to attempt to produce an edition of Principles of Osteopathy which will be even more useful to students and practitioners than our former editions.

The experimental work done in the laboratories of our colleges and of private investigators, as well as the recorded experiences of our practitioners, tend more and more to substantiate the Principles of Osteopathy as set forth in our previous editions. The feeling that this book will furnish genuine assistance in the teaching and practice of osteopathy leads the author to send it forth, with the belief that its imperfections will be kindly excused by its readers, in view of the spirit of generous helpfulness toward all schools of medicine which has been made the reason for its existence.

Nearly every chapter is in some degree changed or completely rewritten. Several new chapters, of practical value, have been added. Much of the material in early chapters of the former editions, relating to histology, has been eliminated.

The writer wishes to express his gratitude to John Comstock for his valuable assistance in illustrating this edition.

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INTRODUCTION.

Great strides have been made during the past twenty-five years in the practice of medicine. The relative positions formerly held by drug therapy and surgery have been completely reversed. The concoctions of the pharmocopoeia, with their vague and uncertain effects upon human tissues and functions, no longer entice the earnest seeker after medical truths to spend a lifetime experimenting with substances which are absolutely foreign to the human body.

There was a time, not far away, when that person who treated human diseases by manipulation, water, diet and general hygiene was considered to be the chief of impostors. Go a little farther back in the history of medicine and we see surgery dishonored because it was mechanical, not mystical enough for the ponderous minds whose fort it was to deal with strange substances of the animal, vegetable and mineral kingdoms.

During all the years in which drug-therapy flourished there were a few real scientists who devoted time and talents to the structure of our bodies and the function of each part. Discoveries came slowly along these lines because the majority of medical men were concentrating their energies on ferreting out the effects of drugs. Facts in anatomy and physiology which are so patent to us at this time remained obscure for centuries, simply because there was no thought of studying the form and action of tissues, while all nature outside of our own bodies seemed to be a grand laboratory of specifics for human ailments.

If osteopathy had been born fifty years ago, it would have died because the popular and scientific minds were not in a condition to receive it. Even the time at which it was born, scarcely thirty-five years ago, was hardly ripe for this new departure in medicine. Twenty years easily cover the period of its active history.

A Scientific Growth.—There is one distinctive point about osteopathy which should be especially emphasized: It is not an empirical system; nothing is done on the cut and dry plan. It has been developed in a purely scientific way. We might observe the action of the human body in health and disease indefinitely without securing any exact data to pass on to the next generation of observers if we fail to know the structure of the body. A physician may learn many things in an empirical way which are very poor assets for science.

The strange part of medical history, to the modern investigator, is the fact that discoveries in anatomy and physiology, which are of such vital importance to the successful treatment of human diseases, were left stored away between the covers of books, not deemed of any value except to whet the mind of the dilletante in medicine.

Osteopathy as a distinct system of medicine has grown to its present proportions at a time when the older schools of medicine are making radical changes in their therapeutical procedures, e. g., serum-therapy. In spite of all these so-called scientific advances in drug-therapy, osteopathy has made steady advance into public favor, thereby showing that it is fully able to compete with the older systems of practice.

The Founder of Osteopathy.—Dr. A. T. Still, of Kirksville, Mo., is the honored founder of this system of therapeutics. His work was in studying the structure of our bodies directly, and thus gaining an accurate knowledge of how bones, ligaments and muscles, blood-vessels, glands and nerves are placed. Then he sought that department of knowledge which we call physiology, and learned how these tissues act in health. Having had previous training in treating diseases by the drug method, he was slow to discard the old method for one which had never been tried, even though it had good scientific reasons back of it. But the substitution did take place by degrees until his system of therapeutics no longer depended on the use of drugs.

It seems to be a popular idea that it is necessary for the founder of a system to have a creed or statement of belief. We do not doubt but that it is good for us at times to try to put our beliefs in writing, not to form a fixed position, but just as the architect draws many plans to gradually develop his mental pictures. These statements usually contain the truth about our work so far as we know it. We can thus see how far we have advanced and realize that we have much to learn.

Dr. Still has, from time to time, expressed the result of his studies, that is, the observed facts upon which he has built his system of therapeutics. In 1874, Dr. Still stated his observations as follows: "A disturbed artery marks the period to an hour, and minute, when disease begins to sow its seeds of destruction in the human body. That in no case could it be done without a broken or suspended current of arterial blood which, by nature, is intended to supply and nourish all nerves, ligaments, muscles, skin, bones and the artery itself. * * * The rule of the artery must be absolute, universal, and unobstructed, or disease will be the result. * * * All nerves depend wholly upon the arterial system for their qualities, such as sensation, nutrition and motion, even though by the law of reciprocity they furnish force, nutrition and sensation to the artery itself."

Definitions.—Many definitions have been formulated and published to the world. Each one tends to limit one's conception of osteopathy in some particular. A definition always limits the thing defined, therefore, no definition of osteopathy can be complete, because we are dealing with a principle, the universality of which no one knows. Whereas, less than seven years ago, it was thought that osteopathy was an excellent method of treating chronic ailments, we now find osteopaths working day and night at the bedside of the acutely sick. Thus does it spread and become thoroughly recognized as a system applicable to all diseases.

In order to bring before the student as full and comprehensive an idea of the scope of osteopathy as possible, a series of definitions are quoted. These definitions have been taken from current osteopathic literature and are credited to their respective authors.

One of the short paragraphs in Dr. Still's autobiography is sufficient to give a clear understanding of his idea of the human body. "The human body is a machine run by the unseen force called life, and that it may be run harmoniously, it is necessary that there be liberty of blood, nerves and arteries from the generating point to destination."

The following definition is one which has been used in the American School publications for a long time: "Osteopathy is that science which consists of such exact, exhaustive and verifiable knowledge of the structures and functions of the human mechanism, anatomical, physiological and psychological, including the chemistry and physics of its known elements as has made discoverable certain organic laws and remedial resources, within the body itself, by which nature, under the scientific treatment peculiar to osteopathic practice, apart from all ordinary methods of extraneous, artificial, or medicinal stimulation, and in harmonious accord with its own mechanical principles, molecular activities, and metabolic processes, may recover from displacements, disorganizations, derangements, and consequent disease, and regain its normal equilibrium of form and function in health and strength." Mason W. Pressly, A. B., Ph. D., D. O.

"Osteopathy is that science of healing which emphasizes, (a) the diagnosis of disease by physical methods with a view to discovering not the symptoms but the causes of diseases, in connection with misplacements of tissue, obstruction of the fluids and interference with the forces of the organism; (b) the treatment of diseases by scientific manipulations in connection with which the operating physician mechanically uses and applies the inherent resources of the organism to overcome disease and establish health, either by removing or correcting mechanical disorders, and thus permitting nature to recuperate the diseased part, or by producing and establishing antitoxic and antiseptic conditions to counteract toxic and septic conditions of the organism or its parts; (c) the application of mechanical and operative surgery in setting fractured or dislocated bones, repairing lacerations and removing abnormal tissue growths or tissue elements when these become dangerous to the organic life." J. Martin Littlejohn, LL. D., M. D., D. O.

"Osteopathy is a school of mechanical therapeutics based on several theories. 1. Anatomical order of the bones and other structures of the body is productive of physiological order, i. e., ease or health in contradistinction to disease or disorder which is usually due, directly or indirectly, to anatomical disorder. 2. Sluggish organs may be stimulated mechanically by way of appropriate nerves (frequently by utilizing reflexes) or nerve centers. 3. Inhibition of over-active organs may be effected by steady pressure substituted for the mechanical stimulation mentioned above. 4. Removal of causes of faulty action of any part or organ is the keynote of the science." C. M. Case, M. D., D. O.

"Osteopathy is that school of medicine whose distinctive method consists in (1) a physical examination to determine the condition of the mechanism and functions of all parts of the human body, and (2) a specific manipulation to restore the normal mechanism and re-establish the normal functions. This definition lays stress (1) upon correct diagnosis. The osteopath must know the normal and recognize any departure from it as a possible factor in disease. There is not one fact known to the anatomist or physiologist that may not be of vital importance to the scientific osteopath. Hence a correct diagnosis based upon such knowledge is half the battle. Without it scientific osteopathy is impossible and the practice is necessarily haphazard or merely routine movements. The definition lays stress upon (2) removal of the cause of disease. A deranged mechanism must be corrected by mechanical means specifically applied as the most natural and only direct method of procedure. This work is not done by any of the methods of other schools. After the mechanism has been corrected little remains to be done to restore function, but stimulation or inhibition of certain nerve centers may give temporary relief and aid nature. The adjuvants used by other schools, such as water, diet, exercise, surgery, etc., are the common heritage of our profession and should be resorted to by the osteopath if they are indicated." E. R. Booth, Ph. D., D. O., Ex-President A. O. A.

"Osteopathy is that science or system of healing which, using every means of diagnosis, with a view to discovering, not only the symptoms, but the causes of diseases, seeks, by scientific manipulations of the human body, and other physical means, the correcting and removing of all abnormalities in the physical relations of the cells, tissues and organs of the body, particularly the correcting of misplacements of organs or parts, the relaxing of contracted tissues, the removing of obstructions to the movements of fluids, the removing of interferences with the transmission of nerve impulses, the neutralizing and removing of septic or foreign substances from the body; thereby restoring normal physiological processes, through the reestablishment of normal chemical and vital relations of the cells, tissues and organs of the body, and resulting in restoration of health, through the automatic stimulation and free operation of the inherent resistant and remedial forces within the body itself." C. M. Turner Hulett, D. O.

"Osteopathy is that science which reasons on the human system from a mechanical as well as a chemical standpoint, taking into consideration in its diagnosis, heredity, the habits of the patient, past and present; the history of the trouble, including symptoms, falls, strains, injuries, toxic and septic conditions, and especially in every case a physical examination by inspection, palpation, percussion, ausculation, etc., to determine all abnormal physical conditions; the treatment emphasizing scientific manipulation to correct mechanical lesions, to stimulate or inhibit and regulate nerve force and circulatory fluids for the recuperation of any diseased part, using the vital forces within the body; also the habits of the patient are regulated as to hygiene, air, food, water, rest, exercises, climate and baths; such means as hydropathy, electricity, massage, antidotes and antiseptics, and suggestion sometimes being used as adjuncts." Chas. C. Reid, D. O.

The above definitions have nearly all been taken from the Journal of the American Osteopathic Association.

Osteopathic Diagnosis.—Physical diagnosis is and always will be the leading factor in the success of osteopathic practitioners. This ability to take hold of an ailing human being and detect the disturbing factor in it is the highest attainment of the physician. Osteopathy has developed the art of palpation to a wonderful degree. Basing this art on a definite knowledge of structure and function makes it the chief reliance in diagnosis. Every physical diagnosis begins with palpation and proceeds with ausculation and percussion, and not failing to use chemical and microscopical methods when necessary. The student must learn to use his sense of touch continually, in fact, learn to see with his fingers. Add to this development of touch a training in chemical and microscopical analysis of secretions and excretions of the body, and we have a practitioner thoroughly equipped to make an accurate scientific diagnosis.

Osteopathic Therapeutics.—Osteopathic treatment is based on this kind of physical diagnosis which we have just described. It takes into account the fact that the organism is a self-recuperating mechanism and requires proper food, proper surroundings, and perfect activity of every tissue, especially the blood. Thus we divide treatment into three divisions, (1) manipulation for the purpose of correcting the mal-position of any tissue, whether that tissue be bone or blood; (2) proper feeding, i. e., dietetics; and (3) proper surroundings, i. e., hygiene.

If the condition of the body is such that none of the three methods just mentioned will right the difficulty, i. e., if there are broken bones, ruptured muscles and connective tissues or false growths, we can then use surgical means. Surgery is a part of the osteopathic system, just as it is of all systems of medicine. The chief assurance lies in the fact that the osteopathic system is very conservative as regards the use of the knife.

Osteopathy includes all those qualities which make up a successful system; its diagnosis is accurate and its treatment is comprehensive, including scientific manipulations, scientific dietetics, hygiene and surgery.

In a recent article in the American Monthly Review ot Reviews, the following sentences appear: "With but few exceptions, the entire vegetable and mineral kingdoms have given us little of specific value; but still, up to the present day, the bulk of our books on materia medica is made up of a description of many valueless drugs and preparations. Is it not to be deplored that valuable time should be wasted in our student days by cramming into our heads a lot of therapeutic ballast."

This is probably the most recent statement of this kind in the public prints. It substantiates the position taken by the osteopathic colleges. We feel justified in claiming that osteopathy today occupies a position which every other system of medicine must come to sooner or later. It is broad enough and liberal enough to accept truth wherever demonstrated. Its foundations being laid in the basic sciences, and its treatment never departing from the facts of these sciences, make it a system of lasting worth and capable of adding an entirely new conception of the phenomena of life to medical literature.

The formation of the name osteopathy (from osteon, bone, and pathos, suffering) seems to be as perfect a descriptive name as it is possible to form which would cover the basic principle of the science. The bones are the foundation upon which all the soft tissues are laid, and the osteopath makes all his examinations, using them as fixed points from which to explore for faulty arrangement. The name does not mean bone disease, but since the osteopath finds many diseases resulting from irritation due to slightly displaced bone, the name is used in the sense of disease caused by bone. We do not consider that all diseases are caused by displaced bone, but it is a cause which has heretofore been overlooked. We recognize that there are many causes of disease, and do not wish to be understood as trying to fit fact to theory, but as a result of observing certain facts, this basic principle of osteopathy has been made clear.

We believe that health is the natural state, and that this condition is bound to be maintained so long as every cell has an uninterrupted blood supply, and its controlling nerve is undisturbed. Therefore, the first effort of the osteopath is to remove all obstructions to blood and nerve supply, feeling certain that when these obstructions are removed, health will follow. Hilton in his lectures on "Rest and Pain," which are considered medical classics, has expressed himself forcibly on this subject, as follows: "It would be well, I think, if the surgeon would fix upon his memory, as the first professional thought which should accompany him in the course of his daily occupation, this physiological truth—that nature has a constant tendency to repair the injuries to which her structures may have been subjected, whether those injuries be the result of fatigue or exhaustion, of inflammation or accident. Also, that this reparative power becomes at once most conspicuous when the disturbing cause has been removed; thus presenting to the consideration of the physician and surgeon a constantly recurring and sound principle for his guidance in his professional practice."

Every system of curing human ills which is based on the known facts of anatomy and physiology will last, because it is true. When systems of drug medication are known only as history, osteopathy will be ministering to the human race, because it knows no other path than that which leads to greater truths in physiology and anatomy.

CHAPTER I.

CAUSES OF DISEASE.

Normal and Abnormal.—In order to use the word abnormal, with reference to the structure and function of living tissues, we must have knowledge of the normal. Normal is a word having, apparently, as many interpretations as the word "beauty," i. e. standards to which these words are applied differ, even as the individuals who use them. In order that we make clear what we conceive as normal and abnormal conditions, it is necessary to call attention to variations in structure and function, which should be recognized as not being far enough removed from typical conditions to indicate the existence of a need for corrective interference.

The Ideal Normal.—Our first steps in the acquirement of a medical education are practically all concerned with study of the normal. We dissect bodies which have been changed by disease and therefore we come in contact with abnormality. To counteract this we study descriptive anatomy and idealize our real knowledge which was obtained by dissection. Ofttimes our ideal has such attributes of perfection that nothing ever comes up to standard and hence appears to us to be defective. This hypercritical attitude leads to exaggeration of the interpretation put upon symptoms and hence leads to misdirected efforts at correction.

Variations in Structure and Function.—We need therefore, first of all, a fairly good knowledge of the variations in structure and function which may be recognized as considerable departures from type, but still not abnormal in the sense we use that term when speaking of disease. No tissue in the body is unyielding and hence will adapt itself to even a very moderate force, if that force is long continued. This is well illustrated by the great changes which can be produced in the alignment of the teeth under corrective bracing.

Adaptation.—The changes in structure, which are frequently recognized, may be evidence of adaptation, i. e. they are the final result of the body's effort to maintain its existence at the highest point of efficiency of which it is capable. With this thought ever in our minds we may safely observe the character of structures and draw more just conclusions as to the existence of normal or abnormal conditions.

Normal Health.—People usually seek the services of a physician because they suffer some degree of discomfort. True it is that some seek a cosmetic effect, but this may hardly be seriously considered. Normal health means a condition wherein we are unconscious of bodily distress and are able to do what is ordinarily counted as our share of work. This state of bodily comfort, under the ordinary stress of labor, is not necessarily based upon symmetry of structural development, i. e. absolute conformity to our ideal of structural perfection.

Comfort and Efficiency.—Normality from the cradle to the grave seems to be a personal equation, i. e. bodily comfort under the stress of moderate physical and mental exertion. Increase of physical or mental exertion either, through adaptation, produces increased capacity, or, through failure of adaptation, produces destructive changes. Comfort and efficiency are the real attributes of normality. If these are present in average degree there is little likelihood of a physician being consulted.

Variation of the Normal.—The normal of any individual varies at different periods of life and following accidents or severe illnesses. The physician is frequently consulted with the hope that the normal of later years might be raised to the degree consciously possessed at a former time, or in the hope of being restored to the normal which existed previous to an accident or severe illness. The new normals which constitute the result of repair after injury and illness do not measure up to the previous standard in most cases. Consciousness of a decrease in efficiency leads many people to the hope of securing an increase by some specific means.

Distress and Inefficiency.—The physician is constantly dealing with two classes of patients, those who suffer bodily distress, and those who are conscious of bodily inefficiency, in some degree, and hence suffer mental distress. It is alluring to sufferers of either class to think there is a specific removable cause of their distresses, hence any form of treatment, aiming to specifically attack the cause, has a captivating character.

Difference in Belief as to Causes.—All forms of treatment are, at least in fancy, based on the desire to remove the cause of the ailment. The reason there is such wide discrepancy in methods is because of differences in belief as to causes. In other words, if all forms of disease were thoroughly understood, i. e. as to cause as well as manifestations, there would very quickly develop an agreed form of treatment. It appears so, but there is another factor to consider. The same disease, due to the same cause, does not manifest itself the same in every individual, therefore the same means used to remove the cause does not bring the same reaction in every individual. This has led to a multiplicity of methods even where the cause is known. It is certainly a great gain to have but one unknown quantity, the vitality of the patient, instead of the two that previously existed, i. e. the cause of the illness and the vitality of the patient. This desire to have but one unknown quantity has frequently led to the development of medical dogmas based on a belief in the existence of certain causes of disease. The germ theory and the lesion theory are good present day examples. Both the germs and the lesions are so universally found that both form convenient foundations for dogmatizing.

Interpretation of Phenomena of Disease.—Although these studies are directly concerned with the phenomena of lesions there is no desire on our part to exalt any group of phenomena out of its comparative value with any other group. It is hoped that by presenting, as well as we are able, the lesion theory of disease, we may be able to show paths of convergence leading to a better interpretation of disease phenomena and thus the truths which underlie the lesion theory will not become distorted into fantastic vagaries. We do not wish to be understood as claiming for osteopathy the discovery of the cause of disease. There are many causes, widely divergent in character. Osteopathy brings to your attention a cause, frequently found and of sufficient definiteness to warrant concentrated attention.

Favorable Reaction to Environment.—Since we are mechanisms of living tissues, our survival depends upon reacting favorably to environment. We find the elements, air, light, heat and cold all affect us adversely at times. They become destroyers of bodily comfort and efficiency when intensified. Changes in atmospheric pressure, intensification of light, increased heat or cold, affect us seriously.

Known Causes of Disease.—Chemical poisons, such as lead, arsenic, mercury, phosphorus, carbon monoxide and other gases, are causes of profound injury. The organic poisons, alcohol, opium, morphine, cocaine, food poisons, snake venoms, autointoxications, play no small part in causing bodily discomfort and inefficiency. The vegetable organisms, fungi and bacteria claim abundant recognition as causes of disease. Protozoa are properly listed as causes, for have we not the wonderful discoveries concerning malarial fever, sleeping sickness, amoebic dysentery and yellow fever; sufficient scientific achievements to startle the world. The fluke, cestode and round worm infections have long been recognized causes of disease. Add to the foregoing all those adverse conditions imposed by the nature of our crowded existence in cities, noise and unrest, surfeit and poverty, fatigue and worry, it is little to be wondered at that we find ourselves searching almost hysterically for some thing to aid us to survive it all.

The Tenacity of Life.—It is marvelous how our bodies adapt themselves to all the vicissitudes of environment, survive the effects of inorganic and organic poisons, invasions of bacteria or protozoa, maintain existence in spite of deficient food and rest. The tenacity of life in human tissues, the adaptations and compensations that are developed, are worthy the pen of some scientific genius who has the literary ability to make the layman have faith in natural law.

Lesion-Disease Association.—With all these causes of disease we may well ask ourselves what relation the spinal or other joint lesion has. It would be difficult to find any disease process that does not exhibit a spinal or other joint lesion, in the sense we osteopaths recognize. This coincidence of disease and spinal, or other, joint lesion does not necessarily indicate a sequence of events starting in the lesion. As scientists, rather than special pleaders for a theory, we want to know the significance of this association. It is our aim to devote the pages following to an analysis of this lesion-disease association. We aim to write helpfully, analyzing our failures that we may know our weaknesses, analyzing our successes so that we may make our solid principles more widely recognized.

Remove the Cause of Disease.—No great amount of analysis of the various causes of disease is required before we realize that to "remove the cause" we must do something more than treat individual members of society. There is a phase of medical practice which requires us to view the good of the community rather than any portion of it. Some lives are sacrificed because we have no cure for the individual. We cure the community, the race, by sacrificing the individual. Public health requires what seems to be cruelty toward the individual from whose disease we must be protected.

Preventive Medicine.—As fast as causes of certain diseases have been demonstrated, plans for prevention take precedence over treatment of the individuals who suffer from those diseases. Thus a new class of physicians is developed, i. e. those trained to cope with the problems of preventive medicine rather than meet the exigencies of treating individual patients. It is the necessarily aggressive advance of preventive medicine which arouses antagonism and social discord. No one could successfully contend that all preventive methods, thus far enforced, are satisfactory. Then, too, it is not possible to demonstrate quickly to all the members of a community the necessity for certain procedures. Sacrifice of the individual, be it ever so slight, for the good of the whole, is not agreeable to the victim or his friends. Altho we are developing methods primarily applicable to the individual rather than serving the aggressive purposes of preventive medicine, that which makes the individual an efficient member of society subserves public health.

Symptoms.—Diseases manifest themselves by certain phenomena which are designated as symptoms. Symptoms are abnormal degrees of normal reaction. This is made evident by the fact that some symptoms represent sub- and others supernormal functioning. The supernormal functioning represents a reaction, on the whole favorable to recovery, whereas the subnormal reaction is not favorable. Since the symptoms represent phases of reaction or non-reaction in tissues, the effort put forth by the body, as a whole, to recover, is in proportion to the energy contained in its cells. In a restricted sense the cause of disease is in the cells of the body. They contain the stored energy, i. e., potential energy. When this potential energy is released by some force, or stimulus, we have kinetic energy. Potential energy does not transfer itself spontaneously into kinetic energy without first being affected by some other force, which may be called a stimulus. The amount of potential energy converted into kinetic is not proportional to the amount of the stimulus used to initiate the process. All stored energy, i. e., potential energy, requires a certain strength of stimulus to start the process of conversion into kinetic. When this strength of stimulus is known, it is called the normal. There are usually several kinds of stimuli, each one having a varying degree of intensity. For example, the potential energy in a muscle fiber will be converted into kinetic energy as a result of mechanical, thermal, chemical or electrical stimuli. Certain amounts of each of these stimuli are required to initiate the change in the form of energy.

A Normal Stimulus.—The potential energy in a muscle fiber has a certain degree of resistance to stimuli. A definite amount of any one of the four forms of stimuli named is necessary to cause the muscle fiber to contract. This definite amount, which is capable of stimulating the muscle to an average contraction, is called the normal stimulus, and the action of the muscle is called the normal contraction. If the muscle should contract more vigorously than usual in response to this normal stimulus, the resistance of the potential energy of the muscle fiber is below normal. The strength of stimulus and discharge of energy may vary greatly in their proportions within normal limits, but there are well marked lines above or below which resistance is spoken of as above or below normal.

A Change of Resistance.—When the resistance of the potential energy is below normal, a normal stimulus causes too great an effect, that is, too much potential energy is transferred into kinetic energy. When the resistance of the potential energy is normal, and the stimulus above normal, there also results an excessive discharge of potential energy. Therefore, excessive discharge results from lowered resistance, or increase of stimulus. Resistance is a quality of the cell protoplasm. The stimulus is an external force. The cell depends on proper surroundings in order to maintain its resistance to external stimuli, such as bacteria. The strength of bacteria may also be increased or decreased by the nature of their surroundings.

Cause and Effect.—After potential energy has been changed into kinetic energy, this latter may generate more potential energy, and this also may be converted into kinetic. Thus cause is converted into effect and effect into cause. This is an endless chain. When such a process is beyond the normal, as in the body when varying symptoms present themselves, therapeutic efforts must be concentrated on some particular reflex in order to break the chain.

Cell Relations.—The relations of a cell with its fellows, that is, its structural relations, are the basis upon which its resistance, in large measure, depends. Therefore, anything which disarranges its normal relations will, in all probability, change its resistance to stimuli. All therapeutic methods which aim at lessening the too rapid conversion of potential into kinetic energy, that is, increasing cell resistance, must see that correct structure is attained.

Excessive Stimulation.—In cases where almost complete exhaustion of potential energy has resulted from lowered resistance and we find that even increased strength of stimulus fails to evoke a response, the same structural fault may exist. We know that stimulation, when excessive, passes into inhibition. Perhaps it is truer to state that overactivity of a cell leads to exhaustion of its potential energy. The stage of exhaustion, in this sense, is consonant with inhibition. As an example: In case of structural changes in the lower dorsal region, there may result a change in resistance in the secretory and contractile cells of the intestines, due to changed blood supply. Diarrhoea results for a time, followed by constipation. At the beginning of the rapid conversion of potential into kinetic energy the muscles feel tense. After the constipation, or period of exhaustion, sets in, they are flabby.

Structural Defects.—Structural defects may result in lowered resistance in groups of cells. They also act as stimuli to set free the potential energy in these cells. In many cases we note only a predisposition to yield to weak stimuli. This is the condition in individuals who are "fairly well," but cannot endure any of the normal stimuli in average amount. They cannot exercise freely without a bad reaction. A slightly heavier meal than usual, the excitement due to the presence of many people, arouses "symptoms." Their physiological processes are easily perverted by normal stimuli because a structural defect, either directly or indirectly, has decreased cell resistance. Cases of lowered resistance, supposed to be due to heredity, should be carefully examined for structural defects. It is not improbable that many an ancestor is wrongly accused of transmitting a "predisposition." While cell resistance remains below normal, all external stimuli, such as atmospheric changes and the presence of bacteria, even if in only normal amounts, may call forth "symptoms of disease."

Cell Life Dependent on Circulation.—The individual cells of the body depend on the supply of nourishment brought to them by the circulating fluids of the body. The protoplasm of the cells is a complex, chemical substance made up of an enormous number of complex molecules. These molecules, on account of the looseness of combination of their atoms, require sufficient crude material brought to them to maintain the proper atomic tension. Upon this tension is based the resistance to normal or abnormal stimuli. The necessary food for cell protoplasm is brought to the cells by blood and lymph. Since cell protoplasm is entirely dependent upon the circulating media, any disturbance of these media changes the metabolism of the cell, and hence a change in resistance results. This resistance may be varied by failure on either the arterial or venous side of the general circulation, resulting in changed lymph circulation. The constant removal of katabolic products is of as much importance as the constant renewal of material for anabolism.

Intracellular Tension.—Intracellular tension, i. e., the cohesiveness of the atoms of each molecule, is dependent on lymphatic circulation; this upon arterial and venous circulation. If there is abnormal variation in any of these circulatory fluids, there results a change in resistance of the cells. Therefore, a normal stimulus may provoke too great a transference of potential into kinetic energy and thus initiate a chain of such transferences of one form of energy into another. As a rule, the kinetic energy which results from the release of potential energy, in excessive amounts, acts as a stimulus to release still more potential energy and so on to the point of exhaustion of the supply of such stored energy. This change is exemplified in the series of symptoms which appear in many diseases. Each liberation of a new supply of energy gives rise to a new system. If the potential energy resides in a gland, excessive secretion results; if in muscle, excessive contraction, etc. The way in which the kinetic energy is manifested depends upon the manner in which its cause, i. e., potential energy, is stored. The secretion or the contraction may act as a stimulus to liberate still more potential energy.

Scientific Therapeutics.—Therapeutic methods become scientific just in proportion as they are based on the known structure and function of the tissues and the exact cause of the disturbed condition of the tissues, i. e., the disease. The effort to develop scientific therapeutics has led to various ways of looking at the problem. We have mentioned the fact that each case of illness is a problem with two unknown quantities, i. e., the cause of the illness and the reaction power, i. e., the resistance of the individual. The cause, in many instances, may be sufficiently well known to govern the method of treatment, at least the treatment appears scientific if we think only of the cause. The possible weak point in the plan of treatment is the fact that no consideration has been paid to the existence of the second unknown quantity, i. e., the resistance of the tissues to the disease as well as to the treatment. The treatment of typhoid fever by intestinal antiseptics appears scientific because it appears to bring the cause of typhoid and the means of destroying it in proper relation. The treatment has not proven successful because of the second unknown quantity and because that which is destructive to the cause is likewise destructive to the tissues.

The Problem as a Whole.—The development of scientific therapeutics is evidently not easily accomplished, even when we know the cause of disease. There are those who treat diseases and those who treat individuals, i. e., those who attack causes, with little regard for the reactions of the individual, and those who aim to support the reactions of the individual without any direct attack on the cause. It is evident that neither method is altogether right, hence scientific medicine is ever striving to evolve a treatment suited to the problem as a whole. Take for example the problem of ridding the body of an intestinal parasite, such as a tape worm. Methods of treatment differ, altho based on a known cause and a known condition for elimination of the parasite. There are many ways of making the parasite sick enough to loose its hold on the walls of the intestine. The question is: Which way will be least disturbing to the host? The practice of osteopathy is full of such problems, the majority of them nowhere near as simple as the one used as an illustration. The human body is disturbed by many specific causes, varying in destructive power, which bring forth series of symptoms, which, taken together, give us a picture of a certain disease. To these causes all human beings react in approximately the same way. The symptoms pass through varying degrees of intensity, run a characteristic course and disappear. We recognize that the reaction power of the body has triumphed over the cause of the disease. The fact that the majority of sick people get well under all sorts of treatment naturally leads us to believe that the body is able, in a majority of instances, to conquer the cause of the disease. Recognition of the healing power of Nature leads to the development of two views as to how disease should be met. There are those who distrust and decry all therapeutic methods. Such are fond of pointing to past therapeutic failures and are, in fact, therapeutic nihilists.

Natural Recovery.—It is not enough to recognize the fact of recovery. We want to know how natural recovery takes place, then we may be able to assist, at least not hinder, the forces acting for recovery. The study of structure and function of human tissues is the foundation for understanding how Nature cures. We believe that osteopathy has brought, and is now bringing, very valuable additions to the sum of human knowledge as to how Nature cures. It is building its portion of scientific therapeutics based upon a knowledge of causes and reactions.

Extrinsic Causes of Disease.—The causes of disease previously mentioned, i. e., environmental conditions, poisons, parasites, etc., are all external influences, in the sense that they are not a part of normal tissue structures. The causes noted especially in osteopathic diagnosis are a part of the structure of the body. The structural relations are sufficiently altered to compel the body to react on its own structural imbalance.

Inherent Recuperative Power.—Since it has inherent recuperative power to overcome the effects of external causes of disease, there is no doubt but that it usually survives localized structural lesions of this inherent character. It adapts itself as well to internal structural conditions as to diseases produced by other causes. We have noted the necessity of a normal molecular intracellular tension in order to maintain the efficiency of the cell, also the necessity for proper relations between the cells and the circulating fluids. Any structural fault which interferes with this relationship compels the body to react to this fault either in a way to correct it, or, if it threatens the life of the whole body, get rid of it. We see in these reactions just such phenomena as we exhibit in our social relations, i. e., a sick member of the community causes no great reaction in the body politic until his illness menaces the whole people.

Disturbed Tissue Relations.—Osteopathy emphasizes the disturbances in tissue relations. It sees in these both predisposing and exciting causes of disease; predisposing, in that tissue resistance to outside influences is weakened; exciting, in that, in many instances, the reactions take on the character of acute diseases. Injuries are so very frequent that there is scarcely an individual who has not put the structural tissues to a severe test. These strains, usually of sufficient severity to produce local distress and healing reactions, leave their influences, and if a long time for healing was required, perhaps influenced the general statics of the body.

The Biological Relation of Function and Structure.—The author does not look upon the so called osteopathic lesion as being an evidence that structure determines function, biologically considered. The structural lesion is an interruption of the biological concept that function fashions the structure. This interruption disturbs function, but the biological law is sure to assert itself in the recuperative process. Since "biology has no statics," living tissues are always being rebuilt to serve the function which brought them into being. This ability to repair an injured tissue and make it serve the special function for which it was intended, is the foundation for adaptation and compensation, those phenomena which we see exhibited by the body in so many forms in its struggle to survive.

The True Art of Healing.—If we can study these phenomena, understand what Nature is trying to do, assist accordingly, then we are indeed physicians. "In no case can anything appear in the form of disease which was not previously present in the body as a predisposition; external forces are able merely to make this predisposition apparent. When the physician, by thorough observation and investigation, knows the conditions that influence a given predisposition in a definite way, when he is scientifically trained and has a true conception of hygiene, and is at once physician and naturalist, then he is able to cure disease by use of the very same forces which serve to create or alter the human constitution. In this simple sense there is a true art of healing."

CHAPTER II.

THE LESION AS A CAUSE.

Definition.—The principles of osteopathy take their natural beginning in the consideration of "the lesion." The word "lesion" is used by osteopaths to designate something more than "an injury, hurt or wound in any part of the body" (Gould). Any structural change which affects the functional activity of any tissue is called a lesion. There may be structural changes, abnormal development, which are very evident to palpation but do not affect functional activity and, therefore, are not lesions. A lesion is not only a structural change, but such a change as influences function detrimentally. Fig. 112 illustrates a structural change without detrimental influence on function, while Fig. 113 illustrates a true lesion. The relation of these structural lesions to the media of communication and exchange, nerves and blood vessels, is believed to be the chief element active in producing and maintaining functional disorders. This is the central principle of osteopathic practice.

Characteristics of a Lesion.—Lesions may be present in any tissue, but their existence is most easily recognized in bone, ligament and muscle. Dislocations and subluxations of bones, thickened ligaments and contracted muscles constitute the usual varieties of lesions. A true lesion is usually palpable; the functional disturbance is related anatomically and physiologically; there is hyperaesthesia at the palpable area. These three conditions constitute the characteristics of the lesion as it is designated by the osteopath. Its palpability may vary between very wide limits; the location of the structural change and functional derangement may be direct or indirect, the hyperaesthesia distinct or indistinct; still, the diagnostician is justified in centering attention upon the lesion if a reasonable amount of association can be detected.

Classes of Lesions.—Lesions, according to osteopathic theory, may be of two classes, i. e., first, change in size of tissues; second, change in position. Generally speaking, a change in size is far more difficult to overcome than a change in position, because the former is a result of more profound changes. Tissues may increase in size as the result of efforts to repair injury, e. g., the formation of callous in bone, or thickening of ligaments following a sprain.

Causes of Lesions.—The causes of lesions fall under two general divisions: First, violence; second, failure to react to environment. In the first division all the lesions are primary in character, i. e., the violence immediately changes the relations of structure, and this change becomes an obstruction to vital activity of the body fluids. If the lesion is not corrected by the recuperative power of the body itself or by outside efforts, the change in position is very apt to become complicated by a change in size. The injury results in thickening of the ligaments or other fibrous tissues.

Secondary Lesions.—The second division of lesions is a very large one. These lesions develop as an evidence of the failure of the organism to become perfectly adapted to its food, clothing, labor or general environment. They are, therefore, secondary in character and must be recognized as objective symptoms of one functional derangement, while at the same time they operate primarily to cause functional derangement elsewhere. Thus they may be removed by manipulation and cease to act as an active cause of functional change, but will return again so long as environmental forces are overwhelming.

Effect of Violence or Fatigue.—The first division or primary lesion may result from sudden violence or from a force comparatively weak but long continued. In other words, a lesion may be developed immediately, under great force, or slowly as the result of great fatigue. An example of a lesion developing under fatigue is noted in the faulty positions assumed by the body following prolonged effort or in performing certain tasks.

Failure of Adaptation.—The second division or secondary lesions may result from failure to react properly to changes of temperature. The temperature of the surrounding air may be the same at various times, but the character of the clothing may necessitate a greater effort at adaptation. There must be suddenness in the change of temperature or clothing in order to produce the lesion, i. e., the responsiveness of the tissues must be overtaxed. The first effect of failure of adaptation is the contraction of muscle and accompanying sensitiveness. The distortion of the bony structure is consequent on the contraction. Ordinarily, if the shock is not too great, the adaptive forces of the organism will exert sufficient power to correct the condition, but when the environment is not suitable the lesion may become permanent. Humidity or electrical conditions of the atmosphere may operate to produce these lesions.

Chemical Causes of Spinal Lesions.—We have noted that these lesions have been discovered coincident with visceral disorder. We may, therefore, safely assume that food which is too difficult of digestion or the usual food taken during fatigue, may act chemically to produce spinal lesions. In this instance they are certainly objective symptoms of visceral disease, but as stated before they must be primary causes of other disorders. To remove such a lesion by manipulation is helpful to the organism, but the patient must know that dietetic indiscretions or eating when fatigued was the real starting point of the disease. Here is where dietetic and hygienic knowledge must be a portion of the physician's therapeutics. If the pointing out of structural changes as a result of functional disturbance due to indiscretions in eating and other appetites will lead patients to simpler living, the physician may feel that he has performed a duty more valuable to the patient than the removal of his secondary lesions. There can be no doubt but that the removal of a primary lesion due to violence is absolutely essential, but when we maintain that all lesions must be removed before function can right itself, we become absurd. Furthermore, if we contend that a structural lesion antedates all functional disturbances we make of life a series of accidents, instead of a force governed by fixed laws.

The Reason for the Persistence of a Lesion.—The question arises, why does the muscular contraction persist after the proper changes in habits have been made? This question can not be answered at present. Scarcely one of us will voluntarily make the change in habits until forced to do so by failure of the body to respond to our demands. Many things of a sociological character are at work to compel people to labor after fatigue is evident, to eat, sleep and dress unhygienically. Viewed from this standpoint, the practice of medicine is a problem in sociology. The original irritation which causes the tension probably causes more or less congestion of blood. The congestion results in over-growth of tissue, which becomes a fixed condition maintaining the lesion, i. e., it is a portion of the lesion.

The Sequence of Lesion Phenomena.—We have considered three points concerning lesions—hyperaesthesia, muscular contraction, and subluxation. They have been considered in this order merely on account of historical reference. In osteopathic practice, they are reversed. We note first the structure, then the tension which accompanies the change in structure, then the hyperaesthesia.

Variations in Development.—It is not uncommon to find changes from the usual forms of the bones. Sometimes these changes may be very deceptive, but when analyzed with reference to the existence of functional disorder in the area of their normal influence and the presence of hyperaesthesia, they will be recognized as morphological changes due to natural causes. Lesions which might have been active at a former time are sometimes nonactive on account of laws of accommodation which are always active in the body. If the body has succeeded in recuperating from the effect of these lesions, it is unwise to disturb them. As an example of an accommodated lesion, we may mention the formation of a new socket for the head of the femur, following dislocation. There are variations in development all through the body, and each physician should strive to become acquainted with them.

Palpation of a Lesion.—The first sign of a lesion is noted by palpation, i. e., the change in structure is felt. According to what we have just said, this is not sufficient evidence of the existence of an active lesion. It must be accompanied by other signs. First, try to eliminate the apparent existence of the lesion by having the patient "assume different positions." Second, note whether the bony landmarks in that area vary from the normal. Third, note whether the lesion causes the patient to assume any special attitude. Fourth, test the amplitude of movement in the articulation to determine the changes in its extent. If there is perfect flexibility it is scarcely probable that a lesion exists, for an active lesion is quite inconceivable without tension. Fifth, feel of the soft parts of the joint, muscles and connective tissues. Note any swelling or change in temperature. Sixth, inspect the surface as to color and texture. Seventh, test sensibility by pressure. Ordinarily an examination of the body for lesions consists in comprehensive palpation, which notes synchronously the existence of positional change, tension, temperature, swelling and sensitiveness. The existence of tension is sufficient evidence of decrease of flexibility. When violence is the cause of the lesion, it is necessary to correct structure directly. When the osseous lesion is the result of muscular tension due to reflex stimulation, methods differ according to the viewpoint of the physician. Some manipulate for direct reduction, others relax muscles and thus remove the cause of the osseous lesion. The really comprehensive plan should take into account the cause of the tension which occasions the osseous lesion. Having done this, the physician may manipulate the lesion to secure direct reduction with the feeling that the problem has been undertaken wisely.

Description.—Theories of the causation of disease are capable of being spun out to the point where concrete usefulness is very doubtful. In order that we may not wander too far in theoretical speculation, we will seek to keep the phenomena, which we are trying to describe, of such a tangible character that the reader will not have to draw on the imagination.

Find the Lesion.—Osteopathy has developed as a school of medicine exploiting "the lesion" as a cause of disease and its correction as the efficient cure of disease. This theory has been so enthusiastically adhered to that many have been more than willing to attribute failure to cure a given case as due to the practitioner's inability to find or correct the lesion. The desire to maintain the adequacy of a theory is thus apparent. This book is written to present the usefulness of osteopathy but not the extremes of theoretical speculation.

Inspection of the Back.—In order that we may quickly have before us characteristic lesion phenomena for discussion and elucidation, let us observe some well recognized peculiarities noted in the inspection of the dorsum of the body. A mature male patient, stripped for inspection, will present, as a general rule, some peculiarities which the trained diagnostician will recognize as adaptation due to labor or mode of life. Closer inspection of the spine, as to its curves, will show adaptation of even more significance, i. e., to body weight, general vitality and visceral conditions. As a rule the diagnostician is trained to note these latter conditions from other points of view. The point is here emphasized that the spinal column is a good recorder of all these things.

Palpation of Vertebral Structures.—Digital palpation of the vertebral and paravertebral structures will, in most cases, show some degree of localized unilateral deviation in vertebral alignment or muscular tension. These apparent changes from what we conceive as the ideal normal are present in practically all people, sick or well. It remains, therefore, necessary that we add to these physical changes something of a determining character in order to recognize an active lesion. Tenderness to pressure is the determining sign. Having located a lesion, i. e., an osseous deviation with muscular tension and tenderness in the same spinal segments, we can now proceed to analyze it with reference to its existence as cause or effect. The spinal vertebral lesion just noted may involve two or more vertebrae with their attached tissues. Some observers claim that a lesion of a single vertebra is rare. Since osteopathy has fostered the view that structure affects function in preference to the reverse, the author feels justified, solely by historical considerations, in beginning all analyses of lesions from that viewpoint. It is candidly understood that in doing this the author is not holding a brief for either side of any controversy which circles about the question whether the egg preceded the chicken or the reverse.

History of Accident.—In any case under examination the diagnostician desires to uncover the history of the lesion, hence the most direct question possible is asked, i. e., "Is there any history of accident?" If a history of accident is given having direct bearing on the lesion under consideration then we are quite justified in believing it to be the primary cause of disturbed function. For example, a patient when attempting to alight from a street car just before it stopped, found his footing insecure and hence clung to the handrail of the car with one hand in an effort to protect himself. The forward motion of the car rotated him and wrenched his back. He was able to go to his home without feeling more than a sense of weakness and pain in the area of the dorso-lumbar articulation. The next morning he was quite unable to rise. Examination showed great muscular tension in the muscles controlling the movement of the twelfth dorsal and first lumbar. Pressure on the spinous processes of these vertebrae caused intense pain. The bowels became constipated and the cutaneous areas supplied by the twelfth dorsal and first lumbar pairs of spinal nerves gave some subjective symptoms of being disturbed. This case recovered in a few weeks under the influence of hot packs to the injured area, rest in bed, and after acute soreness abated, passive motion. This case, for many years, has had attacks of "lumbago." These attacks usually follow changes in the weather and some exertion beyond the ordinary. The lesion always exhibits its old characteristics, viz., tenderness, muscular rigidity and loss of motion in the arthrodial joints between the twelfth dorsal and first lumbar. Usually an osteopathic treatment to establish relaxation and movement is sufficient to secure rapid recovery.

Traumatic Lesion.—We have in this case a condition similar to the results of a sprained wrist or ankle This is a case of such evident traumatic origin that no one would think of it from any other standpoint. The lesion is a characteristic one, derived in a characteristic manner and fulfills our classical picture of localized spinal injury. It is fairly mild in its disturbance of function of the nerves from the injured area. It was recovered from to such an extent that the patient has considered himself well except at such times as the formerly injured tissue failed to function properly under somewhat unusual conditions. There has never been complete recovery of function in the articulation. This is evidenced by partial loss of flexion and extension, hence "the lesion" is always apparent to the trained sense of touch. This lesion presents the same characteristics so commonly noted in peripheral joints which have been sprained and recovered from with partial loss of motion. It is usually many months before the point of attachment of a strained ligament is free from sensitiveness to pressure or tension.

Weight Carrying and Balancing Function Disturbed.—With an injury of this character located where it has a weight carrying and balancing function to perform, forming part of the protective covering of the spinal cord and its membranes, as well as being a part of the wall of a visceral cavity, there are many far-reaching influences which may be attributed to it. The rigidity which nature manifests first as a protective reaction, i. e., to prevent motion in the injured part, will be maintained as a constant factor in any case of joint injury which heals with a partial return of motion. By this is meant that before the motion of the joint reaches its limit the muscles assume the function of ligaments, so as to protect the weakened ligaments. This action of the muscles we note as a protective rigidity which under the influence of passive motion may be absent but reappears when the joint is put through its voluntary functional tests. Thus the fact that the lesion under discussion involves structures forming a part of the weight carrying and balancing mechanism of the body makes it more difficult of recovery. In order to protect it from movement rigidity exists in segments just above and below it. A lesion at the point mentioned will tend to produce a straight spinal column because it is situated at the junction of two curves, the dorsal posterior and the lumbar anterior. Any exaggeration of these curves necessitates greater movement in this joint. Therefore, if this joint be injured and its movement limited there is greater rigidity in both curves in order to protect the injured joint through which their compensating movements operate. The tension of the posterior spinal muscles is met by counter-balancing contraction of the psoas magnus, the diaphragm and the abdominal muscles. The tension of the diaphragm results in lessened respiration. The tension of the abdominal muscles subtracts one factor in the maintenance of bowel action. Lessened oxygenation and elimination are thus possible results on a purely mechanical basis. To compensate for these decreases the whole body metabolizes at a slower rate and, without the sympathetic nervous system is vigorous, the decrease in visceral activity soon makes itself so apparent that the patient may be considered constitutionally ill. Thus it appears that a spinal lesion may influence body metabolism adversely as a result of the natural healing reaction as manifested in rigidity. The decrease of rhythmical movement in the walls of the abdomen and thorax is the immediate consequence of spinal rigidity. These functions are less interfered with when the weight carrying function of the spine is least called upon, hence the horizontal position is naturally assumed to lessen pain and get rid of the demand for compensatory tensions.

Lack of Physiological Rest.—While these injuries are acute we note easily the compensatory reactions just described, but no doubt the majority of such cases feel the press of economic necessity and hence try to adapt themselves to labor through hours more than sufficient to produce a fatigue akin to sickness. The lesion develops a chronicity, or rather has never had a chance to heal under the benign influence of physiological rest. This chronic lesion necessitates permanent compensatory changes such as we have noted. This patient develops periodical digestive weakness, synchronous with his times of fatigue. He visits a doctor and from then on "suffers many things of many physicians." Through time and the compensatory changes in this patient's body the original lesion and its significance are lost to view. The effort made to correct or palliate the digestive disturbance probably has no reference to anything but the prominent symptoms. It is such cases as these, suffering from chronic illness, whose history of traumatic lesion is discovered by the osteopathic examination, which have given prestige to osteopathic therapeutics. The treatment given by the osteopath to this old lesion reestablishes movement in the joint and, therefore, the compensatory tensions in the back, abdomen and chest are lessened.

Influence on Circulation and Innervation.—Having thus followed the mechanical influence of this traumatic lesion through some of its compensations we can with profit turn our attention to the far more subtle influences upon circulation and innervation. The trauma under consideration has been sufficient, in some degree, to rupture tissue continuity and therefore requires increase of circulation for repair. The swelling, occasioned by the congestion of the circulation, being under the spinal apponeurosis, does not evidence its presence by a localized tumefaction. Some fibers of an intrinsic spinal muscle, i. e., one of the fifth layer, according to Gray's grouping, has been injured, hence our repair inflammation is deep seated. The deeper seated the lesion, the more pressure will be exerted on the branches of nerve trunks emerging from the intervertebral canal and the more likelihood will there be that the patient will complain of some symptoms of a character which might be interpreted as of central origin, especially if bilateral. The subjective symptoms, pain and paraesthesia, in the area of cutaneous distribution of the twelfth dorsal nerve are usually unilateral, hence showing that the lesion causes a peripheral neuritis or, at least, a pressure on the nerve sufficient to cause the brain to register as though the peripheral distribution of this nerve was irritated.

Segmental Coordination.—A segment of the spinal cord coordinates the impulses reaching it over its afferent fibers, hence, in the case of our lesion, the bombardment of this segment with impulses from the injured tissue as well as from the nerves subjected to pressure as a result of the repair inflammation will cause efferent impulses to be sent to somatic and splanchnic areas supplied from this segment. These outgoing impulses are influencing motion, secretion, nutrition which are probably disturbed if the sensory nerve impulse which calls forth the reaction is a disturbed one. It is hardly probable that reactions of the kind here mentioned tend to remain active within one spinal segment. The nerve centers involved are vertical, i. e.. extend through one or more segments and hence our reactions tend to spread. As soon as visceral activity is disturbed by vasomoter changes a train of reflexes of a compensatory character are initiated and without we hold firmly in mind the character and location of the lesion and realize the probable, as well as possible, compensatory reactions of a mechanical, circulatory and nervous character dependent upon it, we are quite apt to be led astray by the boldness with which some obscurely related symptom crowds its way into the fore-ground of our attention. The persistence with which many of the older osteopaths have worked upon the lesion and refused to be led away, in fruitless efforts to palliate symptoms, has contributed much to the success of their school.

Example of Fatigue.—Another phase of the lesion as a tenable cause of disease is found in those cases whose structure suffers on account of fatigue or effort to become adapted to position. We will take two lesions commonly associated, i. e., muscular tension with a variable amount of distortion over the splanchnic area, and muscular tension centered over one or all of the upper three cervical vertabrae. A bookkeeper fatigues his back muscles by his position. The effort to see clearly, especially if there is any intrinsic defect of vision or of the coordinating power of the occular muscles requires compensatory action of the cervical muscles to maintain the head in the most favorable position for seeing. The fatigue resulting from many hours of this compensatory effort, supplemented by other events of daily life, produces a so-called "bony lesion," usually about the second or third cervical or even as low as the fourth dorsal. By carrying the weight of the head forward of the center of the body the strain on the extensor cervical muscles is eased somewhat by rounding the shoulders, depressing the thorax, shortening the distance between the end of the sternum, costal arches and the pelvic brim, thus relaxing the abdominal muscles and permitting gastro and enteroptosis. This sagging of the stomach and bowel must be checked if possible, hence the extensor muscles over the splanchnic area contract to maintain the normal erect attitude, but fail eventually because the body is not planned to sustain the weight of the head in a position constantly off the center of the body. This illustrates the gradual development of lesions due to efforts of adaptation.

Loss of Muscular Tone.—Loss of tone in muscles will allow those tissues to which they are attached to yield to the force of gravity and, hence, lesions will be produced. As example, one of my surgical cases complained bitterly, on the third day after a hysterectomy of pain in the back and at the lower end of the abdominal wound. Inspection of the wound showed nothing unusual. The course of the pain was examined and it was found to follow the course of the twelfth dorsal nerve. The feebleness of the patient allowed all her tissues to sag, with the result that the right twelfth rib lay against the transverse process of the first lumbar vertebrae. A pressure thus exerted on the twelfth dorsal nerve produced pain in the area of its distribution. A small pad of gauze and cotton, sufficient to keep the rib away from the transverse process for a few days until general body nutrition reasserted its tonic effect, was sufficient for relief.

As heretofore stated, it isn't the acute lesion, so easily recognized, that has contributed so much prestige to osteopathy. It is the lesion having been overlooked or mistreated and considered a negligible quantity as a causative factor.

Experimental Lesions.—As a foundation for better clinical observation and understanding, experiments have been conducted, notably by Dr. Louisa Burns, in the Physiological Laboratory of the Pacific College of Osteopathy, Los Angeles, and by Dr. Carl M. McConnell of Chicago. These experiments consisted in producing artificial lesions on small animals, usually dogs, and noting the immediate and remote effects, then killing the animals and making a careful pathological study of the changes in the lesioned tissues. Dr. McConnell's description of the manner in which he produced experimental lesions is as follows: "The production of the lesion is a simple but still very important matter. It cannot be performed successfully in a haphazard manner. Strict attention to the thorough relaxation of tissues about the field of operation and definite application of mechanical principles are demanded. After selecting a healthy animal (a small or medium size dog is best), surgical anesthesia is instituted. Complete relaxation under anasthesia is necessary. Following this, further relaxation of the area of intended operation by traction is essential for ease of lesion production. Next, having determined the character of osteopathic lesion desired, that is, right or left rotation, or hyperextension, or hyperflexion, or combination of these, the second essential is to apply definite mechanical principles. Bringing the fulcrum to bear at just the desired point when the tissues are thoroughly relaxed is as necessary in producing a lesion as in adjusting one. Much strength can be wasted if the leverage is not right; otherwise comparatively few pounds exertion will accomplish the result. A simple way is to place the animal flat upon its belly, completely under surgical anesthesia, then while an assistant bears down with his thumbs upon the selected vertebra the operator grasps the animal by the rear legs and exerts traction in line with the spinal column until the spinal muscles thoroughly relax and stretch, then immediately, while still maintaining the traction, hyperextend and rotate the spine until the desired point is felt to give and slip. It is simply a question of applying the indicated mechanics. Various leverages may be utilized. Frequently we place a small block transversely under the animal, especially in producing rib lesions, in order to help separate the ribs, as well as to secure a stable fulcrum.

"The traumatism is not carried to a point where tissues are torn or lacerated. The object is to obtain a slight slipping or maladjustment of the articular surfaces. If done correctly, that is, specifically, little force is required. The immediate noticeable results are malalignment of the vertebrae, malposition of the ribs corresponding to the deranged vertebrae, if the lesion is a dorsal one, and contraction of the spinal muscles of the same segments. These changes are readily palpated. After recovery from the anesthesia and during the ensuing time the above characteristics are evident with the added ones of tenderness and rigidity. Muscular contraction usually subsides, but not always, until only the deep spinal muscles are palpably contracted and these corresponding to the local lesion. In some cases the animal exhibits upon movement that the back is stiff and tender;.others do not and shortly show no apparent ill effects. Later on, a number present more or less systemic disturbances, depending upon the locality of the lesion. The periods of observation have ranged from three to eighty days, that is, the time from production of the lesion to autopsy."

Loss of Motion.—The moveable vertebral and costovertebral articulations are arthodial, i. e., gliding, hence any change in one of these articulations, short of dislocation, is in a normal direction. In other words, the lesions which we recognize are partial fixations, hence it isn't the position which constitutes the lesion so much as it is the loss of motion, i. e., the loss of function and the exaggerated muscular contraction which maintains the fixation and the character of the injury which is the cause of these changes.

Necessity for Study of Structure.—Based on this idea of what the lesion is we must study the normal structure and function of every vertebral and costo-vertebral articulation, so that we may recognize not only the compensatory changes on the immediate group affected, but also those widespread compensations of a mechanical, circulatory and nervous character which are part of every reparative and adaptive effort of the body. Since pathology is the study of the perversions of the normal we can not understand what the body is trying to do in any given case without taking into account the successes and failures of compensation as are made evident by this division of medical science.

CHAPTER III.

THE LESION AS AN EFFECT.

Analysis of the Causes of Lesions.—As previously noted, the inspection of the vertebral and paravertebral tissues in almost all cases of illness involving the trunk of the body will show physical signs of compensatory reactions. These physical signs we call "lesions." They seem to be identical in character with those which we noted as traumatic lesions, i. e., there is deviation in osseous alignment, muscular contraction and hyperaesthesia. It may be impossible to secure from the patient any history of trauma as the foundation of this lesion, therefore two explanations are open to us; either we must wilfully hold to the hypothesis that a trauma did occur of so light immediate effect as to escape the notice of the patient, or use the facts of anatomy and physiology to build up a rational theory of normal reactions. It is much easier to declare trauma as the cause than analyze the protective reactions of the body. This fact has led the exponents of the various forms of spinal adjustment to explain every lesion by claiming an obscure trauma as the cause. Since no one ever goes through life without many slips, falls and other strains which can be called to mind, it is easy for the patient to be convinced that some remote experience of this kind is in fact the foundation for all the trouble.

The Attractiveness of the Traumatic Lesion Theory.—The theory that an obscure trauma in the spinal tissues is the essential and adequate cause of bodily disorders is captivating both to the physician and the patient. It has so many definite elements which are evident both to the mind of the physician and of the patient. The physician's palpating finger feels the change in osseous alignment and muscular tone. The patient recognizes the difference in sensitiveness between this lesion area and those outside the lesion influence. Specific manipulation having for its aim the correction of alignment in the lesioned area gives so frequently almost instant sense of relief that it is no wonder physician and patient become convinced that the hypothesis of trauma is correct. Under the influence of such a theory as this our osteopathic literature is well spiced with statements tending to belittle the influence of all other causes of disease. The writer wishes to emphasize the fact that lesions can be divided into two great classes, i. e., primary and secondary. The first class is made up of those of traumatic origin and are undoubtedly causes of disorder in their areas of influences. The second class is made up of those lesions which are physical sign of the body's efforts at adaptation and compensation.

Classification of Lesions. — A given lesion can be classed as primary or secondary only after careful study of all those factors which constitute the history and symptomotology of the case. Visceral lesions cause muscular contractions in the spinal area from which they receive their cerebro-spinal nerve communications. They also cause pain in areas of higher sensibility, cutaneous areas, with which they are associated by innervation from the same segment of the spinal cord. These referred pains and contractions of spinal muscles are beginning to be recognized by specialists in pulmonary, digestive and renal diseases. There has been no well ordered effort to coordinate the facts which lie at the foundation of these phenomena. It is hoped that we may make for our students a beginning in this work by what is to follow.

Examples of Secondary Lesions.—As examples of various secondary lesions we will call attention to the lesion phenomena found usually to be synchronous with envolvments of some of the organs of the body. Rather than rush into an analysis of lesions, we deem it more to the student's interest to have a clear picture of the phenomena we desire to analyze later on. Our practitioners who are devoting much time in treating the eye recognize that in diseases of the eye and orbital tissues there are points in the neck which are rarely free from tenderness. Along with the tenderness are found muscular contraction and malalignment, these completing our trinity of localized lesion phenomena. Such lesions may be located as low as the second dorsal.

The Spinal Lesion an Objective Symptom.—Disturbance of circulation in the tonsil is associated with spinal lesions. These lesions vary in number and extent according to whether the disease process is simple and decidedly local, or is of enough severity to produce constitutional symptoms such as chill, fever, etc. The spinal lesions multiply and intensify in proportion to the extent and severity of the disturbance of the body. This is the case no matter in what organ or tissue our original disturbance made its appearance. Just as the symptom complex varies according to the severity of a disease, so the spinal lesions proportion themselves in like manner. Therefore, in this sense, spinal lesions are physical signs: objective and subjective evidence of disturbance in tissues innervated by branches of nerves from the same segment of the spinal cord.

Visceral Reflexes.—Each viscus, or localized tissue, such as glands, mucous or serous membranes, tend to establish reflex lesions in the spinal area tissues which are supplied with nerves from the same spinal cord segment as they themselves are supplied. In proportion to the amount of compensatory assistance required by any organ or tissue from those parts of the body ordinarily called upon for such assistance, our spinal lesion increases in extent and intensity. As a common example of the foregoing, the stomach may fail to do its work thoroughly and thus throw added work on the small intestine and its related glands, liver and pancreas. If these are somewhat overtaxed by their compensatory efforts, our spinal lesion which represented the stomach, extends further down over the spinal areas from which the liver and pancreas receive a portion of their innervation. Such examples as this can be recognized in a majority of cases.

Pleurisy.—Disease processes in the lungs produce spinal lesions of various kinds, according to their intensity and destructiveness. Pleurisy produces so great contraction in respiratory muscles, which act particularly on the ribs lying over the inflamed area, that friction of the pleural surfaces at this point is reduced to a minimum. Physicians, taking their plan from this natural compensatory contraction, frequently reinforce natural efforts by strapping over the contracted area with adhesive. The thorax adapts itself to the state of its contents, hence when a portion of the lung is destroyed the antero-posterior diameter of the chest is lessened in proportion. The vertebral and costo-vertebral articulations enter into this adaptive process and hence exhibit decided lesion phenomena.

Cardiac Lesion Patterns.—In case of heart lesions the body is called upon to make extensive compensatory reactions and hence our spinal lesion phenomena may be limited to the area of the heart's innervation, or extend in proportion as the heart's condition involves the pulmonary circulation, the portal circulation or the kidney.

Unity of the Body.—Disease processes in the pelvic viscera produce their characteristic spinal lesion phenomena just as the thoracic and abdominal organs. The point we desire to emphasize is that the unity of the body is exemplified by the spinal lesion phenomena. No organ or tissue can or does suffer injury without other tissues being drafted to compensate for its condition so as to maintain not only existence but the most satisfactory life of which the organism is capable. If the spinal lesion is viewed not only as a possible cause but, also, as a quite probable effect of tissue disturbance elsewhere, we will appreciate more fully the manner in which the body strives to live up to its best.

CHAPTER IV.

SPINAL HYPERAESTHESIA AND MUSCULAR TENSION.

Osteopaths are not the first or only physicians who have used the spine as a means of diagnosis as well as an area upon which to concentrate therapeutic methods. It is interesting and instructive to note the steps in the development of the knowledge of spinal conditions and of the indications of remote functional disturbances which are registered there.

Subjective Symptoms.—Subjective symptoms precede any attempt to discover objective evidences of disease. It was early noted by physicians that patients could not be relied upon to interpret their own symptoms. This led to efforts to discover symptoms which were independent of the patient's imperfect perceptions. Palpation would naturally be used at the areas complained of by the patient. Since the brain takes cognizance of only the peripheral areas of distribution of sensory nerves, instead of the whole course of the nerve fibers, the physician might still be misled in applying palpation, because he would be largely governed by the patient's sensory impressions. Palpation made with reference to a realizing sense of the distribution and function of the nervous system, becomes a more satisfactory means of diagnosis. As the knowledge of the nervous system increased, attention was called more and more to the spinal column, on account of its relations to the great nervous mass within it. Palpation of the spinal column demonstrated the existence of sensitive areas, associated with visceral or other disorders; therefore, hyperaesthetic areas are the first diagnostic points mentioned in medical literature, in regard to the spinal lesion. Such hyperaesthetic areas were considered as evidence of spinal irritation; that is, irritation of the spinal cord.

Irritation of the Spinal Nerves.—The first reference to spinal irritation which I have found is contained in a monograph entitled "A Treatise on Neuralgic Diseases Dependent on Irritation of the Spinal Marrow and Ganglia of the Sympathetic Nerve," by Thomas Pridgin Teale, 1834. He quotes a letter from Mr. R. P. Player to the editor of the Quarterly Journal of Science "On Irritation of the Spinal Nerves," dated December 10, 1821, as follows: "I take the liberty to submit to your notice a pathological fact which has not, to the best of my knowledge, been generally remarked and attention to which, so far as my own experience goes, promises some diminution of those difficulties with which the healing art has to contend. Most medical practitioners who have attended to the subject of spinal disease, must have observed that its symptoms frequently resemble various and dissimilar maladies and that commonly every function of every organ is impaired whose nerves originate near the seat of the disorder. The occurrence of pain in distant parts forcibly attracted my attention and induced frequent examinations of the spinal column; and after some years' attention, I considered myself enabled to state that in a great number of diseases morbid symptoms may be discovered about the origins of the nerves which proceed to the affected parts, or of the spinal branches which unite; and that if the spine be examined, more or less pain will commonly be felt by the patient on the application of pressure about or between those vertebrae from which such nerves emerge.

Spinal Treatment.—"This spinal affection may, perhaps, be considered as the consequence of diseases, but of its existence at their commencement any one may satisfy himself; and this circumstance, combined with the success which has attended the employment of topical applications to the tender parts about the vertebrae, appears to indicate that the cause may exist there. Prejudice sometimes operates against ideas of connection so remote; but in many instances patients are surprised at the discovery of tenderness in a part, of whose implication and disease they had not the least suspicion."

Control of the Body by the Nervous System.—Dr. Teale brings to his aid in the exposition of his subject, some interesting corroboratory observations made by others and recorded in the medical literature of that period. He quotes Dr. Darwell in an interesting paragraph which is a faint distant undercurrent of Dr. A. T. Still's oft-repeated statement concerning the interaction of nerves and the blood stream. The passage is as follows: "If, however, the nervous system is more or less connected with every function of the animal body; if the circulation of the blood, the phenomena of the respiration and the operation of intellect, cannot be carried on without its intervention, the manner in which it is disregarded can not but be a most important defect. It has perhaps in great measure arisen from always contemplating the brain as acted upon by the circulation and never reversing the order of review."

A Concept of the Nervous System.—One of the best expressed concepts of the nervous system I have read, is Dr. Teale's introduction to his monograph. It is the concept which is being more clearly taught in osteopathic colleges than in those of other schools of medicine: "The term Neuralgia which was originally employed to designate certain affections of nerves attended with severe pain has of late with great propriety been extended from its original and literal signification, to many other morbid affections of nerves, which are not characterized by pain, but by some other perverted state of their functions."

Neuralgia.—"Neuralgia includes within its range a great variety of diseases, presenting an endless diversity both in their symptoms and in the parts where they are seated. That such variety should exist, ceases to excite surprise, when we consider how varied are the functions of the different nerves and how diversified the tissues and organs to which they are distributed.

"To the attentive observer of diseases, neuralgic affections, under the more extended signification, must repeatedly present themselves. The skin, for instance, may be the seat of every degree of exalted or diminished sensibility, from the slightest uneasiness to the most acute suffering and from the most trivial diminution of sensibility to the complete obliteration of feeling,—symptoms not dependent upon disease affecting the different tissues of the part but solely referable to a morbid condition of the sentient nerves. The voluntary muscles may in like manner indicate in a variety of ways a morbid condition of the nerves with which they are supplied. They may be affected with weakness, spasms, tremors, or a variety of other disordered states included within the two extremes of convulsion and paralysis. The involuntary muscles may have the harmony of their actions interrupted from a morbid condition of their nerves; the heart may be affected with palpitation; the vermicular motion of the stomach or the peristaltic action of the intestines may be subject to irregularity. The sensibility of the internal organs may likewise be affected, the heart, the stomach, the intestines, being the seat of pain, referable to their nerves, and independent of inflammation, or any alteration of structure. The secretions may also undergo alterations, both in quantity and quality, from a perverted agency of the nerves upon which they depend. Such is a very imperfect recital of the various morbid affections which may be included under the term Neuralgia, and so frequent is their occurrence that they must be familiar to every practitioner. They are, however, often perplexing in their treatment and not unfrequently exhaust the patience of the afflicted sufferer, and also of the medical attendant.

"The difficulty and embarrassment which have attended the diagnosis and treatment of these affections, I am inclined to believe, has principally arisen from mistaken views of their pathology. They have too often been regarded as actual diseases of those nervous filaments which are the immediate seat of the neuralgia instead of being considered as symptomatic of disease in the larger nervous masses from which those filaments are derived; hence the treatment has too frequently been ineffectually applied to the seat of neuralgia; instead of being directed to the more remote and less obvious seat of disease.

"It is now pretty generally admitted as a pathological axiom, that disease of the larger nervous masses, as the brain and spinal marrow, is not so much evinced by phenomena in the immediate seat of disease, as in those more remote parts to which the nerves arising from the diseased portion are distributed. In the more severe forms of disease, this principle is readily admitted and recognized. When for instance one-half of the body shall have lost its sensibility and the corresponding muscles their power of action, the skin and the muscles are not regarded as the seat of disease, but the brain is immediately referred to. In the slightest forms of disease of the brain and spinal marrow, such as do not completely obliterate but merely impair or pervert the functions of the nerves—such as do not paralyze the sentient and muscular powers of the part but produce weakness, tremors, spasms, etc., in the muscular system, and numbness and prickings, pains and other morbid feelings in the nerves of sensation, this important principle, which as strictly obtains as in the former instance, is too often entirely overlooked; and a numerous class of complaints of very frequent occurrence, are regarded as nervous or spasmodic diseases of the part affected, instead of being considered as actual diseases of that portion of the brain and spinal marrow from which the nerves of the part are derived.

Visceral Disturbance Due to Disturbed Nerve Control.—"The same pathological principle is, I believe, equally applicable to the sympathetic system of nerves; although it may be difficult to establish this opinion by actual experiment, yet I think it may be rested upon a well grounded analogy, which will justify us in regarding the nervous masses of the ganglionic system as bearing the same relation to the nerves derived from them, as the large nervous masses of the cerebro-spinal system bear to their respective nerves. Hence many nervous affections of the viscera ought not be considered as diseases of the viscera themselves but as symptomatic of disease in those particular ganglia whence their nerves are derived.

Co-existence of Spinal Tenderness. — "Influenced by such considerations, I have for a few years been in the habit of treating many of these nervous affections as diseases of some portion of the spinal marrow or ganglia; and have been still further confirmed in my opinion by the frequent and almost uniform co-existence of tenderness on pressing some portion of the vertebral column and the circumstances of the tender portion of the spine being in a particular situation where the nerves of the affected part originate.

Symptoms of Spinal Irritation. — "The symptoms of spinal irritation consist in an infinite variety of morbid functions of the nerves of sensation and volition which have their origin in the spinal marrow, and the parts in which these morbid functions are exhibited, of course, bear reference to the distribution of the spinal nerves.

"The morbid states of sensation include every variety, from the slightest deviation from the healthy sensibility of any part, to the most painful neuralgic affections on the one hand, and to complete numbness or loss of feeling on the other; including pains which may be fixed or fugitive or darting in the direction of the nerve, pricking and tingling sensations, a sense of creeping in the skin, of cold water trickling over it, and numerous other states of perverted sensation of which words are inadequate to convey a description. In the muscular system we find weakness or loss of power, tremors, spasms or cramps and sometimes a tendency to rigidity.

"These symptoms sometimes exist in so slight a degree that the patient considers them unworthy of notice, and only admits their existence when particular inquiry is made respecting them; the only complaint which he makes being of an unaccountable sense of weakness and inability of exertion. In other cases the tremors have excited alarm; sometimes the neuralgic pains in the scalp or the fixed pain in the muscles, particularly when it occurs in the intercostal muscles, have suggested the idea of serious disease in the brain or in the lungs; and when the pain is seated in the muscles of the abdomen, a fear that some organic disease of the abdominal viscera has taken place harasses the mind of the patient. The muscular weakness in some cases tending to paralysis often suggests the fear of apoplexy or paralysis from cerebral disease.

Duration of Affections Due to Spinal Irritation.—"The affection is often of very protracted duration, undergoing alternate variations from the sanative powers of the constitution and the different existing causes of disease. There are many individuals in whom the complaint has existed, in varying degrees of intensity for a series of years, without its real nature having been suspected; the patients and their medical attendants having regarded it throughout as a rheumatic or a nervous affection.

"In this complaint tenderness in the portion of the vertebral column which corresponds to the origin of the affected nerves, is generally in a striking and unequivocal manner evinced by pressure. In some instances the tenderness is so great that even slight pressure can scarcely be borne, and will often cause pain to strike from the spine to the seat of spasm or neuralgia.

"This affection of the spinal marrow occasionally exists throughout its whole extent; more frequently, however, it is confined to some particular portion, and occasionally is seated in different and remote portions at the same time;

the particular symptoms and tenderness on pressure indicating the affected part.

"The symptoms of course vary considerably, according to the particular part of the spine which is affected, and bear reference to the distribution of the different spinal nerves.

Affections of the Upper Cervical Region.—"When the upper cervical portion of the spinal marrow is diseased, we frequently find neuralgic affections of the scalp; the pain strikes in various directions over the posterior and lateral parts of the head; sometimes the twigs in the neighborhood of the ear, sometimes those which ascend over the occiput to the superior part of the scalp, are more particularly the seat of the complaint; the nervous twigs distributed to the integuments of the neck are occasionally affected, the pain darting across the neck to the edge of the lower jaw, and sometimes encroaching a little upon the face. These neuralgic diseases frequently assume an intermittent form, the paroxysms generally occurring in the evening. A stiff neck or impaired action of the muscles moving the head frequently attend the affection of the upper cervical portion of the spinal marrow; and occasionally the voice is completely lost, or suffers alteration, and the act of speaking is attended with pain or difficulty.

Irritation of the Lower Cervical Region.—"Irritation of the lower cervical portion of the spinal marrow gives rise to a morbid state of the nerves of the upper extremities, shoulders, and integuments at the upper part of the thorax. Pains are felt in various parts of the arm, shoulder, and breast; sometimes the pain takes the course of the anterior thoracic branches of the brachial plexus, occasionally the pain is fixed at some point near the clavicle, scapula or shoulder joint at the insertion of the deltoid, or near the elbow or shoots along the course of some of the cutaneous nerves. Frequently one or both of the mammae become exquisitely sensible and painful on pressure, and some degree of swelling occasionally takes place in the breast, attended with a knotty and irregular feeling, when the neuralgic pains have existed a considerable time in that part, prickling and numbness, tingling and creeping sensations are often felt in the upper extremities; and also a sensation of cold water trickling over the surface. On rubbing the hands over the part affected a soreness is frequently felt, which is described as not merely situated in the integuments but also in the more deep seated parts. In the muscular system are observed most frequently a weakness of the upper extremities sometimes referred particularly to the wrists, tremors and unsteadiness of the hands; also cramps and spasms of various degrees of intensity. Occasionally there is an inability to perform complete extension of the elbows, the arm appearing restrained by the tendon of the biceps; and tightness being produced in this part when extension is attempted beyond a certain point. As far as I have observed, the pain and other morbid feelings in the upper extremities and chest are felt more frequently and more severely on the left than on the right side.

"Females of sedentary habits appear particularly subject to these affections of the upper extremities, and it is not uncommon for them to complain of being scarcely able to feel the needle when it is held in their fingers, and that their needles and work frequently drop from their hands.

Irritation in the Upper Dorsal Region.—"When the upper dorsal portion is affected, in addition to various morbid sensations similar to those in the extremities, there is often a fixed pain in some part of the intercostal muscles, to which the name pleurodynia has been assigned; and when this pain has existed a long time, there is tenderness on pressing the part.

Irritation in the Lower Dorsal Region.—"When the lower dorsal half of the spinal marrow is the seat of irritation, or subacute inflammation, the pleurodynia, when it exists, is felt in the lower intercostal muscles; frequently there is also a sensation of a cord tied round the waist; and oppressive sense of tightness across the epigastrium and lower sternal region; and soreness along the cartilages of the lower ribs or in the course of insertion of the diaphragm. Various pains, fixed and fugitive, are also felt in the parietes of the abdomen, throughout any part of the abdominal and lumbar muscles; the pain is frequently fixed in some portion of the rectus muscle and not infrequently in the oblique muscle or transversalis, a little above the crest of the ilium, particularly when the origin of two or three of the lowest dorsal nerves is diseased.

Irritation in the Lumbar and Sacral Regions.—"The affection of the lumbar and sacral portion of the spinal cord often produces a sensation of soreness in the scrotum and neighboring integuments; and the lower extremities become the seat of various morbid sensations, spasms, tremors, etc., for the most part resembling those which have been described as occurring in the upper limbs. The patients also complain of a sense of insecurity or instability in walking; their knees totter, and feel scarcely able to support the weight of the body.

The Effect of Recumbency.—"In some cases very considerable relief is found from recumbency, the pain frequently being diminished as soon as the patient retires to bed, independently of any paroxysmal remission.

Irritation of Spinal Marrow Not Necessarily Dependent on Disease of Vertebrae.—"This irritation or subacute inflammatory state of the spinal marrow is not necessarily connected with any deformity of the spine, or disease in the vertebrae. It may co-exist with these as well as with any other diseases, but it so repeatedly occurs without them that they can not be regarded as dependent upon each other. Where, however, inflammation and ulceration of the vertebrae or intervertebral cartilages exist, it is probable they may predispose to, and in some instances, act as an exciting cause of an inflammatory state of the nervous structures which they contain; for we not frequently find inflammatory affections of the vertebrae in conjunction with symptoms of irritation of the spinal marrow. But these two affections, although co-existing, bear no regular relations to each other; and during the progress of the vertebral disease the affection of the nervous structures is subject to great changes and fluctuations. The local remedies employed for arresting the disease in the bone often alleviate the affection of the spinal marrow at the very commencement of the treatment, long before the vertebral disease is suspended; but as the neighboring inflammation in the bones appears to predispose or excite the nervous mass which they contain to disease, relapses of the nervous affections are repeatedly occurring during the whole course of the complaint.

Lateral Curvature. — "The affections of the spine, termed lateral curvature and excurvation, appear to have no necessary connection with the disease which I have been describing; and the proportion of cases in which they are found united is so small that lateral curvature can scarcely be considered even as predisposing to this disease. The most extreme degrees of deformity are frequently observed without any affection of the nerves; and when lateral curvature does occasionally co-exist, local antiflogistic treatment will often speedily remove the nervous symptoms while the curvature remains unrelieved. Hence there is an impropriety in considering these nervous symptoms as a result of the deformity and in explaining them upon the mechanical principle of pressure and stretching, to which the nerves are supposed to be subjected as they issue from the intervertebral foramina. If the pressure and stretching produced by the curvature were the cause of the nervous symptoms, they ought to continue as long as the deformity remains.

Treatment.—"When the different neuralgic symptoms which have been enumerated can be traced to this morbid state of some portion of the spinal marrow, the treatment that ought to be pursued is readily decided upon. Local depletion by leeches or cuping, and counter irritation by blisters to the affected portion of the spine, are the principal remedies. A great number of the cases will frequently yield to the single application of any of these means. Some cases which have even existed several months I have seen perfectly relieved by the single application of a blister to the spine, although the local pains have been ineffectually treated by a variety of remedies for a great length of time. A repetition of the local depletion and blistering is, however, often necessary after the lapse of a few days, and sometimes is required at intervals for a considerable length of time. In a few very obstinate cases issues or setons have been thought necessary; and where the disease has been very unyielding, a mild mercurial course has appeared beneficial.

"When my attention was first directed to this subject, I considered recumbency a necessary part of the treatment; it is, for a moderate length of time, undoubtedly beneficial and frequently very much accelerates recovery, but subsequent observation has convinced me that it is by no means essential. I have seen several instances of the most severe forms of those complaints occurring in the poorer classes of society, where continued recumbency was impracticable, which have, nevertheless, yielded without difficulty to the other means of the treatment, whilst the individuals were pursuing their laborious avocations.

"These observations, however, are not intended to apply to those cases in which there is actual disease of the vertebrae.

"When there exists a tendency to relapse, I have thought it advantageous to continue the use of some stimulating liniment to the spine for a few weeks after the other means of treatment have been discontinued. A liniment consisting of one part spirits of turpentine and two of olive oil is what has generally been employed.

Ganglia of the Sympathetic Nerves.—"The ganglia of the sympathetic nerves appear subject to a state of disease similar to that which has been described in the preceding chapter, as occurring in the spinal marrow.

"As the disease may be confined to one part of the spinal marrow, or exist simultaneously in different portions, or may even pervade its whole extent, so the affection of ganglia may be confined to one of these nervous masses, may exist in several which are contiguous, or in ganglia remote from each other; and as there is reason to believe the whole chain may occasionally be affected.

"The disease of the ganglia is seldom found, except in conjunction with that of the corresponding portion of the spinal marrow, whereas the spinal marrow is often affected without the neighboring ganglia being under the influence of disease. Thus we frequently find symptoms of disease in a portion of the spinal marrow without any evidence of its existence in the corresponding ganglia, frequently the symptoms of both combined, and occasionally, but rarely, symptoms referable to the ganglia without the spinal marrow being implicated.

Symptoms of Irritation of Sympathetic Ganglia.—"The principal symptoms resulting from irritation of the ganglia of the sympathetic are to be found in those organs which derive their nerves from this source. They consist of perverted functions of these organs, and are exemplified by a variety of phenomena. The involuntary muscles, deriving their power from the sympathetic, have their action altered as is evinced by spasms and irregularity in their contractions. The heart is seized with palpitations, the large vessels with inordinate pulsations; the muscular fibers connecting with the bronchial apparatus are thrown into spasms, constituting a genuine asthma independent of bronchial inflammation. The muscular fibers of the stomach and intestines become the seat of spasms and various other deviations from their natural operation. The sensibility of the organs, which derive their sentient power from the great sympathetic, is variously perverted, the nervous filaments being the seat of pain. The heart and lungs, for instance, are subject to morbid sensations bearing great analogy to those which have been designated 'tic douloureaux' when occurring in the spinal nerves. The stomach and intestines are liable to similar neuralgia, to which the names gastrodynia and enterodynia have been applied. The kidneys, the bladder, and the uterus are liable to the same perverted state of their sensibility. The secretions also undergo alterations, products being formed, which in health have no existence. This is exemplified by the enormous secretions of air which sometimes occur in the stomach. Large quantities of clear transparent liquid are also secreted by this organ, constituting what is called pyrosis. The secretions of the stomach undergo variation in their quantities, rendering them unfit for digestive process. It is probable that the secretion of the liver also experiences some alteration in these complaints. The urine is sometimes influenced, and I am inclined to suspect that some forms of diabetes partake of neuralgic character. Leucorrhoea is frequently a concomitant of these diseases, and ceases on their removal; but I am not prepared to say that it is ever symptomatic of them. Irregularities in the catamenia are often observed, the discharge often being generally in excess.

Middle and Lower Thoracic Sympathetic Ganglia.—"The ganglia most liable to the disease are the middle and lower thoracic, from which the splanchnic nerves are derived, giving rise to various disorders of the stomach and digestive organs, which will hereafter be more fully discussed. Next in frequency is the affection of the cervical ganglia, producing painful and spasmodic states of the heart. The symptoms denoting disease of other ganglia, although occasionally met with, are less frequent in their occurrence. Irritability of temper and depression of spirits often attend these complaints, particularly when the stomach is the part which suffers.

"The disease of the ganglia, like that of the spinal marrow, is not necessarily connected with disease of the vertebrae or distortion of the spine. It may co-exist with these complaints, and, when it does so, the symptoms proper to the ganglionic disease are often erroneously supposed to be produced by distortion or by disease of the vertebrae; they are, however, frequently relieved by treatment, whilst the disease of the bones remains uninfluenced by it, and the most extreme distortion of the spine or destruction of the vertebrae from inflammation may exist without there being any symptoms attributable to neuralgia of the sympathetic nerves.

"In conjunction with the symptoms denoting disease of the ganglia, tenderness to a greater or less degree may generally be found on pressing some part of the spine, and the tender portion invariably corresponds with the symptoms; or rather, the seat of tenderness is near the part occupied by the particular ganglia from which the nerves of the disordered organ are derived; for example, when the heart is affected the tenderness is found in some of the cervical vertebrae, and when the stomach is the seat of complaint, it is in some of the middle or lower dorsal vertebrae.

Spinal Treatment. Hyperaemia.—"With respect to the treatment, I have but little to add to what has been said in the preceding chapter respecting the treatment of irritation of the spinal marrow. Leeches, cuping, blisters, etc., to the neighborhood of the affected ganglia constitute the essential part."

Muscular Tension.—Following the observation of spinal tenderness came the noting of muscular tension accompanying it. As near as I can determine from perusing medical literature, muscular tension was not recognized until after the advent of Osteopathy. Since the attention of medical writers was called to the conditions of the spinal column called "lesions" there are frequent passages descriptive of these in medical literature. One of the best of these references is found in Boardmen Reed's work on "Diseases of the Stomach and Intestines," and is as follows:

"Dr. John P. Arnold has recently called attention to a novel objective sign which may be recognized upon palpation over the sensitive regions along side of the spinal vertebrae, and sometimes in such regions which are not sensitive to pressure, though in all cases he maintains that the part of the body supplied by the vaso motor nerve fibres immerging in the corresponding intervertebral space will be found to present some abnormal condition. The peculiarity described by him is, in such cases, a somewhat doughy, and in chronic ones, a gristly tense, cord-like feeling of the band of longitudinal muscular fibres which run up and down on either side of the spine. This abnormality is supposed by Arnold to be due to a congested or infiltrated condition of the muscle while the cord itself is anaemic, probably in chronic cases. Hammond believed the spinal cord to be anaemic in such cases. The findings obtained by a careful palpation over the spine should thus assist in directing our attention to the organ or part of the body which may be suspected of being diseased.

Digital Examination of the Spinal Area.—"You should make it a rule to examine carefully the spines of all chronic invalids by pressing deeply with the finger tips (or with the thumbs, as Flint advised) close to the vertebrae and then exert gentle traction in a lateral direction outward from the spine on either side. The patient should be lying upon his right side while you palpate along the left side of the vertebrae, and should then change to his left side in order that you may palpate upon the right side of the latter so that the tissues may be in the utmost condition of relaxation practicable. In both cases you will find it best to stand in front of the patient and reach over his upper side to make palpation along the region of the upper side of the spinal column.

"In numerous patients, especially those suffering from digestive derangements, you will be likely while palpating in the way described to recognize in the longitudinal muscles running parallel and close to the spine the tense, cord-like sensation above mentioned. If, simultaneously with your recognition of such a condition the patient complains of sensitiveness in the same regions, the accuracy of your finding will be at once confirmed."

The Use of Spinal Muscular Tension in Diagnosis.—The use of these tense cord-like muscles as diagnostic evidences of disease has been a constant practice of Osteopaths from the beginning of Dr. Still's work. Judging from the quotation the true significance of these contractions has not been apprehended by the medical profession in general. It is very evident that a contracted muscle is shorter and thicker than when relaxed, also that when contracted it exerts force to draw its extremities together. The ends of the muscle being attached to bones forming portions of a movable articulation, a change in the relation of the bones must follow. This change is called a subluxation and is described more in detail in another chapter.

Cause or Effect?—Having noted that sensitiveness and muscular contraction are well recognized conditions found along the spinal column, the question arises, are these merely objective symptoms of disease or are they to a large extent causative factors in the origin and maintenance of diseased conditions of the areas of peripheral distribution of spinal nerves? Are they causes or effects?

They have been noted almost exclusively as efficient causes of disease. Furthermore, osteopathic therapeutics have been administered from that standpoint with marked success. This change in position and size of tissues is recognized as an obstruction to the movements of fluids, and therefore is a condition operating in the system to cause disease.

CHAPTER V.

THE SEGMENTATION OF THE BODY.

The Lesion as a Guide in Diagnosis.—Since the spinal lesion may be either cause or effect, i. e., a trauma or an expression of the body's protective reaction, we need certain fundamental facts upon which to base judgment. No matter whether the lesion is cause or effect the physician must recognize it as a guide for the unravelling of a series of phenomena which are quite sure to be present in any case. It is a well recognized fact that effects become causes and thus a cycle of reflexes become established making it difficult to recognize where the series began. Any diagnosis worthy the name must be based on structure and function. Much of the phenomena we are called upon to interpret is difficult to understand, unless we know not only normal structure but the development processes whereby this present structural formation was achieved.

The Spinal Segment.—The far reaching influence of a cervical lesion can readily be understood when we study the embryological development of cervical structures. To mention a nerve to a diagnostician should instantly bring to his mind all the structural associations of that nerve, its origin and distribution. The thought of its origin and distribution would naturally bring to mind an association of all the tissues depending on it for innervation. We would thus have a picture of a localized community of interests. Considering the similar distribution on the opposite side of the body we have pictured a sort of transverse division of the body. Every pair of spinal nerves, with the tissues directly under their influence, should form in our minds an entity, a mechanism in which reactions tend to take place independent of all other segments. Although we may think of a segment as a unit, the development of the body has coalesced its various structures in such a way as to locate the nervous control of any one structure, such as a muscle, in more than one segment of the spinal cord, hence the controlling nerve to a muscle usually contains fibers from more than one segment.

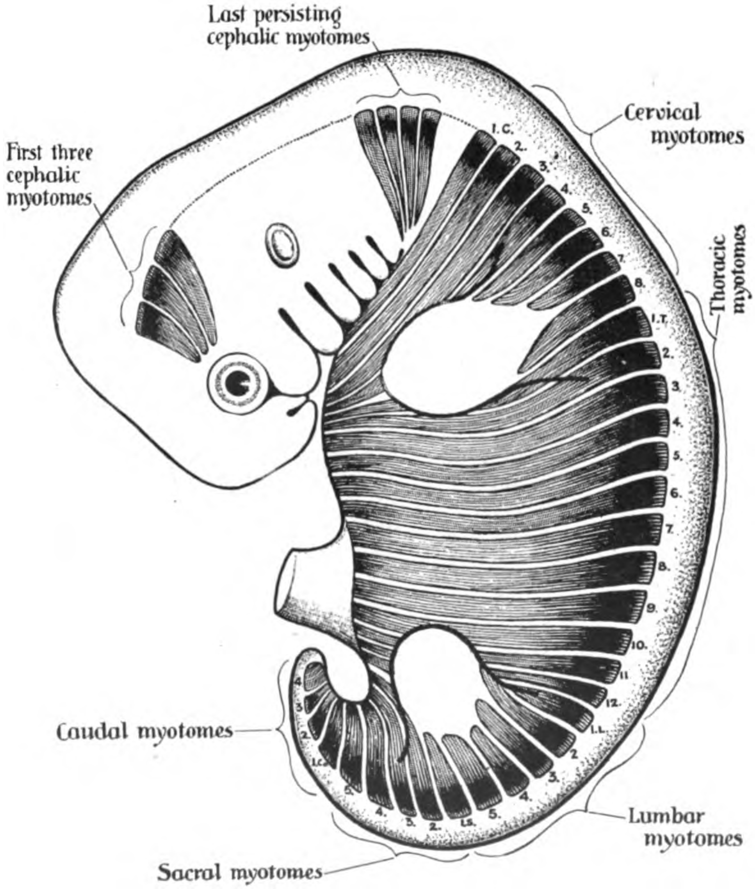


FIG. 2. Scheme to illustrate the disposition of the myotomes in the embryo in relation to the head, trunk and limbs. Drawn by John Comstock (after Cunningham).

It is readily seen that there is an element of protection in this fact. A slight central lesion, i. e., an injury to the spinal cord, its membranes; or a pressure lesion due to disease of the bone, as in Pott's disease, might not produce complete loss of function in any single muscle because the governing nerve to that muscle is made up of fibers from two or more cord segments.

Injury of a Single Nerve. Example: Posterior Thoracic. —Complete paralysis of a single muscle is indicative of serious injury to its governing nerve at some point exterior

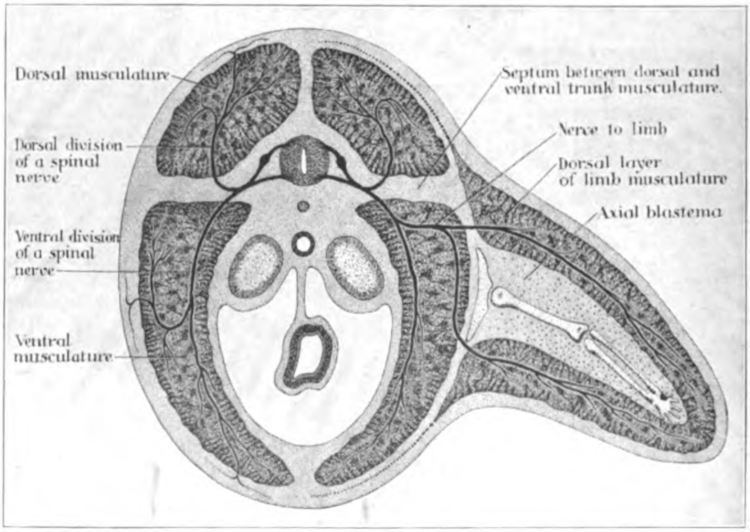


FIG. 3. Diagram of a segment of the body and limb. Drawn by John Comstock (after Kollmann).

to the central nervous system; in fact, beyond the point of coalescence of the fibers which form it. As an example of injury of a single nerve we may take a case of paralysis of the Serratus Magnus. This large muscle which acts to hold the posterior border of the scapula close to the thorax, when one is pushing with the hand or when taking a deep inspiration, is innervated by the posterior thoracic nerve which is made up of fibers from the upper portion of the brachial plexus, fifth, sixth and seventh cervicals. Evidently an injury capable of involving all the fibers of the posterior thoracic nerve and no others must be peripheral to the point of junction of its fibers from the fifth, sixth and seventh cervicals.

A patient came to me in 1901 complaining of a peculiar loss of power of the right arm. He was a large, powerfully

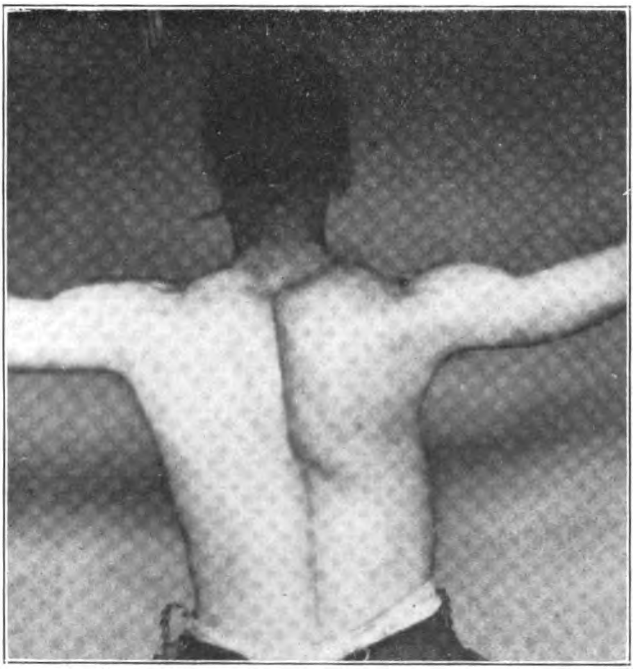


FIG. 4. Paralysis of right serratus-magnus. Shows the prominence of the scapula, when it is the foundation for a movement such as extension of the arm to the side.

built young man whose occupation, as a lumber shover, unloading lumber on the San Pedro docks, was lost as a result of his condition. He gave a history of perfect health at all times. Said that two days previous, on Sunday, he had erected a tent for himself and as he was tightening the guy ropes he felt a sharp pain under his right shoulder blade, which was immediately followed by inability to push with the right arm. The pain was of short duration. He described his position as a somewhat awkward one, i. e., he was kneeling on his right knee facing one of the tent guy rope pegs. With his right hand grasping the wooden clamp

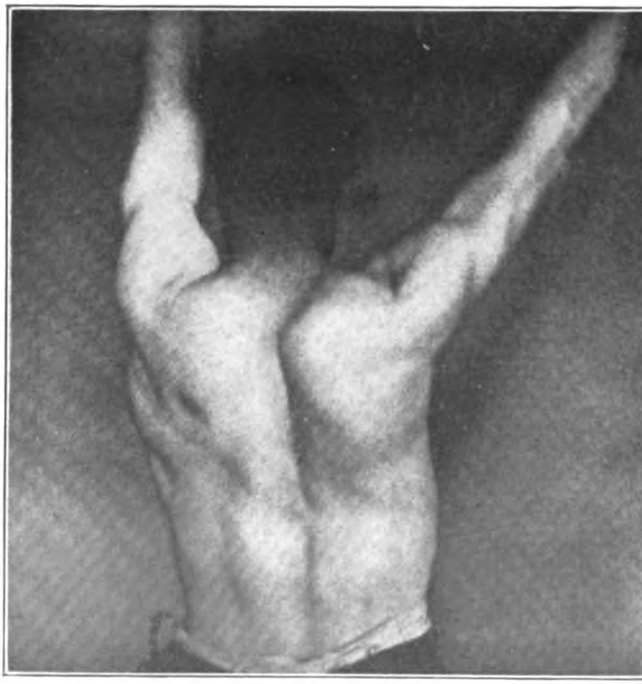


FIG. 5. Paralysis of right serratus magnus. Shows loss of power to rotate the scapula on the thorax.

on the guy rope, he attempted to draw the guy rope taut. His great strength enabled him to do this, even though his right hand was considerably behind him. Figs. 4 and 5 show the effects of the paralysis of the Serratus Magnus in this case.

A second case presenting exactly the same symptoms was seen in the clinic of the Pacific College of Osteopathy a short time later. A telephone lineman, while engaged in stringing wire from pole to pole, made a vigorous awkward pull with the right hand some distance back of his hip. His legs were entwined about the crosspieces of the pole. At the time of greatest effort he felt a severe pain under the

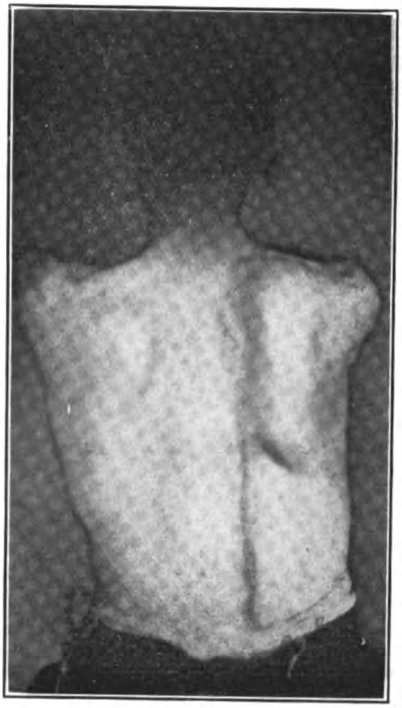


FIG. 6. Paralysis of right serratus magnus. Shows the "winged" condition of right scapula when arm is extended forward.

right shoulder, followed by a profound sense of weakness in the shoulder and arm. The scapula immediately took a wing position and the patient could not shove with the right arm.

These cases serve to give us a picture of the influence of position and motion of the shoulder as governed by one nerve taking origin from three cervical segments. The lesion was not a spinal one, i. e., such as we have before described, neither was it one involving the cells of origin of this nerve in the spinal cord. The awkward position of the patients and their naturally great strength operated to in-

FIG. 7. Paralysis of right serratus magnus. Shows outline of the vertebral borders of the scapulae when arms are extended forward.

jure them in much the same way as the various nerve holds practiced by the jiu-jitsu wrestler. The pressure where the nerve crossed the ribs became too great and, hence, caused a severe trauma of the nerve.

A Unilateral Cervical Spinal Lesion.—The foregoing cases present the classical first symptoms of a severed motor nerve. In order to present the symptoms accompanying a cervical lesion of the spinal lesion type we will describe a case which has been under observation for a long time. A woman, 41 years of age, has been under my professional care for three years. At the time of my first examination

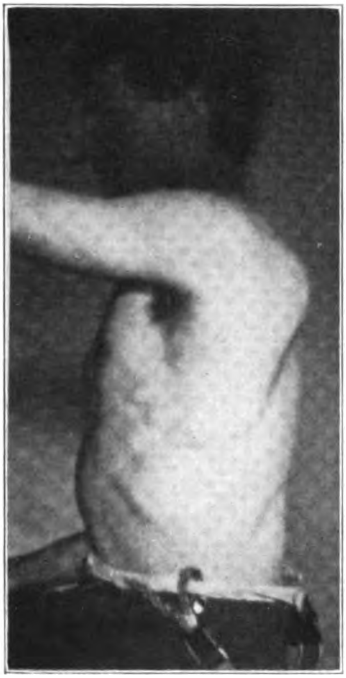


FIG. 8. Shows digitations of the serratus magnus and normal position of the scapula.

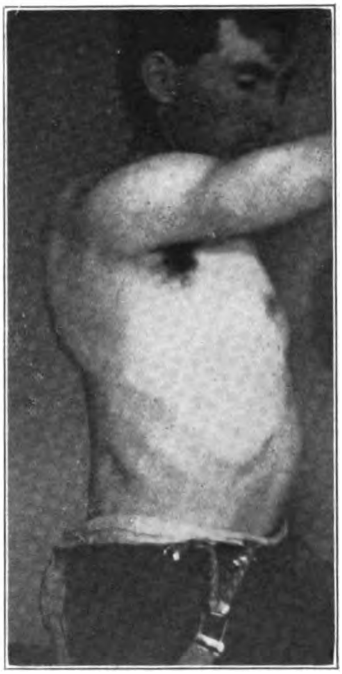


FIG. 9. Paralysis of the right serratus magnus. No digitations are apparent. The scapula takes an extreme "wing" position.

she appeared to be constitutionally ill, but careful examination failed to discover any organic disease. Functional rhythm seemed discordant everywhere, hence our first efforts were to see that environment was fairly normal. Rest, nutritious diet and an optimistic atmosphere served to eliminate many of the irritating symptoms.

The first examination of the spinal area discovered a lesion between the sixth and seventh cervical vertebrae. There was muscular ankylosis controlling this articulation and any attempted movement of the whole cervical area, sufficient to make demand on this joint, caused pain of a sharp neuralgic character to radiate into the left shoulder and arm. This pain could be produced most easily by either voluntary or passive rotation of the head to the left. A persistent effort to rotate the head in this direction caused the hand and arm to become numb. The hand would become bloodless, cold and moist; power to pick up a book or cup was greatly lessened. These symptoms would wear off in twenty-four to thirty-six hours, but the pain would leave her in almost a state of collapse. Massage of the arm and hand would bring no reaction; heat also failed to stimulate circulation.

These attacks had been brought on by any sort of housework, at first only sweeping or such work as required arm leverage. Later it seemed as though the attacks came without any mechanical reason. They were accompanied by severe headache, tachycardia, meteorism, cold extremities and subnormal temperature. As might be expected in such a case the spinal lesion picture was a mixed one and it seemed, in view of so many symptoms of auto-intoxication, as though the mid-dorsal lesions were more nearly primary than the others. The sensitiveness of this spinal column was so great and so many compensations were in evidence that it was deemed best to attempt at first merely to simplify the symptom complex as much as possible by giving the spinal column physiological rest. The patient was kept in bed, thus reducing the demand on the weight carrying function of the spine. This, and the psychological influence of trying a new plan under optimistic circumstances, served to reduce the number and complexity of symptoms, but in no wise changed the character, or viciousness, of the reactions arising from any disturbance of the articulation between the sixth and seventh cervical vertebrae.

Treatment.—Direct extension, slow and gentle, was attempted with marked success. Great care had to be exercised when releasing the extension, else the closure of the cervical articulations acted as though a nerve had been caught by direct pressure. Gradually the muscular tension around this joint was decreased and a slight degree of rotation toward the lesion, i. e., in this case the left side, could be accomplished without arousing severe pain. Digital pressure made against the left side of the sixth cervical spine would always cause a severe reaction. It was not possible to use any quick leverage or thrusting movements in this case for correction of the lesion until about eighteen months after we gave our initial treatment. A fairly wide range of movement is now possible. The patient can voluntarily rotate the head to the left, but the sensitiveness on the left side of the cervical spine has never entirely disappeared. She lives a normal existence as a busy housewife. She has gained thirty pounds in weight.

In this case the lesion is nearer center, i. e., closer to the spinal cord. The symptoms it presents are nearer in character to those of true central origin, except that they are unilateral. The local symptoms, pain, muscular tension, anaesthesia and vaso-constriction, are manifested in the area of distribution of the brachial plexus. Although the spinal muscles, whose tension constituted an ankylosis of the articulation between the sixth and seventh cervical vertebrae, are innervated by branches of the posterior division of the lower cervical nerves, the reflexes, through the cells of origin of the lower cervical nerve trunks in the spinal cord, were manifested in all divisions of the brachial plexus, not only in the plexus but overflowed into the sympathetics, as shown by the vaso-motor disturbance and rapid heart action.

There is a history of accident in this case which classes this lesion as traumatic. We have its effects shown in the reaction of the cerebro-spinal and sympathetic systems. In other words, the somatic and splanchnic structures, innervated by nerves from the lower cervical group, act and react upon each other in an effort to adapt themselves to this lesion. As time went on the whole body was engaged in a losing effort at adaptation, simply because the lesion area was never given physiological rest, i. e., eliminating all demand on the weight carrying and balancing functions of the joint. The manipulation of this spinal joint was also in the nature of physiological rest because it reduced the hypertension and gradually reestablished normal functional movements.

FIG. 10. Paralysis of the trapezius and clavicular division of the sterno-cleido-mastoid due to death of some of the central cells of the spinal accessory nerve.

Involvment of the Central Nerve Cells.—The next step in severity in lesions is the involvment of the contents of the spinal canal, either through direct invasion of the tissues of the cord, or by pressure due to destruction of sections of the spinal column. The point we wish to illustrate is that the diagnostician must, in order to do scientific work, make a diagnosis based on the facts of anatomy as interpreted by embryology. If symptoms were noted and interpreted with the same precision with which the trouble man on a telephone system works out his problems we would not find so many fantastic medical theories. It is, in large measure, the failure to teach the fundamentals of anatomy, physiology and pathology in a thorough manner that is responsible for the vagaries in medical practice. We are not forgetting the

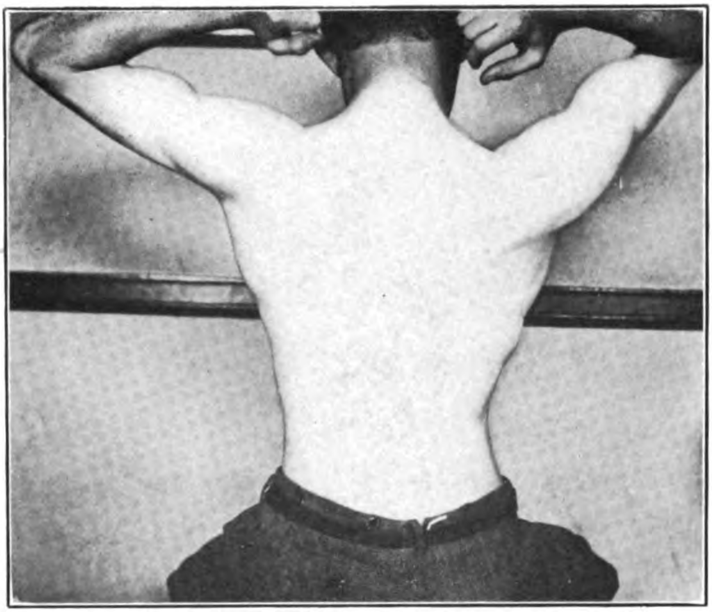


FIG. 11. Atrophy of right trapezius.

fact that the public is not educated to this view and, therefore, the one who attempts to act irrespective of the public's state of education has a hard row to hoe.

Cervical Muscles.—In the first case described, wherein the Serratus Magnus was paralyzed, we noted that it receives its innervation from the cervical region. This makes it a cervical muscle. In this same sense the trapezius and latissimus dorsi are cervical muscles and will necessarily enter into any reactions involving the segments of the spinal cord which give origin to their nerves. In order to bring to your attention some of these peculiar changes which have taken place in the development of the body, we will review a few of the most notable which will aid us in the interpretation of the effects of lesions.

Embryology.—Embryology is the "histology of very young beings." We may question here what contribution

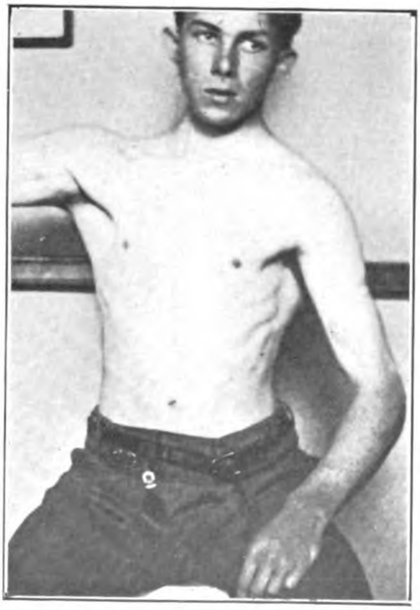


FIG. 12. Shows atrophy of right trapezius.

the study of embryology has made which has practical significance in the diagnostic and therapeutic work of our practitioners. Since we have a "division of labor," as evidenced by a variety of tissues having special functions, and since self-preservation for purposes of perpetuating organisms of a similar character is a prime requisite of life, groups of tissues are associated into mechanisms. Comparative embryology has helped us to recognize, in part, these mechanisms. The recognition of the segmental arrangement of the body is one of the great contributions of embryologists.

Segmentation.—Early in the development of the embryo the mesodermic cells on either side of the longitudinal groove show transverse divisions which form a series of segments called protovertebrae or mesodermic somites. With-

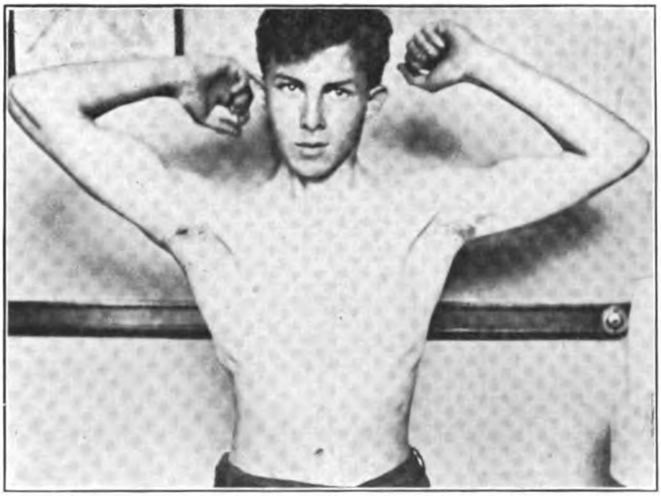


FIG. 13. Paralysis of right trapezius and portion of the sterno-cleido-mastoid.

out our going into a lengthy description of the arrangement of the mesodermic cells to form the spinal column and its muscles, we want this early series of divisions kept in mind.

"The appearance of the mesodermic somites is an important phenomenon in the development of the embryo, since it influences fundamentally the future structure of the organism. If each pair of mesodermic somites be regarded as an element and termed a metamere or segment, then it may be said that the body is composed of a series of metameres, each more or less resembling its fellows, and succeeding one another at regular intervals. Each somite differentiates, as has been stated, into a scleratome and a myotome, and, accordingly, there will primarily be as many vertebrae and muscle segments as there are mesodermic somites, or, in other words, the axial skeleton and the voluntary muscles of the trunk are primarily metameric. Nor is this all. Since each mètamere is a distinct unit, it must possess its own supply of nutrition, and hence the primary arrangement of the blood-vessels is also metameric, a branch passing off on either side from the main longitudinal arteries and veins to each metamere. And, further, each pair of muscle segments receives its own nerves, so that the arrangement of the nerves, again, is distinctly metameric.

"This metamerism is most distinct in the neck and trunk regions, and at first only in the dorsal portions of these regions, the ventral portions showing metamerism only after the extension into them of the myotomes. But there is clear evidence that the arrangement extends also into the head and that this, like the rest of the body, is to be regarded as composed of metameres. There is reason, therefore, for believing that the fundamental arrangement of all parts of the body is metameric, but though this arrangement is clearly defined in early embryos, it loses distinctness in latter periods of development. But even in the adult the primary metamerism is clearly indicated in the arrangement of the nerves and of parts of the axial skeleton, and careful study frequently reveals indications of it in highly modified muscles and blood-vessels

"Although the dermal mesenchyme is unsegmental in character, yet the nerves which send branches to it are segmental, and it might be expected that indications of this condition would be retained by the cutaneous nerves, even in the adult. A study of the cutaneous nerve-supply in the adult realizes to a very considerable extent this expectation, the areas supplied by the various nerves forming more or less distinct zones and being, therefore, segmental. But a considerable commingling of adjacent areas has also occurred. Thus, while the distribution of the cutaneous branches of the fourth thoracic nerve, as determined experimentally in the monkey (Macacus), is distinctly zonal or segmental, the nipple lying practically in the middle line of the zone; the upper half of its area is also supplied or overlapped by fibers of the third nerve and the lower half by fibers of the fifth, Fig. 14, so that any area of skin in the zone is innervated by fibers coming from at least two seg-

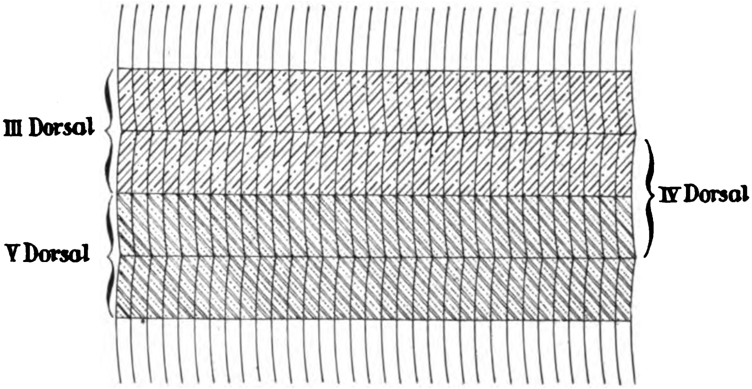


FIG. 14. Showing overlapping of segmental sensory nerves Drawn by John Comstock (after Sherrington).

mental nerves (Sherrington). And furthermore, the distribution of each nerve crosses the mid-ventral line of the body, forming a more or less extensive crossed overlap.

"And not only is there a confusion of adjacent areas, but an area may shift its position relatively to the deeper structures supplied by the same nerve, so that the skin over a certain muscle is not necessarily supplied by fibers from the nerve which supplies the muscle. Thus, in the lower half of the abdomen, the skin at any point will be supplied by fibers from higher nerves than those supplying the underlying muscles (Sherrington), and the skin of the limbs may receive twigs from nerves which are not represented at all in the muscle-supply (second and third thoracic and third sacral)."

Widespread Influence of a Spinal Lesion.—No skin area (or individual muscle) is supplied wholly by fibers from one segment of the spinal cord, but, in fact, is innervated by a nerve made up of fibers from two or more segments. A spinal lesion of traumatic origin, granting that only one articulation is involved, will influence, in some cases, widely separated structures. For example: A lesion between the fourth and fifth cervical vertebrae might influence the diaphragm, latissimus dorsi and trapezius, and through the spinal accessory the muscles of the larynx. Such apparently widely separated structures must be kept in mind when considering a lesion at the location under discussion. Nor is this enough, because skin areas must be reckoned with.

To learn these tissue associations, through the study of anatomy, is quite possible, but embryology furnishes an interpretation which tends to keep them in one's mind. When we know that the diaphragm, trapezius and latissimus dorsi are essentially cervical muscles which have migrated but remain under the control of cervical nerves, we cease to think of one as the dividing wall between thorax and abdomen, a great muscle of respiration; the others as constituting the first layer of dorsal muscles.

Association of Muscles Innervated by the Same Segment.—Such structures, as we have just mentioned, have migrated far from their original segments and have taken on functions and are concerned in reactions which are no longer segmental but have for their aim the preservation of the whole body, hence any injury to one, or all, of them would tend to produce a reflex localized in the segment from which they received their innervation. Compare with these migrated structures a segmental muscle of primitive character like the intertransversalis or interspinalis. The influence of these primitive muscles is wholly on the one articulation, but they are part of the mechanism supplied from the same segment as the migrated muscles. These small muscles, which are the intrinsic muscles of the spinal arthrodial joints, are important prime movers in the effort to maintain the erect position, i. e., they enter into the weight carrying and balancing functions of the spinal column. In case of their injury, a spinal lesion, the lost motion in the joint causes widespread influences, as heretofore mentioned. The fifth layer of dorsal muscles, according to Gray, consists of a network of small muscles, the deepest of which extend between portions of two adjoining vertebrae; more superficially placed layers extend greater distances so as to influence the movements between more than two vertebrae. The next layer of muscles, consisting of the erector spinae and its continuations, influence a greater number of vertebrae and bring rib positions under the influence of cervical nerves. The splenius capitis et colli, of the third layer, and the rhomboids, of the second layer, are likewise supplied by cervical nerves. Thus we find the nerve which takes its exit between the fifth and sixth cervical vertebrae supplies a series of overlapping muscles, the first one supplied, intertransversalis, being wholly intrinsic to the spine and the one on the surface of the body, the latissimus dorsi, having a very widespread influence.

Effect of Sectioning Single Spinal Nerve.—To cut the fifth cervical nerve at its exit from the intervertebral foramen would not paralyze any but the intrinsic spinal muscles between the fifth and sixth cervical vertebrae. All muscles beyond that point would be weakened in proportion to the number of fibers their governing nerves received from that cut trunk. In other words, it appears probable that the severing of the pair of nerves, the fifth cervical, could weaken the gross movements made by muscles innervated by them, but since only the intrinsic spinal muscles of one intervertebral articulation are wholly supplied by them there would be no complete muscular paralysis apparent. The sixth cervical nerves innervate about twenty-eight pairs of muscles in the neck, chest, shoulders and upper extremities and back, and the diaphragm.

Developmental Changes in Muscles.—This gives us some idea of the great changes that have been consummated in the development of the body. The many changes in position and direction of fibers are recognized through the fact that they remain under the nerve control of the one segment. The various changes in the development of muscles are thus described by McMurrich: "It may be seen that the changes which occur in the myotomes may be referred to one or more of the following processes:

"1. A longitudinal splitting into two or more portions, a process well illustrated by the trapezius and sternomastoid, which have differentiated by the longitudinal splitting of a single sheet and contain, therefore, portions of the same myotomes. The sterno-hyoid has also differentiated by the same process, and indeed, it is of frequent occurrence.

"2. A tangential splitting into two or more layers. Examples of this are also abundant and are afforded by the muscles of the fourth, fifth and sixth layers of the back, as recognized in English textbooks of anatomy, by the two oblique and transverse layers of the abdominal walls, and by the intercostal muscles and the transversus of the thorax.

"3. A fusion of portions of successive myotomes to form a single muscle, again a process of frequent occurrence, and well illustrated by the rectus abdominis (which is formed by the fusion of the ventral portions of the last six or seven thoracic myotomes) and by the superficial portions of the erector spinae.

"4. A migration of parts of one or more myotomes over others. An example of this process is to be found in the latissimis dorsi whose history has already been referred to, and it is also beautifully shown by the serratus anterior and the trapezius, both of which have extended far beyond the limits of the segments from which they are derived.

"5. A degeneration of portions or the whole of a myotome. This process has played a very considerable part in the evolution of the muscular system in the vertebrates. When a muscle normally degenerates, it becomes converted into connective tissue, and many of the strong aponeurotic sheets which occur in the body owe their origin to this process. Thus, for example, the aponeurosis, connecting the occipital and frontal portions of the occipito-frontalis is due to this process and is muscular in such forms as the lower monkeys, and a good example is also to be found in the aponeurosis which occupies the interval between the superior and inferior serrati postici, these two muscles being continuous in lower forms. The strong lumbar aponeurosis of the oblique and transverse muscles of the abdomen are also good examples.

"Indeed, in comparing one of the mammals with a member of one of the lower classes of vertebrates, the greater amount of connective tissue compared with the amount of muscular tissue in the former is very striking, the inference being that these connective-tissue structures (fasciae, aponeurosis, ligaments) represent portions of the muscular tissue of the lower form (Bardeleben). Many of the accessory ligaments occurring in connection with diarthrodial joints, apparently owe their origin to a degeneration of muscle tissue, the fibular lateral ligament of the knee joint, for instance, being probably a degenerated portion of the peroneous longus, while the sacro-tuburous ligament appears to stand in a similar relation to the long head of the biceps femoris (Sutton).

"Finally, there may be associated with any of the first four processes a change in the direction of the muscle-fibers. The original antero-posterior direction of the fibers is retained in comparatively few of the adult muscles and excellent examples of the process here referred to are to be found in the intercostal muscles, and the muscles of the abdominal walls. In the musculature associated with the branchial arches the alteration in the direction of the fibers occurs even in the fishes, in which the original direction of the muscle-fibers is very perfectly retained in other myotomes, the branchial muscles, however, being arranged parallel with the branchial cartilages or even passing dorso-ventrally between the upper and lower portions of an arch, and so forming what may be regarded as a constrictor of the arch. This alteration of direction dates back so far that the constrictor arrangement may well be taken as the primary conditions in studying the changes which the branchial musculature has undergone in the mammalia."

Please note that, "since the relation between a nerve and the myotome belonging to the same is established at a very early period of development and persists throughout life, no matter what changes of fusion, splitting or migration the myotome may undergo, it is possible to trace out more or less completely the history of the various myotomes by determining their segmental innervation." In view of this the clinician ought to be well versed in the knowledge of anatomy, i. e., the gross structures innervated from the same segment of the cord. Much of the physical diagnostic work of the osteopath is based on the fundamental facts of embryology and anatomy, i. e., metamerism.

CHAPTER VI.

THE NERVOUS SYSTEM.

The Medium of Communication.—A masterful knowledge of nerve tissue and its arrangement in the body to form the nervous system is an absolute prerequisite for success in osteopathic practice. Every vital phenomenon calls for interpretation by the skillful physician. Interpretation cannot be attempted without a definite knowledge of structure and function of that tissue which acts as a medium of communication between all other elements of the body.

The name of our system, Osteopathy, calls attention primarily to osseous structure, but it is only in connection with its effects on the tissues of communication and exchange, vital phenomena, we are actually interested.

The Attributes of Nerve Tissue.—All physiological phenomena are characterized by the manifestation of attributes of nerve tissue, irritability, conductivity and trophicity. Motion, sensation and nutrition are the vital phenomena whose perversion constitutes disease. Therefore, whatever the pathological condition may be, we are called upon to note a change in some one or all of these attributes of nerve tissue.

Nerve and Muscle Irritability.—Scarcely any thought of muscle is ever complete without the nerve impulse which controls the muscle is also considered. For convenience sake we may separate nerve and muscle when teaching their special attributes, but for all practical purposes they are never separated. Muscle and nerve are both irritable, but we pay no attention to the irritability of muscle because under normal conditions we do not see any evidences of specific muscular irritability. We view muscular irritability as the result of nerve irritability. Therefore nerve tissue is the chief irritable tissue. Irritability is an attribute of cell protoplasm whereby chemical and physical phenomena are enacted in response to irritants. Irritants may be mechanical, chemical, thermal and electrical. Practically all that physiologists know of the reactions of nerve tissue to irritants has been derived through experimentation by means of the electrical current. Osteopathists are bringing to light many facts concerning mechanical stimulation. Hydrotherapists have demonstrated the utility of thermal stimuli. Drug therapy makes use of the chemical form of stimulation.

Conductivity.—Nerve tissue is not only irritable but possesses the ability to transmit its irritability to other tissues and cause certain activities to be initiated there. Conductivity, the second vital attribute of nerve tissue, is the power to carry impulses from the point of irritation to other points in the nervous system. Irritability would be of small moment if conductivity were not present to transmit the message to the center and arouse response. The nerve cell and its axis-cylinder are a continuous mass of protoplasm and as long as the continuity is maintained conductivity will be maintained.

Trophicity.—The third attribute of nerve tissue, trophicity, is very imperfectly understood. We do not use this term here to represent so much the nutritional influences of the cell-body over its axis-cylinder as the influence exerted by nerve tissue over other body tissues, causing them to grow and prosper. This nutritional influence over other tissues is an attribute which we are compelled to note quite frequently in practice. There are individuals in whom motion and sensation are normal but nutrition fails, hence we note that in some cases mechanical lesions may cause only a slight change in the nerve tissue upon which they impinge, and this change is manifested by variation in nutrition of the part controlled by the irritated nerve. It is probably this attribute of nerve tissue which is perverted or lost when the tissues refuse to take up certain chemical elements which are ordinarily normal to them; for example, iron. In osteopathic practice we consider nutritional disorders as being the result of perverted trophic influence of nerves. Of course in cases where it is known that the ingested food does not contain the required element or elements we must regulate the diet. But there are many cases where all conditions appear normal, except that the tissues do not take up nourishment as they should. In these cases we search for lesions in the same way we would if motion or sensation showed perversion or loss. This phase of our subject can best be considered at another time.

Unity of the Nervous System.—The unity of the nervous system is a physiological fact, and this brings deep and superficial areas in close relation. Every portion of the body is able through the medium of the nervous system to work in harmony with every other part. Physiologists divide the nervous system into central and peripheral portions, but for practical purposes this division is of little use to us when attempting to make use of the irritability and conductivity of the nervous system for therapeutic purposes. Since all portions of the nervous system are connected there must be some place where impressions made upon terminal nerve filaments may be assembled, co-ordinated and responded to harmoniously. Wherever large numbers of nerve cells are assembled we expect to find such duties performed.

Other Systems of Integration.—Any influence which we have upon the body through therapeutic methods must be based on the unity of the body. That the body is a unit must be constantly borne in mind, not only a unit because of the nervous system but also a mechanical unit, formed by its fibrous tissues and a chemical unit through its circulating media. The nervous system is so preeminently the master tissue that, when we think of any integrative reaction, we attribute it to this tissue, which not only takes note of impressions secured by contact but reaches out into surrounding space and causes the body to react to things at a distance.

Mechanical Irritation.—The particular therapeutic procedures with which we are here dealing are aimed to affect by contact and hence we are most interested in those reflexes originating through stimuli applied to skin, visceral and somatic tissues. Structural displacements in the human body act as mechanical irritants to nerve tissue, changing the chemical and physical condition of the protoplasm and thus altering its irritability, either plus or minus according to the intensity of the stimulation. The displaced structures may have other detrimental influences on nerve tissue, for instance the pressure brought to bear on the nourishing liquids surrounding the nerve, i. e., the blood and lymph, may cause sufficient chemical change in these liquids to materially affect irritability of the protoplasm of the nerves which they are expected to nourish.

Effect on Conductivity.—Conductivity is not destroyed by these slight mechanical pressures. If the protoplasm of the cell and axis-cylinder were unable to conduct impulses and project them in such manner as to reach other cell bodies of the nervous system our work would be very limited. Conductivity depends on the continuity of protoplasm. The mechanical irritations we deal with in osteopathic practice seldom destroy conductivity. If they did so they would cease to become irritants the moment conductivity was lost. Other irritants may act for a time on the severed portions of protoplasm, but the original lesion would have destroyed the continuity of the protoplasm.

Afferent and Efferent Fibers.—The fibers composing a nerve bundle may be efferent or afferent so far as direction of impulse is concerned. Efferent fibers may be further differentiated by the names, motor, vaso-motor, secretory, according to the structures in which they end. Afferent fibers are usually termed sensory to denote their function of carrying impulses to the central nervous system. Nerve trunks contain all of these various fibers, therefore, pressure will irritate all of the fibers and conductivity of individual fibers will transmit the impulses in the direction of the normal nerve impulse, thus causing contraction in the voluntary or involuntary muscles or activity of secretory tissues; sensory impulses will be transmitted to the central nervous system and will purport to come from the terminal distribution of the sensory nerve. If the afferent impulse is such a one as will reach the patient's consciousness, we find that the central cells are misled as to the location of the stimulus and hence manifest a response in the supposed area. It is not necessary for the patient to be conscious of any irritation in order to bring about this result.

Organization of the Nerve Bundle.—The organization of the nerve bundle complicates our ideas of irritability and conductivity in the protoplasm of the cell and axis-cylinder of a nervous unit. Complexity of action and reaction increases as we near the central nervous system. We have considered that all impulses generated in the protoplasm of a nerve cell and axis-cylinder have been transmitted to all parts of that unit of nerve tissue, but have not in any way influenced any other unit. We have not considered the relations of cell bodies in the central system. It is sufficient for our present purpose to note that the afferent fibers enter the spinal cord as the posterior roots and that their cells are in the ganglia of these posterior roots.

Intraspinal Fibers.—The efferent fibers leave the cord as its anterior roots and their bodies are located in the anterior cornua of the gray matter of the cord. Upon careful study of the spinal cord there are found other cells and axis-cylinders which do not leave the cord but serve to connect the afferent and efferent elements and distribute impulses within the cord. These latter are found in enormous numbers in all portions of the central nervous system.

Segmentation of the Spinal Cord.—The first fact of great interest to us, osteopathically, is the segmentation of the spinal cord. This is only relative in character, but yet is apparent, not only histologically but pathologically. We note that according to distribution of afferent fibers in the

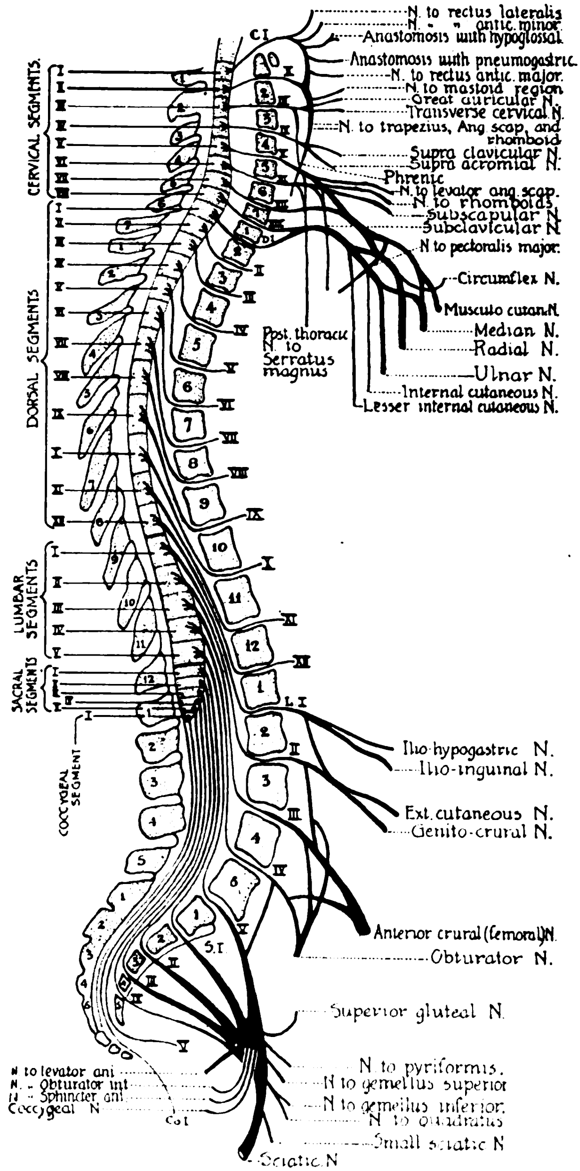


FIG. 15. Diagram of spinal segmentation, showing relation between the points of origin of the spinal nerves and their points of emergence from the spinal column; also their distribution to the muscles. Drawn by John Comstock (after Dejerine et Thomas, modified by Starr).

spinal cord impulses are diffused both above and below the point of entrance. The cell bodies of the anterior roots are also somewhat diffused, but in practice we note that afferent and efferent impulses seem to be correlated within comparatively narrow limits in the spinal cord. How the impulses set up in the protoplasm of an afferent fiber are transmitted from it to the protoplasm of other cells located in the spinal cord and thence transmitted to the protoplasm of efferent cells is not known, nor is it necessary for us to thoroughly understand the method in this instance so long as we recognize the results. Our specific knowledge must comprehend the exact point of entrance to and exit from the spinal cord of each nerve bundle and the peripheral distribution of the same. Having a knowledge of the structure, the function comes naturally as a result.

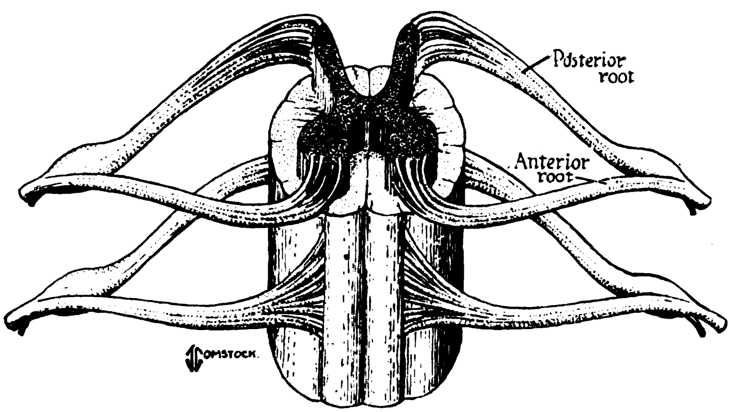


FIG. 16. Diagram showing two segments of the spinal cord.

Segmental Integration.—A segment of the spinal cord, i. e., that portion giving rise to a pair of spinal nerves may be conceived to act independently of other segments. Of course it would be difficult to demonstrate this, but for purposes of analysis we may be permitted to segregate the various divisions and nervous elements so as to better understand the structures with which we are dealing. The central nervous system is constantly receiving impulses from afferent fibers and co-ordinating them. We are almost entirely dependent on reflex action for the effects we secure on deep tissues. Our manipulations affect sensory nerves in

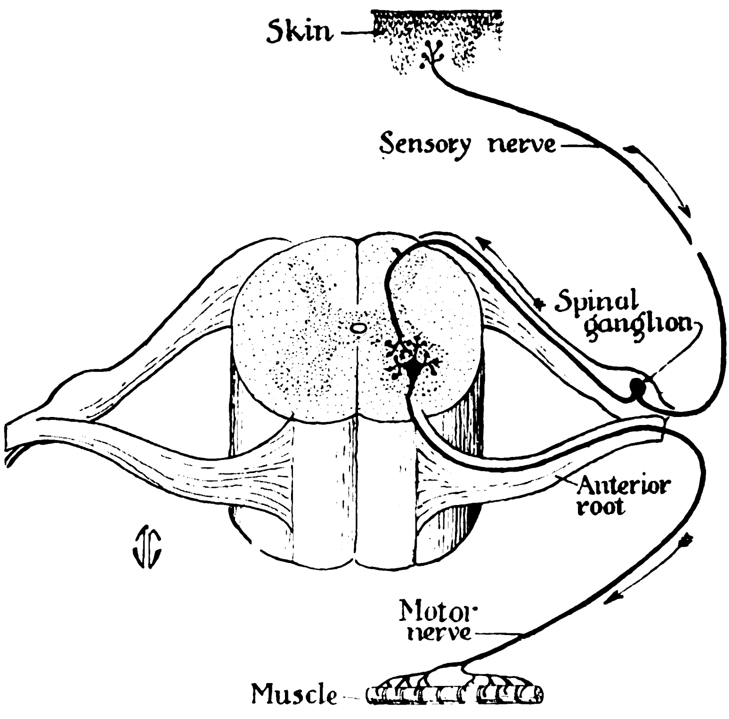


FIG. 17. Diagrammatic representation of a single spinal segment and a simple reflex arc. Drawn by John Comstock.

skin, muscle and synovial membranes. These impulses are carried to the central nervous system and transformed into efferent impulses.

Ceaseless Play of Reflexes.—During life there is no period when the body is not dependent on external stimuli. These ordinary mechanical and thermal stimuli keep a constant stream of impulses entering the central system to be translated into stimuli of muscle and gland. This ceaseless play of reflexes may vary in intensity, but so long as life lasts they are demonstrable. We expect the reflex to be initiated by the sensory side of the reflex arc, therefore the intensity of muscular contraction and glandular secretion is governed by the intensity of the initiatory impulse.

The Simple Reflex.—The simplest reaction in the nervous system may be conceived as a sensory impulse transmitted to the spinal cord over a sensory nerve and from the cord over a motor nerve. The tissue in which the motor or efferent nerve ends will express reaction to the stimuli coming over the sensory or afferent side of this reflex arc.

The Sensory Side of the Reflex Arc.—The sensory side of the reflex arc is the one upon which we must depend to initiate reactions. The segment coordinates the sensory impulses reaching it over the afferent roots of its nerve trunks. By following the distribution of its nerves we can determine what cells its afferent fibers arise in and what cells its efferent fibers innervate. Taking a mid-dorsal segment we find its pair of nerve trunks dividing and branching so as to supply skin, muscle and viscera. All of these parts must have sensory and motor fibers and since our spinal nerves are mixed nerves, i. e., have afferent and efferent fibers, we know that a segment receives sensory impulses from skin, muscle and viscera and the segment integrates these impulses and sends out efferent impulses coordinated for the best good of itself and the tissues it innervates.

Protective Reactions.—A reflex is primarily a protective reaction. It is an effort on the part of the structures entering into the reaction to protect that of which they are a part. It seems that the sole object of a reflex is self defense. Therefore a study of reflexes will tend to make symptomatology far more interesting. The integration expressed in the reactions of a spinal segment mirror the manifold relations existing between the cells which constitute the active elements in a metamere or body segment. The segmental structure of the cord and the reflex action manifested therein show that, on the whole, a definite muscle group and a definite cutaneous area are innervated from a limited portion of the central system. Therefore we may count on the stimuli originated in the cutaneous area being reflexed to the definite muscular area.

Example.—An example in practice is as follows: Patient's head is drawn slightly to the left side. Complains of pain shooting to the left shoulder and over the left clavicle whenever movement is attempted. History of exposure to draught of cold air. Physical examination discloses contraction of left trapezius, levator anguli scapulae and scaleni. Pressure upon these muscles causes pain. When instructed to take a full inspiration, patient says he cannot on account of pain, which is sharp and darting in character and radiates over the intraclavicular portion of the left chest. When we consider the muscles involved and the area of painful sensations, our attention is immediately called to a definite segment of the cord, in this case the point of origin of the third and fourth cervical nerves. The cold air striking the skin intensified the normal stimuli and the efferent impulses from that segment of the cord were intensified as the direct result of the cutaneous irritation. The point of irritation, the cutaneous area, governed the location of the reflex. So long as the original stimulus was only moderately intensified all the reflexes emanated from one segment of the cord, but if they had been more intense or continued longer, we might have found a greater area reflexly affected. The stimuli which would have reached the cord would have been more widely diffused above and below the point of entrance.

Comparative Segmentation.—Since we know that the highly organized spinal cord of man is not to be compared with the same structure in lower forms of animal life and that segmentation in it is illy defined, the practical question arises as to how much dependence we can put upon reflexes in the human nervous system. Will the reflexes guide us to definite segments of the spinal cord? Experience teaches us that a thorough knowledge of the distribution of afferent and efferent nerves in man will interpret reflexes with sufficient exactness and invariably lead the investigator to a spinal segment which is itself affected or is coordinating impulses from a known sensory area.

Efferent Impulses.—When we follow the efferent impulses to their points of distribution our work is greatly complicated. To reason from contracted voluntary muscle to cutaneous sensory area is a comparatively simple procedure, but to start with the sensory impulse and trace it through the central system and thence along efferent pathways, to estimate its final effects, as mechanical work done by muscle and gland in many combinations, requires a considerable knowledge of structure and function of all parts of the human system.

Efferent Fibers to the Sympathetic Ganglia.—Many of the efferent fibers of the cerebro-spinal system take their course through the sympathetic ganglia and are distributed in that system to plain muscle and secretory cells of the body. It has been ascertained by various careful observers that these efferent fibers, after entering the sympathetic system, either end in the ganglia nearest their point of emergence from the cord or pass up or down to ganglia above or below the one originally entered. Some fibers pass through these ganglia and end in the more peripherally placed plexuses.

Ganglionic Control.—Wherever nerve cells are accumulated a certain amount of independent action is probably carried on. Terminal filaments of efferent fibers in sympathetic spinal ganglia are in relation with a large number of cells and the number of fibers leaving the ganglia is greater than those entering. Therefore diffusion of impulses from these ganglia must be very great. The accumulation of sensory impulses in these ganglia may be equally as great. Each ganglion must have a dominant influence over a certain visceral area, and this influence is subsidiary to the control exercised by the segment of spinal cord to and from which the larger number of fibers proceed.

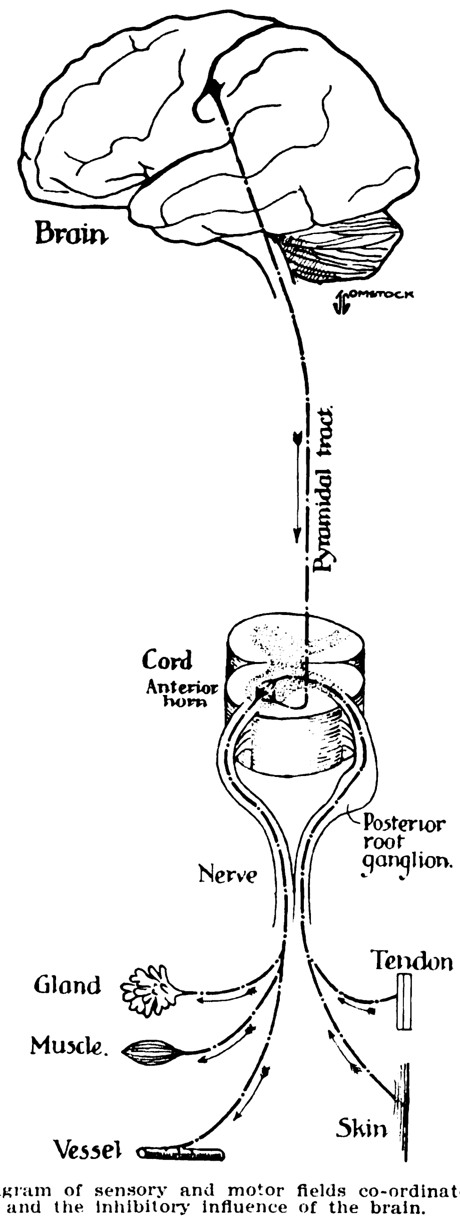


FIG. 18. Diagram of sensory and motor fields co-ordinated in a spinal segment; and the inhibitory influence of the brain.

Three Fields for Reception of Sensory Impressions.—The three original layers of the embryo, epiblast, endoblast and mesoblast, forming skin, mucous membrane and the intervening tissues, are represented by sensory fibers which connect them with the central nervous system. The outer surface of the body is supplied with extero-ceptive, the internal surface with intero-ceptive and the intercellular surfaces with proprio-ceptive fibers. The coordination of these various receptive fields is the duty of the segment. We have reactions in this segment which represent the effort of the segment to adapt itself to external conditions. The external surface registers in the segment the conditions of the outside world, so far as the special endings of its sensory nerves are capable. The internal surface takes cognizance of the presence of material in contact with it which in most cases may serve as food. Not all spinal segments have this visceral division represented in them.

Proprio-ceptive Field.—The surface of the individual cells, which compose the bulk of the body, are represented in the segment by a large number of sensory fibers which register their conditions and needs. This proprio-ceptive field is an exceedingly large one and is usually little thought of when considering the reactions of the nervous system. It is the proprio-ceptive nerves which are affected in any trauma of joints or other deep structures. The sense of position, muscular tension and weight are to a large extent dependent on these fibers.

Segmental Coordination.—The segment of the spinal cord governing a metamere receives sensory stimuli from three different receptor fields, the external and internal surfaces and the bulk of the tissue between these surfaces. The harmonious functioning of the whole segment is the result of the coordination of all the impulses from these three receptor fields, expressed in effector tissues, muscle and gland. These reactions represent the segment's effort to meet the conditions of its environment, plus its own inter-cellular condition, to the best advantage. In other words, its reactions represent its effort to maintain its existence.

Plurisegmental Control.—Just as no skin area, or muscle, other than a distinctly segmental one, as mentioned in Chapter V, no viscus is wholly under the influence of one segment. Therefore one segment is merely a contributor of a partial influence over skin, muscle and internal organ. One segment may furnish the majority of fibers to a certain peripheral nerve, but complete control is divided between two or more segments. This seems to indicate that physiological centers in the spinal cord consist of series of cells, placed vertically, whose fibers thus emerge at various levels. With this fact in view we recognize that any reaction to stimuli, arising in any one of the three receptor fields, will be expressed in effector tissues belonging to at least two or more metameres. Therefore any protective reaction in spinal areas will involve more than one spinal articulation.

Clinical Evidence, Group Lesions.—This agrees with the clinical findings. Take spinal tenderness for example: A point is usually found which shows considerable tenderness and this tenderness shades off through a metamere above and below the most sensitive point. Contraction of a spinal muscle, i. e., of a portion of the erector spinae, extends over two or more metameres. Osseous lesions are usually of the group character. The approximation or separation of two spinous processes represents the involvement of at least four vertebrae, i. e., one above and one below the center of the lesion. Likewise, the lateral deviation of a spinous process means the involvement of three vertebrae. Thus we see that all reactions are practically pluri-segmental instead of segmental. The vertical arrangement of the governing cells in the spinal cord is the foundation for this. Just as we noted the migration of muscles for purposes of better guarding of the body, so also we note that segments have divided their influence with adjoining ones.

Differentiation of Spinal Lesions.—In view of these facts it is hard, in fact impossible, to differentiate spinal le-

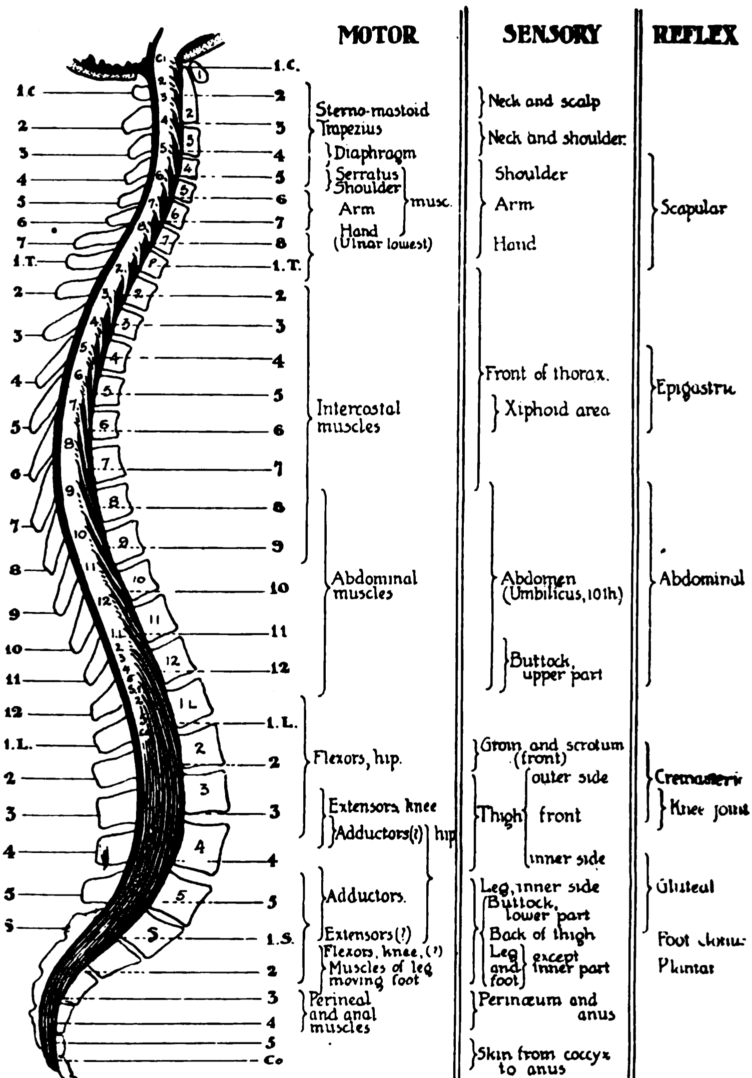


FIG. 19. Diagram and table showing the approximate relation to the spinal nerves of the various motor, sensory and reflex functions of the spinal cord. (Gowers.)

sions as primary or secondary, i. e., traumatic or reflex, based on palpation of the tissues. The characteristics are quite similar because the protective reactions of the body, whether in response to stimuli from the extero-, intero-, or proprio-ceptive fields, will be manifested in the effector tissues, muscle and gland, of the pluri-segments belonging to the receptor fields receiving the stimuli. For example: Irritation of the skin of the back supplied by nerves from the segments of the cord which have rami-communicantes connecting with the renal splanchnics, may produce reactions in all the tissues governed by that pluri-segmental center. A stream of cold air blown on this skin when it is wet would produce a pronounced reaction. Likewise, a counter-irritant would produce a reaction. In the case of the reaction to cold the muscles under this skin area would contract. There would be lost motion in the vertebral articulations of these metameres due to the hypertension of the muscles. Sensitiveness to pressure and a feeling of lameness would develop. The probabilities are that the kidneys would show marked change in function. We have kept our reactions thus far in the metameres whose cutaneous surfaces are affected, but, clinically, we know such a condition as this is serious and hence the whole fighting power of the body is called upon to protect it from this high tension in a series of important metameres.

Lesions Due to Functional Fatigue.—Let us reverse the picture and start with a functional disturbance of the kidneys due to too great demands on them in eliminating nitrogenous waste material. This functional fatigue might produce muscular contraction, pain or tenderness in the spinal areas associated by innervation, i. e., the pluri-segmental areas, and thus duplicate all the phenomena mentioned in our previous description. The field of proprio-ceptive impressions, that is the structural tissues in this particular pluri-segmental field, may likewise be the point at which all these reactions are initiated. Injury, or functional fatigue, as is seen in street car men whose backs suffer from the constant vibration of the cars, will set up reactions which, so far as palpation is concerned, show physical signs similar to the two preceding. After noting the physical signs, of a pluri-segmental character, it is evidently necessary to go much farther into symptomatology in order to differentiate the primary from the secondary lesion. Since the body functions as a whole no limited pluri-segmental reactions continue without other portions of the body enter the contest for the preservation of the whole. In the example just given the contraction of somatic muscles, tension in skin and kidney consequent on the influence of the cold air, is a condition prejudicial to the life of the body because elimination is greatly decreased and hence, unless compensatory elimination can be established, autointoxication of a fatal type will supervene. We may conceive of an elimination center in the nervous system represented by a column of cells extending throughout the cord, controlling in all metameres the sweat function of the skin and in those metameres associated with the bowels and kidneys, the special functions of these organs. We know all these means of elimination are coordinated and, in case of need, strongly compensatory. The bowels must be urged to compensate for the failure of skin and kidney elimination. Elimination may fail so quickly and completely that the consequent autointoxication and high arterial tension strain the heart. A new group lesion representing this organ becomes apparent, and, to the physician who studies the case for the first time, at this stage offers difficulties of analysis almost insurmountable. The spinal lesions mirror the compensatory reactions of the body. They are guides to an understanding of the symptom complex presented in any case of disease and if studied coordinately with the symptoms often lead the mind of the physician logically to the origin of the disease reactions.

CHAPTER VII.

THE NERVOUS SYSTEM (Continued).

Alignment, Tone, Reflexes.—Osteopaths have, to some extent, discarded subjective symptoms, believing that they are of very doubtful value in the large proportion of patients. Having discarded subjective symptoms, they have developed a method which gives equal or better results. It has three phases, two of which are structural and one which is partially subjective. First in order comes skeletal alignment; second, muscular tone; third, condition of reflexes. These three divisions all come under the general head of palpation.

Clinical Illustration.—As an illustration of the value of objective in preference to subjective symptoms, the following case is of considerable value. The gentleman whose physical condition is practically illustrated in Figs. 20 and 21 was examined in the clinic of the Pacific College of Osteopathy. He has been operated on surgically for a peculiar enlargement just above and external to the right knee . The line of the incision is shown in Fig. 20. He stated that he had suffered pain at this point during more than a year, and his physician had decided that there was a tuberculous condition of the bone. The operation did not confirm this diagnosis. No unhealthy tissue was found.

Inspection.—We noted his peculiar handling of the leg when walking, compared both limbs from toe to hip and discovered a marked difference in size, as is indicated in the photograph. By following the course of the nerves to the spinal column, we discovered that the muscles on the right side of the spine were atrophied in proportion to those of the extremity. Fig. 21 shows the fact that the atrophied

FIG. 20. Case illustrating atrophy of the muscles of the right leg due to faulty trophic influence of the nerve cells in the spinal cord. The scar, just above the right patella, is superficial to a hypertrophic condition of the bone.

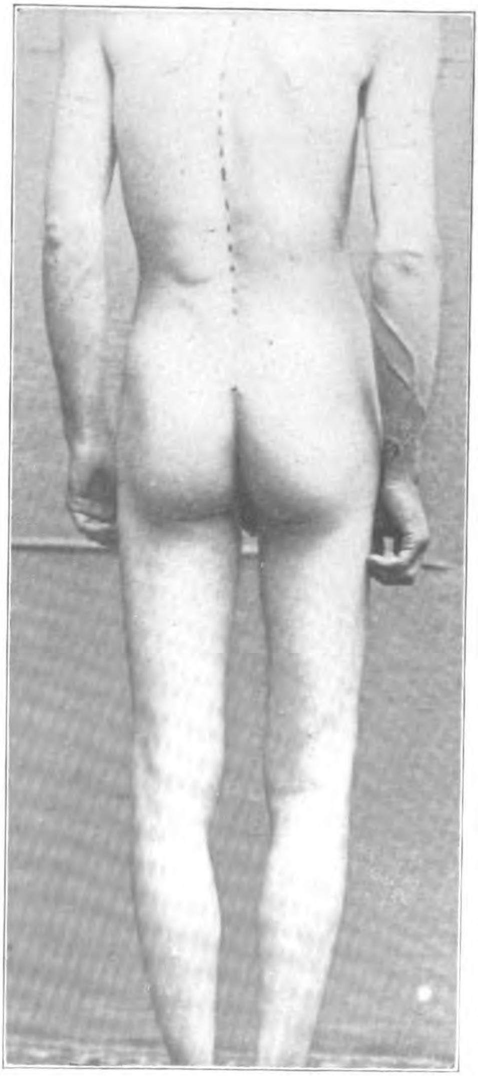


FIG. 21. General view of case illustrated in the preceding figure. The spinal curvature is clearly indicated. Patellar tendon reflex absent on right side but present on the left.

condition extends into the interscapular region, and the spinal column is bent.

Patellar Tendon Reflex.—The patellar tendon reflex was lost on the right side, but present on the left. The right leg was ataxic, but the left leg was normal, thus presenting what might be called a unilateral locomotor ataxia. If this man's surgeon had taken the care to examine him from an objective structural standpoint rather than to depend on the subjective symptoms, it is highly probable that no operation would have been performed. Our examination demonstrated that this man's structural condition was at fault and that the trophic influence of a part of his nervous system was being gradually lost. Both the motor and sensory nerves were acting feebly.

Gastric-spinal Reflex.—It might be asked, "How could one secure a spinal reflex from the stomach?" In what way would the finding of such a reflex surpass ordinary methods of examination? The neurologist, when making examination of a patient suffering with some condition of the sensory or motor portion of the nervous system, must possess a definite knowledge of the origin, course and distribution of nerve trunks in order to locate accurately the position of the lesion. The osteopath pursues the same method of examination, but follows it farther. His investigation takes into consideration the dispersion of efferent fibers in the sympathetic system and the sensory impulses received by the spinal cord from that system.

Sensation.—Edinger quotes Exner as follows: "One must not suppose that all the impulses reaching the spinal cord by the sensory roots are identical with what is ordinarily called 'sensation.' In order that an impression be perceived, it is not sufficient that it be conducted to the spinal cord, but it must be farther carried up, from the place where the peripheral part ends to the cerebral cortex. There is, however, no doubt at all that all these higher connections are few in number, and that contrasted with the multitude of fibers in the posterior roots, the number of such cranial connections is quite small. This alone makes the conclusion possible that there are, indeed, many sensory impressions which arrive at the spinal cord, but that we are aware of but few of them at the time. All the viscera of the body, as the staining method has distinctly shown, are traversed by an altogether unexpectedly large number of nerves and their arrangement and course, their relations to blood vessels and glands, and to muscle fibers, bones and enamel, makes it more than probable that there is, in this connection, a large system which serves essentially to regulate impressions and reflex action."

Visceral Sensation.—It is the reflexes mentioned in this quotation in which we are interested. Sensation and perception are dissimilar. Sensations from the viscera are coordinated in fairly well marked areas of the spinal cord and when these sensory impressions are intense the efferent fibers of the spinal cord manifest the condition existing in a visceral area by causing an abnormal condition of muscular tone in the intrinsic muscles of the back. This contractured condition of the muscles is not the only evidence of the visceral reflex. Pressure on the contracted muscle causes pain. The intensity of the aesthesia is usually in proportion to the visceral irritation. Even though the patient does not say in so many words that there is pain on slight pressure, the examiner, if his palpation is good, can detect the reflex in the action of the muscle.

Dependence on Objective Symptoms.—A patient comes to an osteopath desiring to be examined. He does not vouchsafe any information as to his condition, merely saying: "I want you to examine me and find out what is the matter with me." This is a challenge to the skill of the examiner and calls for something besides a long-distance catechising as to subjective feelings. The osteopath proceeds with absolute precision to determine the condition of his patient's structural formation—(1) skeletal alignment, (2) muscular tone, and (3) segmental spinal reflex. Each yields valuable information. The examiner's fingers may develop a reflex around the sixth dorsal spine. This is noted as a reflex from the gastric area. Testing the segments above and below, this will show how great a section of the cord is irritated and will be an indication of the extent of the internal irritation, i. e., whether other portions of the digestive tract are affected. The reflex might extend as far as the fourth dorsal and still indicate the gastric area. Finding the reflex at the sixth dorsal spine has directed the attention of the examiner to the gastric area and has located a point from which further examination is to proceed. Percussion over the stomach would reveal other facts, and then the examination would be pursued along general lines of physical diagnosis to determine the character of the gastric disorder. The moment the examiner centers his examination on the stomach, the confidence of the patient is assured. Is not this confidence greatly to be desired in every case? Is it not a force which compels the patient to follow the directions of his physician in matters of diet and hygiene? In this example we have illustrated the attributes of nerve tissue, (1) irritability, (2) conductivity. Other conditions which make this illustration possible are (1) muscular contraction in response to nerve stimulation, (2) segmentation of the spinal cord, (3) reflex action.

Depth and Extent of Lesions.—From the clinical standpoint lesions may be classified somewhat according to depth and extent; for example, the lesions which are due to trauma of somatic tissues, involving one spinal articulation, would be deep and as soon as the patient is placed in a position of rest, the extent of the muscular contraction would greatly decrease. This is not the case when the lesion is due to a visceral irritation. The viscus has a pluri-segmental connection with the nervous system and hence the contraction of muscles in the spinal area is usually of greater extent. The position of rest, i. e., reclining, does not usually cause the muscles to relax. This shows that the contraction is not a normal effort to maintain the upright position but a hypertension due to visceral disturbance.

Lesion Picture in Autotoxemia.—As soon as we have an autotoxemia to deal with our lesion picture is greatly enlarged. This is well illustrated in the various manifestations of indigestion. In such cases, not only lesions in the areas segmentally associated, but also above and below, will be found. Some cases will complain of the whole length of the spine while the autointoxication is at its height. As the intensity of the autointoxication decreases the lesion areas become restricted to the physiologically associated spinal areas. This is true in the infections as well. The backache in tonsilitis, la grippe, smallpox, etc., are well known and evidently not located in physiologically associated areas. The phenomena of spinal hypertension and hyperaesthesia are very prominent in these cases. Nothing seems to palliate this spinal condition due to toxemia to the same extent as manipulation. We say palliate because the toxemia which causes the tension is not overcome by relieving the spinal tension.

Lesions Independent of Segmental Reflexes.—As soon as we find lesions that seem to have arisen independently of what we can readily recognize as segmental reflexes, they must be explained on the basis of some integration of the body other than nervous. This is the case in the toxemias. The circulating media are the integrating factors which explain the backache as well as many other aches in those cases where there is no visceral involvement which may reasonably be associated with them. Increasing elimination will usually correct these spinal lesions due to toxemia.

The Lesion as an Expression of Some Form of Integration.—Any spinal lesion may be analyzed from several standpoints, because it may be a partial expression of one or more integrating factors of the body, i. e., the structural, circulatory or nervous. The traumatic lesion shows itself subject to position, i. e., can be rested and lessened by a position which mechanically lessens the strain. The lesion due to nervous integration is not so quickly relieved by the means which relieve the traumatic lesion. The fact that it is a reflex presupposes an adequate point of irritation elsewhere. This point must be located before the lesion is adequately relieved. This is well illustrated in the reflexes in the mid-dorsal area due to fermenting food in the stomach. Emptying the stomach relieves the lesion.

Circulatory Integration Lesion.—The lesion due to circulatory integration is hard to recognize because one naturally thinks of the other forms of integration and attempts to square his findings with these forces. Then also the circulatory integration is largely under the direct influence of the nervous system. It is a good plan to analyze lesions first on a basis of structural integration, then nervous and finally circulatory. This evolutionary method of following a natural plan helps to keep ones mind working in a logical manner.

Protective Reactions.—The protective reactions of the body are not all segmental nor even within small groups of segments. So long as they are purely segmental we are reasonably certain that the condition is not constitutional because a constitutional ailment involves the whole fighting power of the body to such an extent that the clinician readily recognizes the seriousness of the situation. Take for instance the progressive involvement of lung tissue in tuberculosis. The early stages of the disease may show very little or no constitutional symptoms such as chill, fever, sweat and loss of flesh. At this time somewhere in the interscapular area will appear a lesion, muscular contraction and tenderness to digital pressure. This lesion is not distinctive of pulmonary tuberculosis any more than of any other irritation in its associated visceral area. It merely indicates the segment or segments involved in the circulatory disturbance characterized by the congestion in the infected area. As the pulmonary lesion envolves larger areas the spinal lesion grows proportionately. This is probably true except when the pleura is inflamed. Then we have a protective rigidity of a vastly more pronounced character. As soon as effusion takes place the intensity of the rigidity lessens because pain is lessened. As soon as the tubercular process shows constitutional symptoms the spinal lesion picture varies from morning to night, that is, fluctuates with the varying intensity of the disease reactions. The positive and negative phases of the body's reactions are reflexly evidenced in the spinal areas. As the disease progresses and areas of pulmonary tissues are lost or fibrous tissue formed, with consequent lessening in antero-posterior diameter of the chest and decreased amplitude of the respiratory movements, lesions of a structural character appear in the spinal area, such as flattening of the dorsal curve and elevation of the angles of the ribs caused by the rotation downward of the anterior extremities of the ribs in the flattening of the chest. The change in the chest causes a change in the tension of the scaleni muscles in the neck and in case only one pulmonary apex is involved there is unequal tension in the scaleni of the two sides of the neck, thus causing the extensors of the neck to exert a compensatory action. The change in cervical vertebral alignment and muscular tension constitutes in this instance a spinal lesion which is properly compensatory and therefore not helped by corrective movements. Many such lesions, profoundly compensatory in character, should receive no direct corrective manipulation. Since they are dependent upon tissue involvement elsewhere we must make our diagnosis from cause to effect in order to get our therapeutics in right sequence.

Pains Incident to Chill and Fever.—The headache, neckache, backache and legache of chill and fever are subjective symptoms prominent in a host of cases. These symptoms are of varying intensity but even when not complained of, a tenderness in the neck and back is readily elicited by digital pressure. As the fever subsides these areas of sensitiveness to pressure grow less and less, showing that their great extent in the beginning is a constitutional condition. It is readily recognized that our spinal lesion in pulmonary tuberculosis has changed with each phase of the disease. This is probably true of all diseases, hence there is no fixed lesion associated with any visceral or somatic disease. A slightly varying set of reactions accompanies each disease process. These reactions are usually true to type but not capable of classification except in a general way. The organs of the body are innervated from fairly definite areas of the cord and we speak of these as nerve centers, but as before stated these centrs consist of cells placed vertically and extending through several segments. The spinal lesions found in visceral disease are hence pleuri-segmental and, if there is toxemia, there is a set of lesions expressive of this condition superimposed on the first, then, in case of destruction of tissue, compensatory changes in structure are noticeable. The three major forms of integration are involved in any severe illness and hence the diagnostician must try to separate the various evidences of the body's protective reactions. The greater variation will be in those symptoms due to circulatory integration. This is evidenced by the rapid changes in cases of autointoxication. The lesion which is characterized by its persistence will be located in that segment or segments most closely allied with the center of visceral disturbance. The lesion of still more permanence will be the primarily traumatic or secondarily compensatory.

The Practical Use of Knowledge. — We have added nothing new to the world's knowledge of nerve tissue, but we have applied general knowledge of this tissue to specific uses. We have taken the results of laboratory experiments and made them practical methods in the detection and alleviation of disease. It appears to us that sufficient research work has been done on the nervous system by medical men and sufficient general conclusions drawn from their investigations to justify all branches of the profession in making more extensive use of such data. The correlation of laboratory data with the results of clinical experience make the foundation of osteopathic diagnosis at the present time. By this bold application of knowledge, which by the medical profession at large has been regarded as speculative and at least impracticable, osteopathy has gained an impregnable position in the healing arts.

Laboratories make scientists, not physicians; hence physicians have not always grasped the full significance of the scientific discoveries in physiology and applied them to therapeutics.

Whatever osteopathy may at present possess or gain in the future, is due solely to a close adherence to the facts of anatomy and physiology; and the application of these fundamental facts to scientific therapeutics.

CHAPTER VIII.

THE SYMPATHETIC NERVOUS SYSTEM.

Unity of the Nervous System.—It gives a wrong impression to speak of the cerebro-spinal nervous system and the sympathetic nervous system as though they are independent of each other. They are parts of a single system. They make all parts of the body intercommunicative, and make it possible for a slight stimulus to cause a widespread response. They convey all impulses of a sensory character to the central nerve cells and cause internal activity and response to external stimuli. In fact, the harmonious action of the tissues in our body depends on every cell knowing the condition of every other cell. Each cell is capable of perfect life only so long as it is able to communicate with the central nervous system, ready to give and to receive, thus fulfilling the law of reciprocity.

For convenience of description, the nervous system is divided into the cerebro-spinal and the sympathetic. We have already said that these are parts of one whole. They are continuous anatomically and physiologically. In the attempt to write of them separately, we desire you to bear constantly in mind their interdependence.

"The dependence and independence of the cerebro-spinal and sympathetic systems of nerves may be compared to the State and Federal Governments, or the Municipal and State Governments. The former run in harmony, when friction does not arise, yet the State lives quite a distinct, individual life—quite independent of the Federal Government. And the life of each is dependent, however, on the other. The internal life of each (as of the sympathetic)

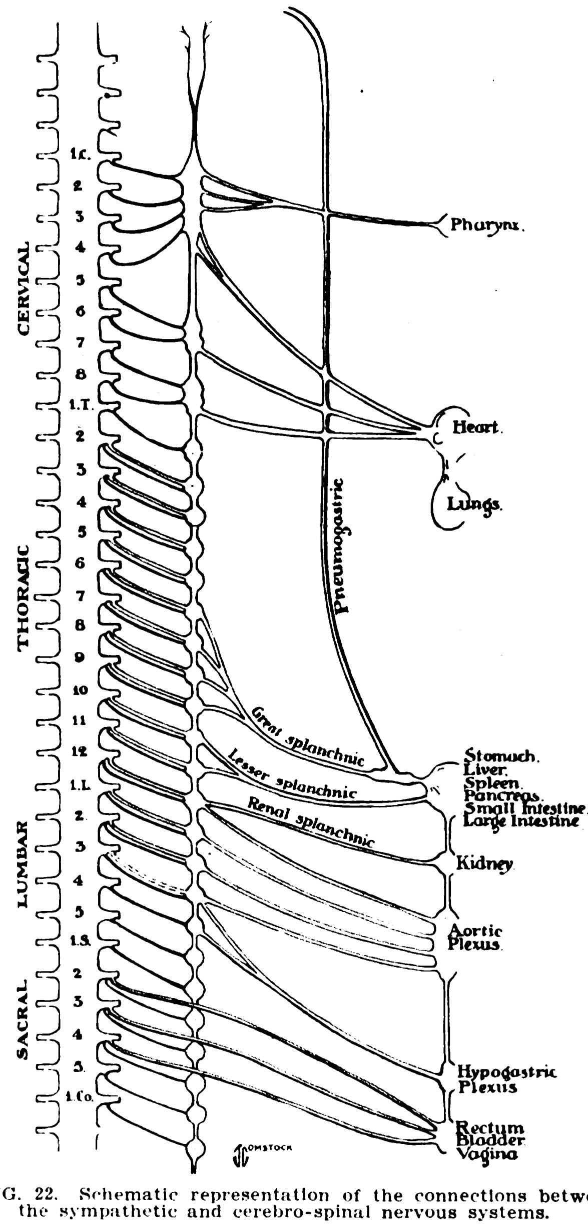


FIG. 22. Schematic representation of the connections between the sympathetic and cerebro-spinal nervous systems.

maintains itself."—Byron Robinson in the "Abdominal Brain," page 55.

Origin.—The sympathetic appears to originate from the ganglia on the posterior roots of the spinal nerves.

(1) Lateral Ganglia.—The substance of the sympthetic is conveniently divided into four portions: (1) The lateral chains of ganglia, placed one on each side of the vertebral column. The chains are connected above by the Ganglion of Ribes (French, 1800-1864), situated on the anterior communicating artery, and joined below by the Ganglion Impar situated on the anterior surface of the coccyx. These chains of ganglia are connected with the cerebro-spinal nerves by well marked cords.

(2) Four Prevertebral Plexuses.—The next prominent aggregations of nerve tissue are the great prevertebral plexuses situated ventral to the bodies of the vertebrae. The first, or Pharyngeal, is situated around the larynx. The second, or Cardio-Pulmonary Plexus, lies in the thorax. The third, or Solar Plexus, encircles the Coeliac Axis and superior mesenteric artery. The fourth is the Pelvic Plexus, which governs the generative organs and rectum.

(3) Visceral Ganglia.—The third part of the sympathetic tissue is composed of those ganglia placed between the coats of viscera, and called the peripheral apparatus or "Automatic Visceral Ganglia." (Robinson.)

(4) Communicating Fibers.—All of these ganglia and plexuses are intimately connected with each other by numerous nerve fibers. These four parts constitute what is commonly known as the sympathetic nervous system. The nerve fibers in the sympathetic system consist of both the medullated and non-medullated varieties, i. e., white and gray. It is commonly believed that the white are cerebro-spinal and the gray are sympathetic fibers, though whether they belong to the one or the other system cannot be told by appearance alone. Function must also be considered. The fibers in the sympathetic system are principally of the non-medullated variety; hence, gray fibers are called sympathetic.

White Rami-communicantes.—The chains of the lateral ganglia are connected with the spinal nerves serially by two distinct nerve bundles to each ganglion. These bundles are called rami-communicantes, and are composed of: (1) A bundle of white or cerebro-spinal fibers passing from the anterior and posterior roots of the spinal nerves to the ganglion, in which a few fibers may end; but the majority pass on to be distributed to the prevertebral plexuses, thereby giving direct communication between viscera and the spinal cord. These white fibers consist of both motor and sensory fibers. The white rami-communicantes leave the spinal cord between the second dorsal and second lumbar vertebrae only. Many of the fibers are demedullated in the lateral ganglia; others retain their sheaths as far as the prevertebral plexuses, where they also become demedullated. The cervical region has no white rami-communicantes.

Distribution.—The nerves in the sacral region which correspond to white rami-communicantes, pass to the viscera without entering the sympathetic ganglia. We may summarize what we have written concerning the endings of the white rami-communicantes as follows: (1) End in the lateral ganglia. (2) Pass through lateral ganglia and end in prevertebral plexuses. (3) Split up before entering lateral ganglia and send some fibers to the ganglia, others to ganglia above and below, after passing into its own ganglia.

Function.—The white rami-communicantes have many functions, and these can be determined by a close study of distribution and physiological action. The functions may be tabulated approximately as follows: First, it has been demonstrated that vaso-constrictors pass out of the cord between the second dorsal and second lumbar vertebrae; second, cardiac augmentors, ending in the lower cervical ganglia and first thoracic ganglion; third, motor fibers to the plain muscles of the intestines; fourth, motor fibers to the sphincter of the iris leave the cord at the third dorsal and ascend in the chain of sympathetic ganglia; fifth, inhibitory fibers to the viscera; sixth, sensory fibers from viscera.

In other words, it may be tabulated as follows: The abdominal splanchnics contain viscero-motor and viscero-inhibitory, vaso-constrictor, vaso-dilator and sensory fibers, which are white rami-communicantes. Since no white rami-communicantes leave the cord above the second dorsal or below the second lumbar, the cardiac augmentors and the constrictors to the sphincter of the iris probably leave the cord as white rami-communicantes in the dorsal region.

We have thus far considered only those fibers which are supposed to originate in the cerebro-spinal system; at least, they are medullated nerves, and hence are considered cerebro-spinal in character.

As we havė previously stated, the bond of union between the sympathetic and cerebro-spinal systems consists of a white and gray bundle.

Gray Rami-Communicantes.—These gray fibers are non-medullated and originate in the lateral ganglia, being axis cylinder processes of nerve cells in those ganglia, passing thence to the spinal nerves and spinal cord.

Distribution.—They pass first to the anterior primary divisions of the spinal nerves and continue with them to their distributive area; or they may pass to the distribution area of the posterior division, to the distribution area of the recurrent branch of the spinal nerve, and to the structures (dura) surrounding the posterior root of the spinal nerve and to the spinal cord.

Function.—Since the function of the sympathetic system is to control the caliber of blood vessels, the plain muscle fibers, and the action of the secretory and excretory glands, we may state the function of these gray rami-communicantes to be as follows: (1) Vaso-motor to the blood vessels of the skin and skeletal muscles in the area of distribution of spinal nerves; also secretory to the sweat glands and motor to the plain muscle controlling the hairs; (2) vaso-motor to the blood vessels in the spinal cord and its membranes. The nerves passing from the lateral ganglia to the prevertebral plexuses, therefore, contain white and gray fibers having the functions of the sympathetic and cerebro-spinal systems, and from these prevertebral plexuses fibers pass to the distal ganglia in the walls of the viscera. Thus we see that all the ganglia of the sympathetic are closely connected with the cerebro-spinal. These ganglia demedullate the spinal nerves which enter them, and more fibers leave the ganglia than enter them. These ganglia have a trophic influence over the nerves which pass from them to the periphery. They are reflex centers.

Functions of the Sympathetic System.—"In general it may be said that the sympathetic presides over involuntary movements, nutrition and secretion, holds an important influence over temperature and vaso-motor action, and is endowed with a dull sensibility." (Robinson's "Abdominal Brain.")

Independent or Dependent.—Whether the action of the sympathetic is independent or dependent is no longer subject for experiment and discussion. You have seen the heart beat after extirpation from the body; also the vermicular motion of the intestines. These are offered as evidences of independent action, but it must be borne in mind that under normal conditions the cerebro-spinal nerves can influence these activities, either repressing or augmenting them.

Ganglia.—The ganglia of the sympathetic contain (a) nerve cells, (b) afferent fibers, (c) efferent fibers—and are therefore governing centers. They are able to receive sensation and transform this into motor impulses, and hence are, in a measure, independent.

Cervical Ganglia of Importance to Osteopaths.—The cervical portion of the gangliated cord contains three ganglia which are designated as superior, middle and inferior, according to position. These ganglia are important to the osteopath, because they are in a measure affected by direct manipulation, i. e., pressure can be transmitted to them through the soft tissues over them.

Superior Cervical Ganglion.—The superior cervical ganglion lies on the rectus capitis anticus major muscle and sends branches upward which form a plexus around the internal carotid artery (carotid plexus). The cavernous plexus is a continuation of this. From these plexuses many communicating branches pass to unite with the cranial nerves of the cerebro-spinal system.

Connections.—This ganglion is connected with the first four spinal nerves and the ninth, tenth and twelfth cranial. Its branches are distributed on all the blood vessels of the head and face.

Vaso-constriction.—Physiological experiment has demonstrated that this ganglion exercises a vaso-constrictor influence over the blood vessels of the head and face.

Distribution.—"The terminal filaments from the carotid and cavernous plexuses are prolonged along the internal carotid artery, forming plexuses which entwine around the cerebral and ophthalmic arteries; along the former vessels they may be traced into the pia mater; along the latter, into the orbit, where they accompany each of the subdivisions of the vessel, a separate plexus passing with the arteria centralis retinae, into the interior of the eye-ball. The filaments prolonged on to the anterior communicating artery form a small ganglion, the Ganglion of Ribes, which serves, as mentioned above, to connect the sympathetic nerve of the right and left side." (Gray's Anatomy, page 871.)

Reasoning from the position of the ganglion, in the neck, its distribution to blood vessels of the head and face, and its vaso-constrictor functions to the vessels, we can readily understand why mechanical lesions in the upper cervical region can be the cause of grave pathological conditions in the tissues of the head and face. Anything which disturbs the normal circulation in a definite area will necessarily affect the nutrition of the tissues in that area; therefore, nutritional disorders of the eye are found to be caused by subluxation of vertebrae, or contraction of muscles in relation to the superior cervical ganglion.

Headache.—Since sympathetic branches are distributed to the blood vessels of the pia mater, we may reasonably expect to affect the caliber of these vessels in the case of congestive headache, by removing all obstructions,—e. g., contracted muscles causing dilatation—to the active functioning of the superior cervical ganglion. The distribution of these sympathetic nerves to the orbit, nose, pharynx, tonsils, palate and sinuses, explains the possibility—yes, probability—of a mechanical lesion in the upper cervical region in these cases.

Middle Cervical Ganglion.—The middle cervical ganglion is the smallest of the three. "It is placed opposite the sixth cervical vertebra, usually upon or close to the superior thyroid artery; hence the name of 'Thyroid Ganglion' assigned to it by Haller." It sends branches to the fifth and sixth spinal nerves.

Distribution.—It sends branches to accompany the inferior thyroid artery to the thyroid gland, where they communicate with the superior and recurrent laryngeal nerves. These branches regulate the caliber of the inferior thyroid artery and its branches. The chief nerve trunk passing from this ganglion is the middle cardiac nerve. The cardiac augmentors leave the spinal cord as white rami-communicantes to the second, third and fourth dorsal ganglia, then pass upward to the middle cervical ganglion. This ganglion is connected with the superior cervical ganglion.

Function.—The functions of this ganglion are (a) vaso-constrictor (through connection with the superior cervical ganglion) to the blood vessels of the head and face; (b) vaso-constrictor to the vessels of the thyroid gland; (c) augmentor influence to the heart.

Manipulation.—Therefore, inhibition (pressure) will lessen those influences, and stimulation (make-and-break pressure) will increase them. Since sympathetic centers (ganglia) control vaso-motion and secretion, we may consider that this ganglion controls vaso-motion and perspiration in the area of distribution of the fifth and sixth cervical spinal nerves.

Inferior Cervical Ganglion.—"The inferior cervical ganglion is situated between the base of the transverse process of the last cervical vertebra and the neck of the first rib, on the inner side of the superior intercostal artery."

Distribution.—It connects with the ganglion above, and the fibers which connect it with the first thoracic ganglion pass both in front of and behind the subclavian artery. Its chief branch is the inferior cardiac nerve, which communicates with the middle cardiac nerve and the recurrent laryngeal nerve. It sends gray rami-communicantes to the seventh and eighth cervical nerves; also some branches which pass upward to the vertebral artery. The fibers which encircle the subclavian artery are called the Annulus of Vieussens, and some fibers to the cardiac nerve are given off from it.

Function.—From this distribution we may draw the following conclusions as to the function of the inferior cervical ganglion: (a) It is vaso-motor to the area of distribution of the seventh and eighth cervical nerves; (b) it controls perspiration in this same area; (c) it is vaso-motor to the vertebral artery and its branches in the posterior fossa of the skull; (d) vaso-motor to the internal mammary, inferior thyroid, and nervi comes phrenici arteries; (e) augmentor influences to the heart.

Manipulation.—Treatment on this ganglion would lessen its vaso-constrictor influence over the arteries named, and they would then carry more blood at a slower rate. The stimulation of this ganglion would raise blood pressure in the area it controls, and augment the force of the heart.

Recapitulation.—It has been mentioned that the cervical ganglia receive no white rami-communicantes from the cervical nerves, and that vaso-constrictor fibers pass from cerebro-spinal to the sympathetic system in the white rami-communicantes between second dorsal and second lumbar vertebrae; therefore, the constrictor influence manifested by the cervical sympathetics is derived from the second, third and fourth dorsal. They derive fibers also from the upper thoracic region, as follows: (a) Augmentor fibers to the heart from the second, third and fourth dorsal; (b) secretory fibers to the salivary glands, second and third dorsal; (c) pupilo-dilator and motor fibers to the involuntary muscles of the eye and orbit from second and third dorsal; (d) afferent fibers whose stimulation causes activity of the vaso-motor center in the medulla.

Thoracic Ganglia.—"The thoracic portion of the gangliated cord consists of a series of ganglia which usually correspond in number to that of the vertebrae, but from the occasional coalescence of two, their number is uncertain. These ganglia are placed on each side of the spine, resting against the head of the rib and covered by the pleura costalis; the last two are, however, anterior to the rest, being placed on the sides of the bodies of the eleventh and twelfth dorsal vertebrae. The ganglia are small in size, and of a gray color. The first, larger than the rest, is of elongated form, and frequently blended with the last cervical. They are connected together by cord-like prolongations of their substance. In the thoracic region the ganglia are connected with the spinal nerves by both white and gray rami-communicantes."—(Gray's Anatomy, page 804 in 1901 Edition.)

Rami-efferentes.—The rami-efferentes or branches of distribution are divided into an internal and external set. The external branches are smaller, being distributed to the bodies of the vertebrae and their ligaments. The internal branches may properly be divided into an upper and lower group, which are distributed to the viscera of the thorax and abdomen.

Upper Five Thoracic Ganglia.—The upper five thoracic ganglia send branches which are distributed around the upper portion of the descending aorta. From the second, third and fourth ganglia are given branches to the posterior pulmonary plexus, which control the tissues of the lungs. You will remember that the pneumogastric nerves are the motor, sensory and trophic nerves to the air passages. The sympathetic, second to seventh dorsal, are vaso-motor and trophic to the blood vessels of the tissues of the lungs. We have now laid a foundation of anatomical and physiological facts upon which we may base our principles of treatment. The upper thoracic region is an important one, because in it we find not only those white rami-communicantes which are distributed to the aorta and lungs, joining with the pneumogastric nerve to complete the plexuses which control lung action, but also those white rami-communicantes which ascend to the cervical ganglia, and are distributed as follows:

Nerve Distribution.—"(1) Pupilo-dilator fibers pass by rami-communicantes from the first, second and third thoracic nerves, ascend in the sympathetic cord to the superior cervical ganglion to form arborizations around the cells. These gray fibers pass to the Gasserian Ganglion and reach the eye ball by the ophthalmic division of the fifth and long ciliary nerves; (2) motor fibers to the involuntary muscles of the orbit and eyelids, from the fourth and fifth thoracic nerves, following a similar course; (3) vaso-motor fibers to the head, secretory fibers to the submaxillary glands, and pilo-motor fibers to the head and neck, are derived from the upper thoracic nerve, and reach their area of distribution, after similar interruption, in the superior cervical ganglion; (4) the accelerator fibers to the heart are derived from the upper thoracic nerves, and end similarly in the middle and lower cervical ganglia, gray fibers in the cervical cardiac nerve completing the connection."—(Gerrish's Anatomy, page 18.)

Interscapular Region.—Therefore, we have an area extending from the second to the seventh dorsal, in which we must make careful examination for lesions affecting vasomotor, trophic and secretory activity in the thoracic viscera, upper extremities, and structures of the head, face and neck. This explains to you why a treatment in the interscapular region has such far-reaching effects.

A Case Illustrating the Cilio-spinal Center.—As an illustration of the nerve connection between the cilio-spinal center, first, second and third dorsal and the eye, I wish to call your attention to a patient now in the clinic. There was extensive inflammation of the conjunctiva of the right eye, sight in that eye was almost gone on account of the opacity caused by the inflammation of the conjunctiva over

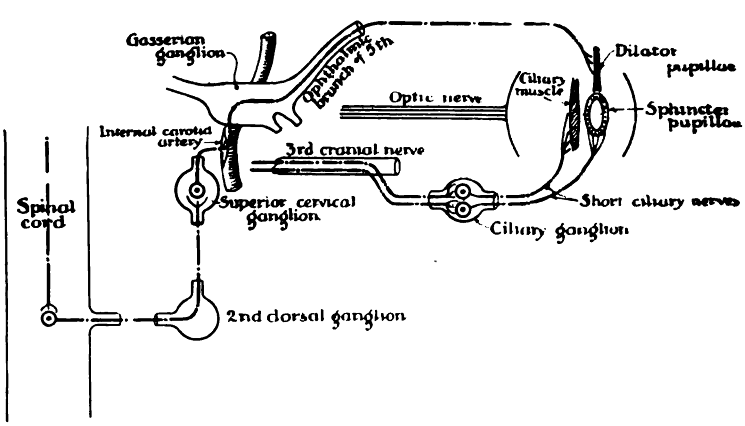


FIG. 23. Diagram showing cilio-spinal center and the course of the nerves governing accommodation of the eye to light and distance. Drawn by John Comstock (after Schultz).

the cornea. This condition was present for five years. The inflammation had traveled to the nasal duct, and as a result it was closed. The duct had been opened by the surgeon's knife long before we saw the case. A close examination of the center likely to be irritated in such a condition disclosed the fact that the area between the first and third dorsal vertebrae was exceedingly sensitive, and, most interesting of all, pressure on this area caused intense pain in the inflamed eye, and caused the pupil to dilate. The muscles in the interscapular area were very much contracted. Treatment was given, and in proportion to the amount of relaxation gained in the interscapular area, the inflammation in the conjunctiva subsided. After one month's treatment, the patient could see to thread a needle, using only the formerly diseased eye. Pressure at the third dorsal spine still causes the patient to speak of a sense of pressure or swelling in the eye. (Two years have passed since this was written. The patient has continued to have perfect use of the eye.)

The following extract from "The Osteopath" in regard to this case is of interest to us while considering the sympathetic nervous system: "It is not surprising that diseases of the eye should affect the sympathetic nerve, and that by that path the center known as the 'cilio-spinal.' But by what sensory path would the influence of pressure be carried to the eye? We know of none. From the first two dorsal nerves, which are identical with the cilio-spinal center, sympathetic fibers are distributed to the dilating muscle fibers of the iris, and when stimulated cause dilatation of the pupils. From the third dorsal nerve fibers are distributed which regulate the caliber of the blood vessels of the eye. Under the pressure, either set of these fibers may be affected. The first may be stimulated, dilating the muscles of the iris so as to press upon filaments of sensitive nerves; or, the pressure may inhibit the vaso-constrictor function of the other nerve, and by dilating the arterioles cause pressure upon the sensitive nerve; or, both causes may operate and thus induce the pain. The abundant supply of sensory nerves to the ciliary muscle, iris and cornea, from the nasal branch of the ophthalmic division of the fifth nerve and the short ciliary branches from the ciliary (lenticular or ophthalmic) ganglion makes it conceivable that any change of arterial pressure might affect these nerves to the extent of causing pain. It seems reasonable to conclude that there was no inflammation, but congestion, and partial paralysis of the vaso-constrictor nerve."—(A. E. Brotherhood, D. O., D. Sc. O., in "The Osteopath," Vol. V., No. III.)

Effects of Treatment, First to Seventh Dorsal.—Treatment in the interscapular region, first to seventh vertebrae, may reasonably be expected to affect the heart beat, the nutritional circulation in the lungs, and the circulation in the upper extremities, head, neck and face.

The remainder of the dorsal area constitutes what is called the splanchnic region. Three splanchnic nerves are given off from this region to be distributed to the prevertebral plexuses in the abdominal cavity.

The Great Splanchnics.—The first is called the Great Splanchnic and takes origin from the sixth to the tenth dorsal nerves, and probably receives many filaments from the upper dorsal nerves. It is a large nerve trunk and contains many medullated nerves from the cerebro-spinal system. Its course is downward and inward, perforates the crus of the diaphragm and ends in the semilunar ganglion. Some fibers end in the renal and suprarenal plexuses.

Lesser Splanchnic.—The Lesser Splanchnic arises from the tenth and eleventh ganglia and their connecting cord. It also takes a downward and inward course, piercing the crus of the diaphragm, and ends in the Coeliac Plexus. It communicates with the Great Splanchnic, and sometimes sends fibers to the renal plexus.

Least Splanchnic.—The Least, or Renal Splanchnic, arises from the last thoracic ganglion and ends in the renal plexus. It sometimes communicates with the lesser splanchnic.

Functions.—First, vaso-constriction; second, viscero-inhibition. I mention merely those functions which have been well demonstrated by physiological experiments and osteopathic practice.

Theory.—The osteopath reasons as follows concerning this Splanchnic area: Since the Great Splanchnic ends in the semilunar ganglion, from this ganglion and plexuses around it fibers are distributed to the blood vessels of the stomach, liver, spleen and intestines; therefore, we operate in the area between the fifth and tenth dorsal spines for vaso-motor effects on the above-mentioned viscera. Again, the Great Splanchnic sends viscero-inhibitory fibers to the muscular layers of the stomach and intestines; hence, we control excessive muscular activity in these viscera by removing obstructions to the normal inhibitory influence of these nerves. The Lesser Splanchnic has the same functions, but exercises its functions chiefly on that portion of the intestinal muscular layer comprised in the area supplied by the superior mesenteric artery; therefore, the tenth and eleventh dorsal area is a vaso-motor and motor-inhibitory center for a segment of the intestines. The renal splanchnics exert a vaso-constrictor influence on the blood vessels of the kidneys, and the osteopath secures vaso-motor effects on the blood vessels of the kidneys, and hence effects secretion by removing obstructions to the normal influence of this nerve.

The twelfth dorsal spine marks a renal center. These nerves contain sensory fibers which carry sensation from the prevertebral plexus in the abdomen to the spinal cord. Therefore, a disturbance in the viscera can reflex its painful sensations to the area of greater sensibility which is in close central connection with the seat of disturbance.

It should be borne in mind that the power of movement resides in the muscular wall of the intestine and is initiated by the Automatic Ganglia in its walls, which are excited by the pressure of food. We may state that the intestines possess an intrinsic nerve apparatus which initiates peristalsis, but the control of the movement after it is initiated is exercised by cerebro-spinal nerves. The pneumogastric nerve exercises a decided motor influence over the intestines. As previously stated, the great and lesser splanchnics are inhibitory nerves to the musculature of the intestines.

Lumbar Ganglia.—Four small ganglia, connected above and below by intercommunicating fibers, constitute the lumbar portion of the sympathetic ganglia. These ganglia are connected with the cerebro-spinal lumbar nerves by rami-communicantes. The first and second ganglia are the only ones in this region receiving white rami-communicantes. The functions which we found were exercised in the lower dorsal area are continued into the lumbar ganglia as far as the second. These ganglia send fibers to the aortic plexus, the hypogastric plexus, and thence to the pelvic plexus. They also send branches, as in other regions, to the blood vessels supplying the bones and ligaments of the spinal column.

Since vaso-constrictor fibers do not enter the sympathetic ganglia below the second lumbar, we may reasonably expect to influence the circulation of the lower extremities by manipulations in this area.

The descending colon and rectum are supplied with viscero-inhibitory fibers from this area. Vaso-constrictor fibers are supplied to the blood vessels in the lower portion of the abdomen. The influence exerted by the lumbar sympathetics may be tabulated as follows:

1st: Viscero-inhibitory to descending colon and rectum.

2nd: Vaso-constrictor to lower abdominal blood vessels.

3rd: Vaso-constrictor to the blood vessels of the penis.

4th: Vaso-motor fibers to the blood vessels of the bladder.

5th: Vaso-motor fibers to the blood vessels of the uterus.

6th: Vaso-constrictor to the blood vessels of the pelvic viscera.

7th: Motor to vas deferens (male), round ligament (female).

8th: Vaso-constrictor to the blood vessels of the lower extremities.

Sacral Ganglia.—The pelvic portion of the sympathetic chain usually consists of four ganglia situated along the inner side of the sacral foramina, and communicates with the four upper sacral nerves. These ganglia are connected with each other, as in other regions. The two chains connect by the Ganglion Impar on the anterior surface of the coccyx.

Distribution.—The rami-efferentes are distributed to the pelvic plexus; or a plexus on the middle sacral artery, and to vertebrae and ligaments in the sacral region.

"Through the pelvic plexus, the pelvic viscera are supplied with motor, vaso-motor and secretory fibers." (Gerrish's Anatomy, page 648.)

The rami-communicantes in the sacral region are gray, hence. the influence of the cerebro-spinal system is carried down from the upper lumbar ganglia.

"Below the second lumbar vertebra they are also of the gray peripheral variety." ("Abdominal Brain," page 31.)

In the sacral region the spinal nerves are distributed directly to the pelvic viscera; some fibers pass into the pelvic plexus, thence to the viscera.

The sacral region offers an area in which the osteopath can secure an influence on pelvic viscera without the extensive sympathetic connections encountered in other regions of the spine.

Function.—These sacral nerves are:

1st: Vaso-dilator to the vessels of the penis and vulva.

2nd: Motor fibers to the rectum.

3rd: Motor fibers to the bladder.

4th: Motor fibers to the uterus.

Cardiac Plexus.—The three great prevertebral plexuses must now engage our attention. The first one, the cardiac plexus, is situated at the base of the heart, and in the concavity of the arch of the aorta; this portion is called superficial, while the deep portion lies between the trachea and the aorta.

Position and Formation.—The cardiac plexus is formed by fibers from the pneumogastric and cervical cardiac sympathetics. "It is very common to find upper cervical cardiac branches of the vagus and sympathetic united to form a common trunk. In other cases, the nerves branch and communicate with each other in a plexiform manner." (Morris's Anatomy.)

The cardiac nerves form the cervical sympathetic chain; all enter the cardiac plexus, but their distribution is variable. The superficial plexus receives the "left superior cardiac nerve of the sympathetic and the left inferior cervical cardiac branch of the pneumogastric."—(Morris's Anatomy.)

The deep cardiac plexus "receives all the other cardiac nerves." From the superficial cardiac plexus branches pass to the plexus around the right coronary artery and pass to the left lung to join the anterior pulmonary plexus.

From the deep cardiac plexus branches are distributed to the anterior pulmonary plexus of both sides, the left coronary plexus, right auricle, superficial cardiac plexus, and right coronary plexus.

Pulmonary Plexus.—The anterior pulmonary plexus is formed by a branch of the pneumogastric and the sympathetic. It is situated on the anterior surface of the bronchi and the branches enter the lung on the bronchus.

The posterior pulmonary plexus is formed by the pneumogastric and fibers from the second, third and fourth thoracic ganglia of the sympathetic. Its branches enter the lung on the posterior aspect of the bronchus.

Physiology.—Physiological experiments have demonstrated that the pneumogastric is motor to the muscles of the bronchioles, sensory and trophic, while the sympathetics are vaso-motor and trophic. Therefore, the function of the lungs and heart can be affected by operating on the interscapular region.

Functions.—The functions of the thoracic plexus are:

1st: Cardiac augmentors, per sympathetics.

2nd: Cardiac inhibitor, per pneumogastric.

3rd: Vaso-constrictor to coronary arteries, per pneumogastric.

4th: Vaso-constrictor to bronchial arteries, per sympathetic, first to fifth dorsal.

5th: Sensory fibers to the pleura and lungs, per sympathetic, first to fifth dorsal.

6th: Sensory fibers to heart and pericardium, per sympathetic, second to fifth dorsal.

7th: Broncho-constrictor, per pneumogastric.

8th: Broncho-dilator, per pneumogastric.

9th: Sensory fibers to mucous lining of air passages, per pneumogastric.

Treatment.—A true inhibitory treatment would produce greatest effect on the heart, if administered over the middle and inferior cervical ganglia. The heart would be slowed. Such a treatment is rarely given, because nearly every case presents some physical lesion which, if removed, allows normal impulses to meet in the cardiac plexus and be re-organized for proper distribution.

Always bear in mind that a plexus is a re-organizing center for nervous impulses, and we can hope only to regulate the function of an organ by attempting to equalize the impulses reaching its controlling plexus. This equalizing process is not ordinarily secured by the administration of inhibition to a definite nerve trunk which ends in the plexus, but by removing a lesion,—usually bony or muscular—which is affecting the nerve fiber in the direction of increase or decrease of function.

The region between the scapulae is in close central connection with the lungs, pleura, heart and pericardium; hence, painful sensations originating in these organs may be referred to this area. The muscles in this area will contract reflexly from irritation of these organs, or from exposure of the skin over them to a change of temperature. Hence, in the first instance the contraction is a secondary lesion; in the latter, a primary one.

Pressure in this area practically causes relaxation of muscles, removes a lesion; but the patient experiences a cessation of pain, freer respiration, and less rapid action of the heart.

Results.—After administering inhibitory pressure, the osteopath realizes that the muscles under his fingers are softer than formerly; then he knows that he has actually changed the physiological condition of an important tissue.

Argument.—Coincident with the softening of the muscles, the heart beats slower; therefore, he has removed an irritant to the augmentor fibers of the heart; the respiration is deeper, therefore a change has been secured in the activity of the walls of the thorax, and in the circulation of blood in the bronchial and pulmonary blood vessels; the pain has decreased, therefore the sensory nerves in the lung tissue are no longer irritated by hyperaemic pressure or toxic substances in the blood. This illustrates to you why the osteopath studies and treats the interscapular region so carefully.

Solar Plexus.—In the abdominal cavity we find the solar plexus, which on account of its great size and wonderful distribution, Byron Robinson calls the "Abdominal Brain."

Location and Formation.—It is placed in front of the aorta at its entrance into the abdomen, and surrounds the Coeliac Axis. It consists of two semilunar ganglia, which are placed on each side of the coeliac axis, and are connected by a large number of fibers which pass above and below the coeliac axis. From this circle of ganglia and nerves, fibers are given off which are joined by branches of the right pneumogastric, and by both small splanchnics. The great splanchnic ends in the semilunar ganglion.

Distribution.—The branches of distribution from the solar plexus are prolonged on the branches of the abdominal aorta as subsidiary plexuses, taking their names from the arteries they accompany, as splenic, gastric, hepatic, diaphragmatic, suprarenal and renal, superior mesenteric, inferior mesenteric, aortic and spermatic. The ultimate distribution of the branches of the solar plexus is to the muscular and secretory tissues of all the abdominal viscera, and to the muscular coat of the arteries supplying these viscera. This great plexus is the vaso-motor center for the abdominal viscera. "It is connected with almost every organ in the body, with a supremacy over visceral circulation, with a control over visceral secretion and nutrition, with a reflex influence over the heart that often leads to fainting, and may even lead to fatality."—"Abdominal Brain," page 76.

Function.—We find that the great and the small splanchnics and right pneumogastric are the chief contributors to the solar plexus, and in order to get a clear idea of the functions of this plexus, we may tabulate them as follows:

1st: Viscero-motor to stomach, small intestines, as far as sigmoid flexure, per pneumogastric.

2nd: Sensory to stomach and small intestines, per pneumogastric.

"If the pneumogastric nerve be divided during full digestion in a living animal, in which a gastric fistula has been established, so that the interior of the stomach can be examined, the muscular contractions will be observed to cease instantly; the mucous membrane to become pale and flaccid; the secretion of the gastric juice to be arrested, and the organ to have become insensible. There can be no doubt, also, that stimulation of the pneumogastric nerves causes the stomach to contract, and that digestion may, to a certain extent, at least, be re-established by stimulation of the peripheral extremities of the divided nerves."—(Chapman's Phys., page 680.)

3rd: Viscero-inhibitory, per splanchnics.

4th: Vaso-motor, per splanchnics.

5th: Sensory, per splanchnics.

6th: Sensory, per pneumogastric and splanchnics.

The fibers of the great and small splanchnics come from the sympathetic ganglia in the dorsal region, sixth to eleventh.

These ganglia may receive fibers from some of the upper dorsal.

Centers.—The facts just stated give us a foundation for osteopathic treatment to influence motion, sensation, secretion, and vaso-motion in the abdominal viscera. The area in the vertebral column which we may consider as containing centers for these various functions lies between the sixth and eleventh dorsal spines. The fibers from this region have a segmental distribution to the abdominal viscera; therefore, the stomach, liver, gall bladder, spleen and intestines each have a limited portion of this area which is their special center; at least, painful sensations are reflexed from them to a definite point in the vertebral column between the sixth and eleventh dorsal spines. The enormous regulative influence which can be excited by an osteopathic treatment in this area is being demonstrated daily.

We have already mentioned the fact that the intestines will contract after being separated from the body, thereby proving that the intrinsic power to cause movement lies in the nervous mechanism in the gut walls. Keep constantly in mind the regulative character of the impulses which enter the "abdominal brain" over the pneumogastric and splanchnic nerves.

The vaso-motor phenomena in this area have been discussed in another chapter.

Hypogastric Plexus—Location and Formation. — The great re-organizing center for the pelvic viscera is called the hypogastric plexus, which lies anterior to the fifth lumbar vertebra. It is formed by a continuation of fibers from the aortic plexus which are joined by fibers from the lumbar sympathetic ganglia. In front of the sacrum the plexus divides into two portions, which join the pelvic plexuses lying on each side of the rectum and bladder, in the male, and of the rectum, vagina and bladder in the female.

Pelvic Plexus.—These pelvic plexuses contain many small ganglia, and are joined by fibers from the upper sacral sympathetic ganglia, and by direct branches of the second, third and fourth sacral cerebro-spinal nerves.

Distribution.—The branches of these plexuses are distributed on the coats of the arteries to the pelvic viscera, and frequently enter the substance of the organ.

Subsidiary Plexuses.—According to the artery followed, we have subsidiary plexuses, called hemorrhoidal, visceral, prostatic, vaginal and uterine.

Functions.—The functions of the pelvic plexus are as follows:

(1) Vaso-constrictor, (2) vaso-motor, (3) sensory, (4) viscero-inhibitor, per hypogastric plexus.

(5) Motor to rectum, vagina and bladder, (6) sensory to rectum, vagina and bladder, (7) vaso-dilator to sexual organs, erectile tissue, (8) viscero-constrictor to neck of uterus, per second, third and fourth sacral.

Summary.—With the arrangement and functions of these nerves well in mind, we recognize two paths over which we can influence the pelvic viscera:

(1) Sensory influences may be reflexed through the hypogastric plexus, and thence to the second lumbar; or, they may pass over sacral nerves to the same point, second lumbar. In connection with disturbance of the pelvic viscera, pain may be reflexed on to the back of the sacrum, or to an area around the second lumbar. Disturbance of function in the uterus causes reflex sensitiveness at fourth and fifth lumbar.

(2) Vaso-constrictor influences come through hypogastric plexus from spinal nerves about second lumbar.

(3) Vaso-dilator influences come directly to the pelvic plexuses from second and third sacral nerves; nervi erigentes.

(4) Viscero-motor influences chiefly from second, third and fourth sacral.

(5) Viscero-inhibitory influences, chiefly through hypogastric plexus, probably from upper lumbar spinal nerves.

We have therefore a vaso-constrictor center for pelvic viscera at second lumbar; a vaso-dilator and motor center at second and third sacral.

Automatic Visceral Ganglia.—The last portion of the sympathetic is but little known, and physiologists have refrained from speculating on it until more definite knowledge is obtained.

Byron Robinson mentions a number of "automatic visceral ganglia" situated in the walls of the hollow viscera. The fact that the heart, intestines, uterus, bladder and fallopian tubes will contract rhythmically in response to mechanical stimulation after all nerve connections are severed, seems to prove the existence of ganglia in the walls of these viscera which are capable of receiving sensation and sending out motor impulses.

Conclusions.—We will therefore conclude that the sympathetic system can act independently of the cerebro-spinal; that it receives sensation, and initiates motion; gives tone to the arteries, and controls secretion. We influence the functions of the sympathetic through its connection with the cerebro-spinal system.

CHAPTER IX.

CIRCULATORY TISSUE.

From the histological standpoint, blood conforms to the general definition of a tissue, being composed of a cellular and intercellular substance. The intercellular substance, being liquid, differentiates it greatly from other tissues. It contains cellular elements which differ from each other in form and function. Then, too, it is a moving tissue enclosed in a system of closed tubes.

Functions.—The blood performs many functions. These may be stated in general terms as follows:

1. To convey nutrition to all other tissues.
2. To remove waste products from the tissues.
3. To convey oxygen for tissue respiration.
4. To distribute heat.
5. To repel invasion of bacteria.

Lymph.—Lymph is another liquid tissue, less rich in corpuscular elements, but greater in total bulk than the blood. The lymph comes in direct contact with the elements of the tissues. Stewart states the relationship tersely when he says, "The blood feeds the lymph and the lymph feeds the cell."

Since we think of individual tissues as possessing some one well developed attribute or function, it is well to call blood and its congener, lymph, the media of exchange. This expression covers at least four of the functions previously mentioned.

With this comprehensive but short statement of the relation of these liquid tissues to the structural, contractile, irritable and secretory tissues, it seems hardly necessary to discuss so self-evident a proposition as that health primarily depends on a perfect circulation. It is not even necessary to add to this the fact that the blood should be pure, because under ordinary circumstances if the blood circulates properly it will become purified.

All schools of medicine have a therapeutic principle around which their practice is built. From its earliest inception the osteopathic idea has been that a perfect circulation is the foundation for perfect health.

The proportion of blood to body weight is about one-twelfth of the whole, i. e., twelve pounds of blood in a body weighing 150 pounds. This amount of blood is distributed approximately as follows: One-fourth to the heart, lungs and great blood vessels; one-fourth to the liver; one-fourth to the resting muscles; one-fourth to the remaining organs. There is not blood enough in the body to maintain all of its activities at the maximum at the same time. Therefore it is difficult to do the best physical or mental labor just after digestion has begun. The splanchnic blood vessels are capable of containing so large a proportion of the whole amount of blood that death may result from lack of sufficient blood returning to the heart to cause it to beat.

Distribution of the Blood.—Granting that the blood possesses all these functions, the question still confronts us, how can we affect its distribution? This question leads us to a consideration of the physiological distribution of the blood. It is believed by the writer that nothing besides the use of water has so great an effect on the circulation of the blood as manipulation according to osteopathic methods. These methods do not depend on a mere physical assistance of the venous flow by means of centripetal stroking, such as is employed by a masseur. Effects on circulation are obtained in nearly all cases by knowing where definite nerves which control the action of the heart and blood vessels are placed and what their action in response to irritation may be. All manipulations are given with a definite knowledge of the location of blood vessels and the nerve centers which control their variation in caliber. The response secured is a new coordination of the whole circulation brought about under the control of the nerve centers.

It has been stated that the blood is contained in a closed system of tubes. A short resume of the most important points in the anatomy and physiology of the circulation may prepare us for a clearer insight of the modus operandi of osteopathic methods.

The Circulatory Apparatus.—The circulatory apparatus consists of the heart, arteries, capillaries, veins and lymphatics; some writers include the spleen.

Muscular tissue is found in the heart, small arteries and veins. The heart is practically all muscle, and its contractions are governed by two sets of nerve fibers from the cerebro-spinal system; the first set is called accelerator; second, inhibitory.

Likewise, the small arteries and veins have two sets of fibers which increase and decrease the intensity of the contraction of their muscular fibers, and thus change the caliber of the vessels.

The capillaries are short, narrow tubes, having a thin wall composed of nucleated cells which possess the power of contraction. So far as known, the capillaries expand and contract in response to the degree of physical pressure exerted by the blood current coming from the arterioles. Thus the change in the caliber of the capillaries is passive. The lymphatics begin in small irregular spaces in the cellular tissue outside of the blood vessels. They are found in direct relation with the cells of perivascular tissues, thus bringing the lymph to each cell. These openings lead to small lymphatic vessels which convey the lymph to the lymphatic glands which are situated so as to filter out the impurities, after which it is emptied into the venous circulation by the lymphatic ducts. The lymphatic vessels possess power of contraction. The lymph equals about one-third of the body weight.

The blood is a passively moving tissue. It is kept in constant circulation within a closed system of tubes by a combination of forces. The propulsion of the blood is almost entirely accomplished by the contraction of the heart. This initial force is supplemented by the aspiration of the chest during respiration, and the contraction of the skeletal muscles of the entire body. It is a debatable question whether or not the muscular coat of the arterioles and venules assist in the direct propulsion of the blood passing through them.

It is the function of the heart to maintain a comparatively uniform tension of the blood in the large arteries. The arterioles and capillaries are concerned in maintaining resistance to the passage of the blood. The degree of resistance in the capillaries, in large measure, determines the amount of nourishment received by the tissues. The relation between capillary resistance to the passage of the blood and the metabolism carried on in perivascular tissues is a point of great importance. The current of blood ordinarily passes through the capillaries very slowly, at a rate of one inch in two minutes, and under low tension, thus giving ample opportunity for the escape of nourishing material for the surrounding tissues.

Tension in the arteries is maintained by three factors: (1) The initial force of the heart beat; (2) friction in the vessels; (3) elasticity of the vessel walls. The first and third of these factors are under nerve control which act according to a large number of stimuli.

The capillaries being passive in action, the tension of the blood stream in them is mainly dependent on the tension in the arterioles. It may be profitably noted that after the initial impulse is given to the blood stream by the heart, the distribution of this blood depends solely on the arteries, arterioles and capillaries. This peripheral distributive mechanism is therefore responsible for the nutrition of the tissues, and its resistance offered to the passage of the blood regulates the amount of force exerted by the heart.

Manipulatory treatments, according to the best authorities writing on massage and Swedish movements, have for their object the acceleration of the blood flow on the venous side of the general circulation. •Osteopathic manipulations are essentially directed to the active instead of the passive side of the circulation.

The osteopath makes use daily of the vaso-motor nerves in order to control the circulation of the blood in local areas; therefore, it is necessary to make a detailed study of this wonderful mechanism in order to achieve the best results in practice.

The more we know of structure and function, the more rational ought our methods of treatment to be, because we will then have no excuse for using methods which do not have a scientific basis to recommend them.

The Heart.—In order to affect the active side of the circulation our manipulations must affect the heart beat. There are two sets of nerve fibers arising in the cerebrospinal system which exert a regulating influence on the beat of the heart. Heart muscle possesses an inherent power of rhythmical contraction. It will beat rhythmically for hours if the muscle be kept moist with a one per cent salt solution.

Contraction begins in the auricles and ends in the ventricles; hence, it is thought that the auricular rhythm is transmitted to the ventricle. Any influence which changes the auricular rhythm also changes the ventricular rhythm.

Regulation of Contraction.—Since the heart possesses inherent power of rhythmic contraction, the nervous system acts as a regulator of the rate of contraction. The two centers of cardiac control act in a manner to increase or decrease the rate. The speed of the blood current is dependent on the rate and strength of the cardiac contractions. The pressure of the blood is dependent on the rate and strength of the cardiac contractions, together with the resistance offered by the arterioles and capillaries. Considering the arterioles and capillaries as possessing fixed diameters, an increase in the number and strength of the heart beats would increase the speed and pressure of the blood current. A lessened cardiac activity would have the opposite effect. The speed and pressure of the blood stream may vary within wide limits and still maintain a fair degree of health.

Coordinating Centers.—The nerve impulses reaching the heart are coordinated in two governing centers in the cerebro-spinal system. These centers are located in the bulb. The inhibitory center is connected with cells in the walls of the heart by fibers which form a part of the pneumogastric nerve. Section of the pneumogastric nerve removes the inhibitory influence over the heart's action. Stimulation of this nerve slows the heart. The relaxation period is lengthened which results in greater filling of the heart and the pressure in the veins is increased while arterial pressure decreases. These results have been noted by many physiologists.

The Pneumogastric Nerve.—The pneumogastric is one of the nerve trunks which can be reached by direct pressure made through the skin and muscles of the neck. Its inhibitory action can be aroused by pinching the sterno-cleidomastoid muscle between the thumb and forefinger, taking care to work deeply under the internal margin of the muscle.

It is no uncommon phenomenon to have a patient faint as a result of this manipulation. Individuals differ greatly as to their response to this stimulation. The stimulation should be a gentle pressure of a constantly varying intensity.

A pulse tracing is appended, Fig. 24, which shows the results of stimulating the pneumogastric in the manner just described. The gentleman upon whom the experiment was made was in excellent health, and possessed a quiet, well-balanced temperament. The tracing shows that the number and force of the beats was lessened and the arterial pressure decreased. This tracing is probably

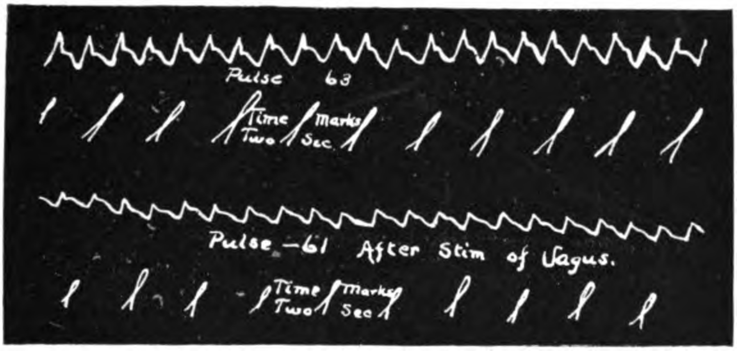


FIG. 24. Stimulation of the pneumogastric by pinching the nerve trunk in the neck.

typical of the change, in a well person, in response to stimulation of the pneumogastric. No sensation of faintness or other disagreeable feeling was noted.

The inhibitory action of the pneumogastric seems to be most active in individuals who suffer from some disorder of the digestive tract. In such patients the constant irritation of the sensory fibers of the pneumogastric, which arise in the mucosa of the digestive viscera, seems to increase the irritability of the whole nerve trunk to such a delicate point that the slightest stimulation made at any point along the course of the nerve will excite its inhibitory action. Many osteopaths, just starting in practice, have had their self-possession severely tried by a patient fainting during manipulation of the neck. I have never heard of any fatal results from manipulation of the pneumogastric. Why stimulation of the pneumogastric should result in cardiac inhibition rather than in phenomena connected with its other branches seems incapable of explanation.

Sometimes spasm of the laryngeal muscles will accompany cardiac inhibition.

The intensity of action of the pneumogastrics is so well known to experienced osteopaths that they are careful to test its irritableness in cases before undertaking any extensive manipulations along its course.

The inhibitory center is continually active and acts according to the blood pressure within the arteries. A rise in peripheral resistance causes a decrease in number and strength of the heart beats.

Accelerator Center.—The accelerator center is connected with the heart by fibers which descend in the cord to the upper portion of the dorsal region; here connection is made with the cells whose fibers pass to the sympathetic spinal ganglia, first, second and third dorsal, and end there around other cells whose fibers convey their impulses to the heart.

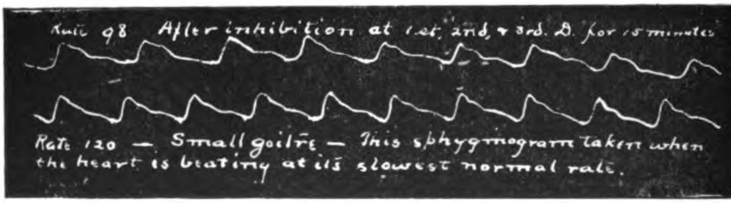


FIG. 25. Sphygmograms illustrating the effect of inhibition, first, second and third dorsal.

The action of the accelerator center is not so readily demonstrated as is the case with the inhibitory center. It causes the heart to beat faster and stronger, thus bringing about a rise in arterial blood pressure and a fall in venous pressure. This center acts in response to lowered peripheral resistance. The products of metabolism brought about by physical exercise also excite it. Deep, steady pressure made on the muscles lying on each side of the first, second and third dorsal spines causes a decrease in the rapidity of the heart's action.

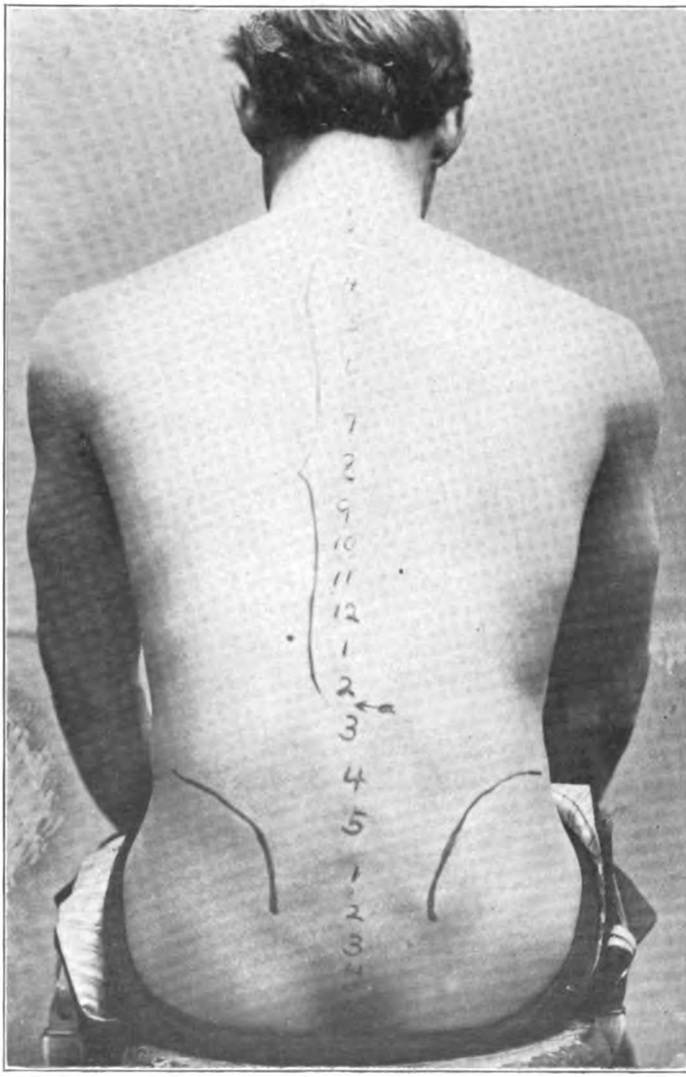


FIG. 26. Vaso-constrictor area, second dorsal to second lumbar.

Stimulation of the Heart.—A make and break pressure made at the edge of the sternum in the first and second intercostal spaces will usually stimulate the heart. Sometimes the first effect is inhibition, but it quickly passes to stimulation. The manipulation made anteriorly increases the number and intensity of the stimuli reaching the segment of the cord from which the accelerator nerves pass out. All centers act according to the sum of the stimuli reaching them from all sources.

Inhibition of the Heart.—In cases of rapid heart beat with high tension pulse the best effects are secured by digital pressure at first, second and third dorsal spines. The pneumogastrics have too many branches to important viscera and act frequently with unexpected intensity. The accelerators act more slowly with less intensity and the action is sustained longer, that is, as a result of manipulation.

Vaso-motor Control of the Coronary Arteries.—A further factor in relation to the regulation of the heart's action is the blood supply for the nourishment of the heart. All organs act with greater force when their blood supply is abundant. The heart beats stronger when its coronary arteries are dilated than when constricted, therefore the power of the heart depends on the vaso-motor control of its own arteries. The vaso-motor nerves to the coronary arteries leave the cerebro-spinal system between the third and fifth dorsal spines. In cases of angina pectoris, this area will be sensitive. Steady pressure here will dilate the coronary arteries and ease the pain. A sharp stroke with the hypothenar eminence on the fourth dorsal spine will nearly always start an attack with such patients.

Angina Pectoris.—Physiologists name the pneumogastric nerve as the vaso-motor nerve to the coronary arteries. I mention the area, third to fifth dorsal, as a vaso-motor center for the coronary arteries because clinical experience seems to demonstrate it. Other osteopaths have noted the frequency of lesions in this area in connection with heart difficulties. The lesions are contracted muscles, lateral subluxations of the vertebrae or in some instances subluxations of the fourth and fifth ribs. With any of these lesions there is intense sensitiveness.

Dr. George Keith of Scotland mentions digital pressure in the second left intercostal space as a means of inhibiting an attack of angina pectoris, and suggests the nerve connection of the pneumogastric as being the nerve path over which the inhibitory impulse travels.

Persons suffering with angina pectoris will press their hands, with all the force they possess, against the left chest. I have used heavy digital pressure on the left side of the fourth and fifth dorsal spines while the patient was in a paroxysm of pain. The pressure never failed to be grateful to the patient. A further experiment with this center was made by extending the patient in a recumbent position. While extension was maintained the angles of the ribs could be raised, the left arm could be extended over the head, a full inspiration could be taken, but as soon as the vertebrae were allowed to approximate as a result of cessation of extension, these things could not be done.

Heat, digital pressure and counter irritation are capable of causing vaso-constrictor paralysis, i. e., vaso-dilation, and hence increase the power of the heart in such cases.

Action of the Heart Centers.—The governing centers of the heart act principally according to the peripheral resistance maintained by the blood vessels. The heart possesses a nerve called the depressor nerve. Its endings are in the walls of the heart and are affected by the pressure of the blood within the heart. A rise in arterial pressure is followed by a rise in pressure within the heart. The depressor nerve notes this fact and carries an inhibitory impulse to the vaso-dilator center in the medulla, thus bringing about a fall in arterial pressure. In this way the heart is protected from over-exertion as a result of too high pressure.

In cases having rapid, weak heart action, inhibit the accelerators to slow the heart, also inhibit in the area of vaso-motor control of the coronary arteries to increase the amount of blood for nourishment to the heart muscle, thus increasing the strength of the beat.

In cases of rapid, high tension pulse, inhibit the splanchnics and in the suboccipital fossae to lessen peripheral resistance, also inhibit the accelerators or stimulate the pneumogastrics.

Vaso-motor Nerves.—In 1840 Henle discovered and demonstrated the muscular coat of the arteries, and as a result of this step forward we have our present knowledge of the vaso-motor nerves. Associated with the demonstration of these nerves we have the names of Brown-Sequard, Bernard, Waller and Schiff.

It has been proven that two sets of fibers innervate the muscles of the arteries; a vaso-constrictor set, which causes a decrease in the caliber; and a vaso-dilator set which causes an increase in caliber. The constrictors were demonstrated first.

Henle said "the movement of the blood depends on the heart, but its distribution depends on the vessels." We have followed the phenomena in connection with the first part of this quotation, hence it remains for us to study the part played by the vessels in the distribution of the blood.

In order to carry our thoughts along in a proper manner, we will commence at the center and work toward the periphery.

The chief vaso-motor center is in the medulla. Destruction of this center causes an immediate fall of blood pressure all over the body. Stimulation of this center causes a general rise of blood pressure.

There are subsidiary centers situated at various levels in the spinal cord.

After the spinal cord is severed, that portion which is no longer connected with the chief vaso-motor center will exercise a vaso-constrictor influence over the blood vessels in its area of normal control. "It is probable that they are normally subordinate to the bulbar nerve cells."

After all connection between the cerebro-spinal system and sympathetic spinal ganglia is cut off, the tone of the blood vessels is maintained, after a short interval, by the sympathetic ganglia.

By commencing at the center and destroying it, then the centers in the spinal cord assume control; destruction of these leaves the sympathetic spinal ganglia active; hence by this process of exclusion we find that the true vaso-motor cells are sympathetic and lie in the spinal ganglia. From these cells in the spinal ganglia-axis cylinder processes pass as gray fibers to blood vessels. These ganglia cells are controlled by fibers from the chief vaso-motor center in the medulla which end around the subsidiary cells in the spinal cord, the neuraxons of these latter terminating by filaments which surround the true vaso-motor cells in the sympathetic spinal ganglia.

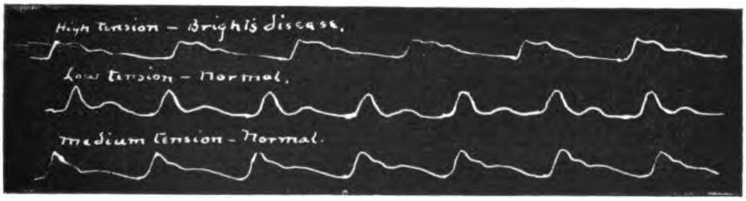


FIG. 27. Arterial tension is manifested in a sphygmogram by the relative height of the aortic notch. The upper tracing shows the aortic notch on a straight line drawn from the top of one percussion wave to the bottom of the next. The middle tracing shows this notch very low.

Since gray rami-communicantes pass from the spinal sympathetic ganglia to the spinal nerves and are distributed with them to the skin and blood vessels, we can influence the distribution of the blood generally and locally by increasing or decreasing the number of sensory impulses, originating in the skin and muscle, which may reach the vaso-motor centers.

"The vaso-motor apparatus consists, then, of three classes of nerve cells. The cell bodies of the first class lie in sympathetic ganglia, their neuraxons passing directly to the smooth muscle in the walls of the vessels; the second are stimulated at different levels in the cerebro-spinal axis, their neuraxons passing hence to the sympathetic ganglia by way of spinal and cranial nerves; and the third are placed in the bulb and control the second through intraspinal and intracranial paths. The nerve cell of the first class lies wholly without the cerebro-spinal axis, the third wholly within it, while the second is partly within and partly without, and binds together the remaining two." Am. Text-book of Physiology.

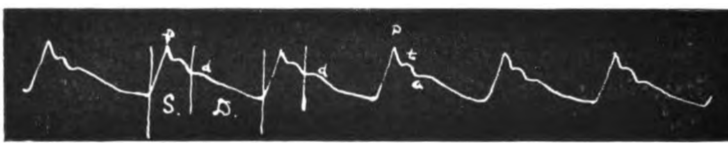


FIG. 28. The signification of a sphygmogram. The space S is the period of ventricular systole when the aortic valves are open; the space D the period of ventricular diastole; t, the tidal wave due to the ventricular systole; p, the percussion wave due to instrumental defect; a is the aortic notch which marks the closure of the aortic valves; d, the dicrotic wave.

Vaso-constriction.—The vaso-constrictor nerves which pass from the bulbar and spinal centers of control leave the cord as white rami-communicantes from the anterior roots of the second dorsal to the second lumbar nerves and enter the sympathetic ganglia to be distributed as has been described before. It is believed that all of these vaso-constrictor fibers end in the ganglia, thus exerting their influence on the true vaso-motor cells in the ganglia which alone send fibers to the blood vessels. All these constrictor nerves are gray.

Vaso-dilation.—The vaso-dilator fibers are not restricted to any one portion of the cord or brain, but pass out with both cranial and spinal nerves, and do not lose their sheaths until they reach their destination. They are best demonstrated in those regions of the cerebro-spinal system from which vaso-constrictors do not arise. The vaso-dilators from the head, face, salivary glands, etc., pass to their destination with the cranial nerves supplying these parts. They do not end in the sympathetics. They probably leave the cord in the anterior roots of the spinal nerves and pass to the periphery without interruption. The vaso-dilators, leaving the cord in the same region as the vaso-constrictors to be distributed to the visceral blood vessels probably pass out by the ventral roots and reach their destination without losing their sheaths in the sympathetic ganglia.

FIG. 29. Sphygmograms illustrating Tachycardia and Brachycardia. Upper tracing—radial pulse of a woman exhibiting great nervousness, a small goitre but no exophthalmos. Lower tracing—radial pulse of a young man whose power of recalling past events of his life was suddenly lost. Result of mental shock.

No distinct centers for vaso-dilator fibers have been demonstrated. They probably arise from segments of the brain and spinal cord and their influence is carried along the paths of motor nerves and is exerted in a local area.

Summary.—1. The vaso-dilator nerves are cerebro-spinal; (a) and are not demedullated in the sympathetic ganglia. (b) They are distributed principally to the arteries of the muscles, (c) and leave the cerebro-spinal axis with the motor nerves from all portions. (d) Their influence is local.

2. The vaso-constrictors are essentially neuraxons of sympathetic cells in the spinal ganglia; (a) are gray fibers; (b) are distributed to viscera and cutaneous blood vessels; (c) and are probably continuous in action to maintain the

tone of the vascular system. (d) The vaso-motor cells in the sympathetic ganglia can act independently, (e) but are normally under the control of the cells in the spinal cord whose neuraxons end in the spinal ganglia. (f) These cells in the spinal cord are under the influence of neuraxons of cells in the medulla which constitute the chief vaso-motor center. (g) Therefore, the vaso-constrictor influence is both local and general. (h) The controlling fibers leave the cord in the ventral roots of the second dorsal to the second lumbar nerves only.

Sensory Nerves.—We have now considered in detail only one side of the vaso-motor mechanism, the motor. We have yet to note the sensory side, that which calls forth the motor response. If there were no chief or spinal vaso-motor centers to transfer sensory impulses to the vaso-constrictor cells in the spinal ganglia, the blood vessels in the viscera and skin could not contract or relax according to the necessity for greater or lesser amounts of heat in the deep or superficial areas.

The vaso-motor centers in the brain and cord send out impulses in response to sensory stimulation; this sensory stimulation is usually of a thermal or mechanical character.

It is difficult to realize the extent of the distribution of sensory nerves. "They are located not only in those places usually known to be sensitive, but also in all other tissues and organs. Whether one examine the liver or the kidney, lung or the wall of a blood vessel, one always finds delicate nerve arborizations in unsuspected numbers. A large portion of them end probably in the peripherally placed end cells belonging to the reflex arc of the sympathetic; another portion may very probably be traced to the spinal ganglia, and even to the spinal cord itself, especially the investigations of the past two years, making use of the silver and methyl blue stains, have not only disclosed the wealth of nerves in the different organs, but have also shown that we have regarded the sensory innervation of the sensitive surfaces, as the skin and the gustatory-mucous membrane as much less fully explained than they really are. One finds there numerous plexuses of nerve fibers beneath and between the epithelial cells, and they send one, often many, fine fibrils to each cell." * * * "In the liver, too, and the bladder, and many other places, one can find numerous examples of the abundant peripheral innervation. We have always given too great importance to the single end apparatus, overlooking the fact that really the major portion of the body tissues is supplied with nerves for every cell. One can hardly overestimate the wealth of nerve fibers in the end organs themselves, as the taste papillae and the tactile papillae. Good staining discloses with each of them plexuses of unexpected density of arborization."

"For what services may such an abundant sensory innervation be provided? It occurs immediately to one that there are a great number of reflexes, very necessary to the preservation of the individual, even though he be unaware of them. The regulation of the secretions, the blood supply to the skin in relation to the caloric body economy of the organism, the adjustment to varying illumination, the tension of the muscles and tendons through the respective tendon reflexes, the different response by such varying tensions according to the intensity of the voluntary impulse, and many other phenomena could be cited. To all of them is necessary, besides the motor part of the reflex arc, a sensory part. Indeed, Exner, to whom we are indebted for indicating the importance of these short reflex arcs and the roles they play in the organism, has pointed out how, in general, for the production of any movement the sensory innervation must be intact."

"By 'sensory innervation,' however, one must not think only those processes are meant which enter into our consciousness, but rather all those by which from any place in the body impressions are conducted to the nearest ganglion, or to the central axis. Whether they be conducted farther still, or whether they be recognized by the individual as they occur does not affect their nature. Sensation and perception are not the same thing."—Anatomy of the Central Nervous System in Man and in Vertebrates in General.—Edinger.

Thus we find that there are abundant sensory nerves in superficial and deep tissue to receive the mechanical stimuli which the osteopath may project upon them.

Recent investigations prove that many conditions which have previously been called inflammation are, in reality, congestions due to vaso-constrictor paralysis, and can be corrected by stimulation of the vaso-constrictor center governing the congested area; the stimulation of such center being secured by mechanical stimuli applied to the sensory nerves ending in the center.

The vaso-motor mechanism responds quickly to osteopathic manipulation, and is our means of correcting any disturbance of circulation, both local and general.

Since the blood carries the nourishment for the tissues, and the vaso-motors control the distribution of the blood, the vaso-motor nerves are trophic nerves. In the same sense they are secretory nerves.

Capillary Circulation.—The capillary circulation is dependent on the state of the arterioles. Their walls are formed by endothelial cells which are elastic, and hence respond to the force of the blood which enters them. If the vaso-constrictors are active in a local area the resistance offered to the passage of the blood current by the arterioles is increased, and therefore the pressure exerted on the capillary walls is lessened, allowing the capillaries to contract. If the vaso-constrictor influence over the arterioles be lessened, the blood current is allowed to exert its pressure on the capillary walls, thus increasing the caliber of the capillary.

If, in a large area of the body, vaso-constrictors are active, the influence of this resistance is felt by the heart, which immediately beats harder to overcome the resistance to the passage of the blood through the constricted arteries. The heart is usually relieved by compensatory dilatation of the arteries in some other area. The visceral and cutaneous arteries usually counter-balance each other in this way. This counter-balancing effect is probably brought about through the sensory impressions sent out irom an overworked heart to the vaso-motor center, thus causing a lessened constrictor effect in some portions of the body.

The relaxation of all the arteries of the body would cause death, because the blood would gravitate to the most dependent part, and there is not blood enough to fill all the arteries when relaxed. A slight relaxation of general blood pressure causes the heart to beat more rapidly for a short time. Relaxation of the peripheral blood vessels is noted by the increased warmth and redness of the area in which relaxation takes place.

Recapitulation.—To recapitulate: (1) Capillary circulation is passive. (2) Vaso-constriction of the arterioles causes a decrease in the lumen of the capillary. (3) Vaso-dilation of the arterioles causes increase in the lumen of the capillary. (4) General vaso-constriction of the cutaneous blood vessels slows the heart and causes it to work against higher pressure, but the heart is relieved by relaxation of blood vessels in visceral areas, chiefly the splanchnics. (5) Decrease of constrictor effect on superficial vessels causes a more rapid heart beat, which is quickly controlled by constriction in the splanchnic area. (6) The vaso-motor center in the medulla acts according to the sum of the sensory influences reaching it from all parts of the body. (7) The spinal vaso-motor centers act according to the influences sent to them by the chief center and the sensory impulses which enter their segment of the cord.

Vaso-motor Centers.—The vaso-motor centers for the various viscera, organs and members are as follows:

HEAD: The superior cervical ganglion.

EYE: The superior cervical ganglion through the fifth nerve.

NOSE, THROAT, TONSILS, TONGUE and GUMS: By the same path. Dilator fibers for the tongue per the lingual branch of the fifth cranial nerve.

BRAIN: "Sherrington and others have demonstrated the presence of vaso-motor nerves in the vessels of the brain. It is probable that the cerebral circulation is wholly dependent upon the general blood pressure, and, inasmuch as the general blood pressure is very markedly regulated by the capacious splanchnic area, it is obvious that the cerebral circulation may be better controlled by modifying the blood supply of the splanchnic area than by any attempts at the modification of the cerebral circulation itself."

Sympathetic fibers to the anterior and middle fossae come from the superior cervical ganglion per the carotid plexus. Sympathetic fibers are distributed to the vessels in the posterior fossa from the vertebral plexus which is formed by fibers from the inferior cervical ganglion.

THYROID GLAND: Middle and inferior cervical ganglion.

The vaso-constrictors for the blood vessels of the head, face and neck with their contained organs leave the spinal cord in the upper dorsal, second to fifth, and pass thence through the cervical ganglion.

LUNGS: Second to the sixth dorsal.

INTESTINES: The vaso-constrictors for the mesenteric blood vessels are found in the splanchnic nerves. Commencing at the fifth dorsal, there is a segmental distribution to the various portions of the intestines. The lowest constrictor influence comes from the second lumbar. Vaso-dilator fibers are also found in the splanchnics.

LIVER: Sixth to tenth dorsal, right side.

KIDNEY: Tenth to twelfth dorsal.

SPLEEN: Ninth, tenth and eleventh dorsal, left side. The vagus is a motor nerve to the muscular fibers in the trabeculae of the spleen.

PORTAL SYSTEM: Fifth to ninth dorsal.

EXTERNAL GENERATIVE ORGANS: First and second lumbar, through the lumbar sympathetic ganglia, second to the fifth, to the hypogastric plexus, thence through the pelvic plexuses and pudic nerves to the generative organs. Function, vaso-constriction. First, second and third sacral nerves are vaso-dilators to the same organs.

INTERNAL GENERATIVE ORGANS: Vaso-constrictor influence at first and second lumbar.

ARTERIES TO THE SKIN OF THE BACK: Vaso-constrictor influence from sympathetic ganglion of the corresponding segment.

UPPER EXTREMITY: Vaso-constrictor influence to the skin, from second to the seventh dorsal.

LOWER EXTREMITY: Sixth dorsal to second lumbar.

MUSCLES: Dilator influence to the arteries of the muscles per motor nerves to the muscles.

Conclusions.—Vaso-motor nerves are of two classes, viz: Vaso-constrictor and vaso-dilator. These nerves act according to the sum of the stimuli reaching their governing center over sensory nerves of skin, muscle and gland. Therefore the osteopath depends on increasing or decreasing the stimuli reaching the spinal centers.

The heart is innervated by two sets of nerves which control it. These nerves arise from centers in the cerebro-spinal system and govern the action of the heart according to the sum of stimuli reaching their centers over sensory nerves of skin, muscle and gland, and in harmony with the resistance maintained by the peripheral blood vessels.

Since perivascular tissues are dependent on the transfusion of nutriment from the blood, through the walls of the capillaries into the lymph, and this process of transfusion is dependent on the tension and speed of the current of blood in the capillaries, any condition which markedly increases or decreases this speed and tension will affect the nourishment of the tissues.

Hyperaemia.—A study of hyperaemia is, in reality, a study of the vaso-motor mechanism. We have noted the fact of vaso-motor nerves controlling the caliber of blood vessels. These nerves are branches of the cerebro-spinal system. Most of them leave the spinal nerves and pass to the sympathetic spinal ganglia as rami-communicantes and then pass up and down to other ganglia of the sympathetic system. Some fibers return from the sympathetic to the spinal nerves and are distributed to blood vessels of skin, muscle and bone in the area of distribution of the spinal nerves. A few vaso-motor nerves do not enter the sympathetic system but pass directly to their destination with the spinal nerves. Thus two paths exist by which vaso-motor impulses reach the blood vessels, a direct route with the spinal nerves and an indirect one through the sympathetics.

Experimenters have long noted the return of vascular tone in an area whose vaso-constrictor nerves have been cut. This return of vascular tonicity is supposed to be due to the presence of a perivascular mechanism which is capable of acting feebly after all other constrictor influences have been paralyzed.

So far as methods of treatment are concerned, we have paid very little attention to the presence of vaso-dilator nerves, but physiologists seem to prove that there are fibers leaving the cord with the posterior roots of the nerve trunks which act as dilators when irritated. The vaso-constrictor nerves are considered as constantly in action.

Irritation of the dilator nerves or paralysis of the constrictors will result in dilatation of the arterioles, so that the capillaries will be dilated to their fullest extent. Such a condition is called an "active hyperaemia." When the exit of the blood through the veins is obstructed and congestion results it is denoted "passive hyperaemia."

The same irritants, mechanical, thermal and chemical, which are capable of stimulating muscles to unusual or unequal contractions so as to produce marked evidences of changed bony alignment, also cause such decided changes in the caliber of blood vessels as to cause tissues to become hyperaemic or ischaemic.

If any hyperaemia exists in the mucosa of the stomach, palpation around the sixth dorsal spine will disclose tenderness. This spinal tenderness is probably due either to the irritation of the dilator fibers which accompany the posterior division of the fifth dorsal nerve or to paralysis of the vaso-constrictors of that area. The resulting dilatation impinges on sensory nerves and causes tenderness. The irritation of sensory nerves in the mucosa of the stomach causes dilatation of blood vessels in that area and in the spinal area from which its sensory nerves arise. The irritation might have originated centrally and then involved the stomach, thus reversing the course of the irritation. These reflex hyperaemias are continually noted in practice, and it is through the reflexes that relief is obtained. One of the classical experiments to prove the reflex action of vaso-motor nerves is to immerse one hand in cold water, the temperature of the other hand will be lowered also.

It is quite generally conceded that the small arteries and arterioles in all parts of the body are supplied with vaso-motor nerves. Their presence in the blood vessels of the brain has been recently proven by G. C. Huber. His demonstration of vaso-motor nerves in the cerebral blood vessels explains many of the circulatory phenomena resulting from osteopathic manipulations.

Irritation of sensory nerves in any part of the body causes vascular dilatation in the irritated area. Physiological experiments seem to prove that vaso-dilator fibers accompany the sensory nerves, or that irritation of sensory nerves causes paralysis of vaso-constrictor nerves. Irritation of the nerves of one side of the body by pricking with a pin causes a rise of temperature on that side and a decrease on the unirritated side, thus demonstrating that vaso-dilation follows sensory irritation.

Experiments to note the effects of direct mechanical irritation of the stomach mucosa demonstrate that dilatation of gastric blood vessels follows mechanical irritation. The physiological hyperaema thus produced is for purposes of increased secretion. It is well known that when this physiological congestion is continued without cessation, as in the case when meals are frequent and full, the congestion becomes pathological, and the secretion of mucus is rapid. The liver and intestines become chronically congested from similar causes. This hyperaemia leads to exudates and hyperplasia which further irritates sensory nerve endings and continues the dilatation of the arterioles. Thus a vicious cycle of reflexes is established which tends to ever increasing destructiveness.

When the sensory nerve terminals in the stomach are irritated and hyperaemia of the gastric vessels results, the influence of the irritation does not end with gastric congestion, i. e., if the hyperaemia be excessive, but causes dilatation of arteries in the spinal cord around the roots of sensory nerves distributed in other parts of the body which are supplied by branches of the same nerve trunk. The brain does not always note the real location of the irritation. It may refer the pain to any point supplied by a branch of the nerve trunk, one of whose branches is irritated. Thus in the presence of chronic congestion of the gastric mucosa, as in gastric catarrh, the irritation may not be intense enough to impress the brain with a painful sensation, but a slight increase of capillary pressure around the trunk of the sixth dorsal nerve such as would be brought about by digital pressure made upon the muscles around the sixth dorsal spine, would cause instant recognition of hyperaesthesia by the patient. Continued pressure made around the spine drives the blood out and lessens the sensitiveness. If hyperaemia has been intense enough to cause exudates, pressure increases the pain the longer it is continued, because the exudates have affected the venous circulation and there is no open path for exit of the blood.

From personal experience I should judge that it is quite probable that hyperaemia occurs along the whole course of the nerve and the nervi nervorum are rendered more sensitive thereby. In case of absolute neuritis, manipulation relieves the condition temporarily, but the pain increases shortly after the treatment is given. This shows that a condition exists which is much more difficult to change than a reflex hyperaemia.

Continued hyperaemic conditions cause increased nutrition, i. e., hyperplasia of connective tissue. Connective tissue seems to be more readily formed than any of the higher grades of tissue. This may explain the rapid stiffening of the spine in cases of visceral hyperaemia.

The digital pressure test is an excellent method of differentiating the intensity of an hyperaemia. Even in cases of conscious pain in the gastric or intestinal areas, it is possible to use this test. In colic, deep pressure made gradually will give relief, but in cases of gastric ulcer or other inflammatory conditions, pressure aggravates the pain.

Therapeutics.—We now have before us an array of physiological facts and it remains for us to indicate how we shall use them.

The osteopath treats the vaso-motor nerves as though there were no dilator fibers to be reckoned with. Practically, we consider that the vaso-constrictors are continually acting to maintain the "tone" of the blood vessels. Therefore, having only this one force with which to reckon, we consider all dilatation as vaso-constrictor paralysis.

We noted the fact that the cutaneuos and visceral blood vessels were supplied with vaso-constrictors and that vaso-constriction in the superficial area was compensated for by dilatation in the deep area.

A large number of sensory impressions reaching the vaso-motor centers over the sensory nerves of the skin usually result in vaso-constriction of cutaneous blood vessels, hence internal congestion. Irritation of the sensory nerves in the skin may cause muscle under the skin to contract, thus obstructing the circulation in the skin. Therefore, our manipulations for vaso-motor effects naturally divide themselves into two classes. First, those which inhibit cutaneous reflexes; second, those which relax muscle in order to remove obstructions. This division is purely arbitrary on our part, but it serves to explain our work. We purposely leave out of this discussion the thought that we may have an osseous lesion causing our vaso-motor disturbance. We divide the spine into areas according to the predominating influence which issues from it; thus, the sub-occipital fossa is the first important area. It has long been known that pressure applied to this area in a case of congestive headache gives great relief. The good effects are not lost when the pressure is removed. This proves that the effect of the pressure is on the nerves of that area, and that they are in close central connection with the vaso-motor center in the medulla. This center regulates the caliber of the arteries all over the body. It has been stated that pressure at the basi-occiput retards the blood flow to the brain, the pressure being on the vertebral arteries. We believe a careful examination of the atlas will convince one that in the average skeleton the groove for the vertebral artery is so deep and well protected that pressure on the surface of the neck cannot affect the artery. If our pressure effect is mechanical, why does the effect last so long? The blood stream is as swift as an ocean greyhound, and would rush into the partly filled vessel with its previous force just the moment the pressure is removed. We can only explain the result by noting the fact that a change has been made in the entire circulation. Downward pressure on the carotids is also recommended to retard the blood flow to the head. This seems impracticable since the pressure cannot help affecting the venous return as well as the carotid stream. The best and most lasting effects are always vaso-motor.

It is a well recognized fact in the osteopathic profession that pressure in the suboccipital triangles causes a lessened blood pressure all over the body. This fact is made use of daily to lower the temperature of the body in cases of fever. If pressure had a mechanical rather than a nervous effect on the circulation, we could hope for no general effect, such as we do secure. This procedure is called inhibiting the vaso-motor center. Why does it inhibit? A "vascular tone" is normal in the body in order to keep the blood equally distributed. This "vascular tone" is easily disturbed since it acts according to the sum of the sensory impulses reaching the center in the medulla. Pressure in the suboccipital triangles affects not only the sum of the stimuli reaching the center, but, most important of all, affects the capillary circulation in this area which is in close nervous and circulatory connection with the medulla. Any external application, such as hot or cold water, local anaesthetics or counter-irritants must secure whatever internal change may be manifested, by the effect these therapeutic procedures may have on cutaneous nerves.

Pressure in the suboccipital triangles will relax the structures forming those triangles, thus lessening the sensory impulses entering the center from that source. The relaxed structures will hold more blood, hence they will in a slight degree relieve congestion of the center.

These triangles are the bilateral surface centers in which we operate to cause dilatation of vessels in the skin of the trunk and extremities. We inhibit vaso-constricton of surface arteries.

The next great constrictor area is the splanchnic, sixth to eleventh dorsal. This and the preceding area are the two points of vantage for the osteopath. Since the splanchnic nerves control a system of blood vessels whose combined capacity is equal to the entire amount of the blood in the body, we can quickly realize what it means to the general circulation to affect this area. In all cases of congestive headaches, fever, hyperaemia of visceral organs, etc., we "inhibit the splanchnics." Why? The reflexes between the skin of the back and the muscles of the back are so intense that they cause vascular constriction of the cutaneous arteries and contraction of the deep muscles of the back, thus adding a mechanical obstruction to the circulation of the blood in an already constricted area. Is it not possible, yes, probable, that this state of the surface tissue causes a congestion of the vaso-motor centers in the dorsal area of the cord, thus nullifying their control of the splanchnic area? Such a condition might be brought about by cold. The eating of indigestible food which remains a long time in the digestive tract may also be a cause.

The facts are as we have stated them, we inhibit over the splanchnic area to lessen the intensity of the reflexes in that area, thereby allowing the centers to regain their control. Remember that inhibition lessens the sensory impressions reaching a center and relaxes muscle both directly and indirectly.

Case Illustrations.—An illustration of osteopathic methods applied to hyperaemia is afforded by the following case: A gentleman about fifty years of age was inspecting mines in the vicinity of Yuma, Arizona. He was of plethoric habit and hence the heat of that locality affected him quickly. About eight p. m., while in his tent preparing to bathe in order to get some relief from the intense heat, he felt a wave of weakness pass up his left side and almost instantly power of motion on that side was lost. Paralysis did not extend to the face. The gentleman was brought to Los Angeles and came under the best of medical treatment. Electricity and massage were tried with fair success, but the left arm and hand remained helpless and were carried in a sling. The hand was badly swollen and would pit under pressure, thus showing a marked degree of vaso-constrictor paralysis. The hand and arm had been thoroughly massaged for two months before osteopathic treatment was given. One hour's seance with the masseur would make a wonderful change in the hand, but the oedematous condition returned in a few hours. The fingers were bent into the palm, showing a marked tendency to a spastic condition.

From the medical standpoint it was considered sufficient for this case to have the local massage of the arm and hand, with administration of strychnine.

The osteopathic examination was made at the end of two months of the treatment just outlined. Slight signs of paralysis were noted at the angle of the mouth on the hemiplegic side. Examination of the neck showed marked contraction of the deep cervical muscles on the left side, extending from the occiput to the fourth cervical vertebra. Moderate digital pressure over these contracted muscles caused pain. There was also some tenderness as low as the sixth dorsal spine. The intense contraction and tenderness in the upper cervical region was noted as a secondary lesion existing as a result of a blood clot. It was reasoned that if these contracted muscles could be relaxed cerebral circulation would be equalized and more rapid absorption of the clot made possible. The spinal tenderness was brought about by the same law of irritation of sensory nerves we have previously stated. There was a dilated condition of the arterioles around the roots of the sensory nerves in the cord similar in character to that which existed at the peripheral distribution of these nerves, especially in the hand. There was decided wrist and elbow reflex, showing that the subsidiary nerve cells in the cord were intact, but that either the cerebral motor areas or some part of their connecting paths were injured. The vascular tone of blood vessels in all other parts of the body was good, showing that the chief vaso-motor center in the medulla was acting. Here was a case showing a perfect reflex in the arm but loss of ability to will a motion; perfect sensation and vaso-motor paralysis.

Treatment was directed to securing relaxation of the contracted cervical muscles and to breaking up adhesiions in the shoulder joint which had been allowed to stiffen. No treatment was given to the hand or arm. The patient was instructed to straighten the bent fingers with the well hand many times per day to overcome the spastic condition. Vaso-motor tone returned to the blood vessels of the hand in proportion to the amount of cervical relaxation accomplished. At the end of one month the hand was allowed to hang naturally, and scarcely any oedema was noticeable. Muscular control and power have steadily increased.

Another illustration is afforded by the following case: A gentleman suffering with inflammatory rheumatism in the second toe of the right foot sought relief by means of osteopathic treatment. He had used the salicylates in his previous attacks, but his stomach had become intolerant of them. The toe was red and angry looking, throbbing with pain and swollen to the size of the great toe.

Examination of the spine revealed tenderness between the fifth lumbar and third sacral spines, also between the second and third lumbar spines. Why should tenderness exist at these points? The answer according to anatomy and physiology is that these spinal areas mark the point of emergence from the spinal column of the anterior crural and great sciatic nerves which are distributed to equal parts of the affected toe; the sensory nerves being irritated by the deposit of faulty katabolic products in the tissues of the toe as the result of a slow blood stream. In this case the patient was caught out in the rain and got his feet wet. The peripheral irritation of the sensory nerves caused dilatation of the arterioles and capillaries. The blood vessels around the roots of other sensory nerves which were branches of the same nerve trunks also dilated in response to this irritation, i. e., hyperaemia in the spinal cord was brought about at the point of origin of the anterior crural and great sciatic nerves, hence the sensory nerves to the skin and muscles of the back which are innervated from the same area of the cord as these great nerve trunks will also be tender to increased tension such as that secured by the digital pressure.

In a case such as this we do not desire to have the deposit in the toe taken up until the eliminating organs of the body are acting freely. To force it into the circulation before such time as it can be eliminated may result in inflaming another part. It is quite necessary that the throbbing pain be subdued so that sleep may be had. The patient soon learns to take advantage of venous circulation by elevating the foot. If pressure upon, and a gentle relaxing movement of the muscles in the spinal area is made, there will quickly be noted a decrease in spinal sensitiveness followed by lessened conscious pain in the toe. It is quite probable that pain in the toe is due to hyperaemia; sensitiveness in the spinal area is due to the same sort of condition, the difference being in degree. It is impossible to prove the presence of these transitory hyperaemias by any direct observations any more than it is possible to prove by post mortem examination that hyperaemia or anaemia of the brain is present as a fixed pathological lesion in faulty functioning of the brain.

Pressure and relaxation in the spinal area draws the blood away from its position around the nerve trunk roots and thus stops many of the impulses which would originate centrally as a result of the irritation of the sensory roots of the nerve trunk.

We usually think of these reflex sensitive areas of the spine as being evidence of the ability of all the branches of a nerve trunk to express some degree of the irritation being brought to bear on any one of the branches. It seems to me that in the light of what is known to happen in the area of an irritated nerve, hyperaemia, that the same change in circulation may occur around the roots of its parent nerve trunk and be the sole reason for what we denominate a reflex pain.

By giving the heavy movement required to replace a subluxated vertebra or even to relax tense muscles around an otherwise normal articulation, it is quite probable that inexplicable changes are wrought in the circulation at these points which immediately change the character of the nerve impulses originating or reflexing from this portion of the spinal cord.

CHAPTER X.

HILTON'S LAW.

In the years 1860-61-62 a seres of lectures was delivered by John Hilton, F. R. S., F. R. C. S., "On the Influence of Mechanical and Physiological Rest in the Treatment of Accidents and Surgical Diseases, and the Diagnostic Value of Pain." These lectures were afterward published in book form under the title of "Rest and Pain." This book is a medical classic and worthy of careful perusal by all students of medicine.

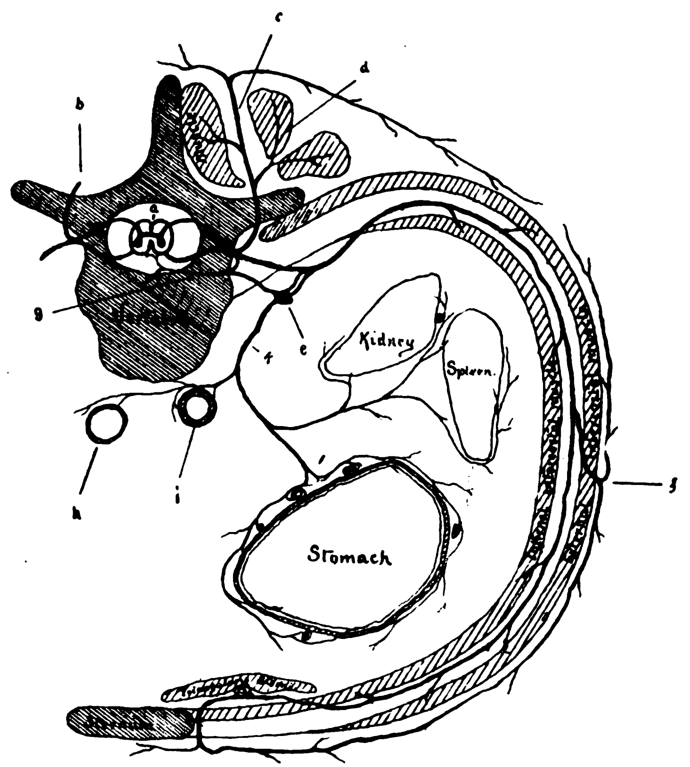
The careful observations and reasonings therefrom which are reported in "Rest and Pain" explain many of the phenomena noted in osteopathic practice. We desire to give all due honor to this man who was so far in advance of his time.

We will quote a few paragraphs from "Rest and Pain" which have a direct bearing on osteopathic methods of diagnosis and therapeutics.

The Law Stated.—After careful study of the distribution of nerves throughout the body, Hilton sums up his observations in a terse sentence which we choose to call a law: "The same trunks of nerves whose branches supply the groups of muscles moving a joint, furnish also a distribution of nerves to the skin over the insertion of the same muscles, and the interior of the joint receives its nerves from the same source."

Hilton further states that "Every fascia of the body has a muscle attached to it, and that every fascia throughout the body must be considered as a muscle."

a Spinal Cord
b posterior primary division
c Internal branch. (cutaneous)
d External branch. (muscular)
e. Sympathetic ganglion
f. Lateral cutaneous bran
g. Recurrent branch
h Vena Cava Inferior.
i Aorta
k. Sympathetic branch



Sectional Diagram of Human Body.
showing the wide range and intimate relations of
Nerve Distribution and Connections.

FIG. 30. Drawn by Dr. J. E. Stuart.

Methods of Studying Anatomy.—These statements lead us to a closer study of each joint and its controlling muscles and governing nerve or nerves. We may study anatomy under artificial divisions such as Osteology, Syndesmology, Myology, etc., and still, after securing an accurate technical knowledge of details, we have nothing of practical value. It is in the correlation of these tissues with their interdependence quite fully understood that we have a working knowledge. With this thought of the influence of one tissue on another and the harmonious action secured by the comparatively varied distribution of the nerve trunks, we find a new and vital interest in anatomy.

This law is based upon the facts of anatomy and physiology, and makes our concrete knowledge of these subjects of constant practical value in both diagnosis and therapeutics. This law shows us the "why" of certain vital and mechanical manifestations, and teaches us practical methods of treatment.

Example of Hilton's Law.—An example of Hilton's law is the distribution of the sciatic nerve to the ankle. The muscles moving the joint, the synovial membrane and most of the skin over the joint are all innervated by it.

The Knee.—The knee has three nerves. Each one has a motor and sensory control. The extensor muscles and the skin over them is innervated by the anterior crural. The flexor muscles and the skin over them is innervated by the sciatic. The obturator, in addition to these nerves, furnishes sensory filaments to the synovial membrane. All the joints of the body may be examined in the light of this law. The same segment of the central nervous system which gives off a purely motor nerve trunk, gives off also a sensory nerve whose filaments are distributed over the same area. Thus it is sometimes necessary to go to the central nervous system to discover this association of motor and sensory distribution. In practice we always do this, because it is easier to work from the center of the areas of distribution.

The Object of Such a Distribution.—Hilton says: "The object of such a distribution of nerves to the muscular and articular structures of the joints, in accurate association, is to insure mechanical and physiological consent between the external muscular, or moving force, and the vital endurance of the parts moved, namely, of the joints, thus securing in health a true balance of force and friction until deterioration occurs."

"Without this nervous association in the muscular and articular structures, there could be no intimation by the internal parts of their exhausted condition." "Again, through the medium of the muscular and cutaneous nervous association great security is given to the joint itself by those muscles being made aware of the point of contact of any extraneous force or violence. Their involuntary contraction instinctively makes the surrounding structures tense and rigid, and thus brings about an improved defence for the subjacent structures."

The Uniformity of the Law.—"This articular, muscular and cutaneous distribution of the nerves is, in my opinion, a uniform arrangement in every joint in the body. We may find numerous illustrations of the same method of distribution in other parts of the body, which have the same definite relations to each other, and in this respect present the same physiological and mechanical arrangement observable in joints. * * * This same principle of arrangement, anatomically, physiologically and pathologically considered, is to be observed with an equal degree of accuracy in the serous and in the mucous membrane. Thus considered, it presents a principle which, if it has any application in practice, must be one certainly of large extent."

Precision of Nervous Distribution to Muscles.—"The great precision with which muscles are supplied by their nerves is worthy of remark; and is such that if we have before us a contracted muscle, we may be sure of the nerve which must be the medium, or the direct cause of it."

"In studying the supply of nerves to muscles over every part of the body, we find a great degree of precision, which marks one difference between their distribution and that of the arteries."

Indications for Use of Therapeutics.—"I should say in aid of other means, employ this cutaneous distribution of nerves as a road or means toward relieving pain and irritation in the joint. You thus quiet the muscles, prevent extreme friction, and reduce muscular pressure and spasm. Therapeutics may certainly reach the interior of this joint and its muscles through the medium of the nerves upon the surface of the skin, and so induce physiological rest to all the parts concerned in moving the joint. * * * The advantage to be derived arises in this way: Sensibility of the filaments supplying the skin being reduced, that influence is propagated through the sensitive nerves to the interior of the joint and to the muscles moving a joint. This diminution of sensibility tends to give quietude or perfect rest to the interior of the joint, which is one of the most important elements towards the successful issue of the treatment of cases of this kind."

The Use of Hilton's Law in Physical Diagnosis.—Hilton's law is applicable in physical diagnosis. The osteopath makes constant use of the superficial expressions of nerve activity. After having learned the whole course, distribution and central connections of the nerve, we can judge rightly as to the structures involved by noting the physiological conditions of all the structures innervated by a definite nerve trunk. Hilton applied his law entirely from the physiological side, i. e., he observed changes in the relations of joint structures, but considered the deformity as due to excessive physiological action of the muscles in their effort to secure rest for the joint surfaces. This is largely true, but he did not question how the process was initiated. The osteopath seeks a point of stimulus to the nerves controlling a joint or other structure, believing that it is of little value to anaesthetize nerve endings and give rest so long as this stimulus is allowed to arouse impulses in the nerve fibers.

Comparison of Methods.—To compare methods of using Hilton's Law, we will note one of his cases, and a similar one treated osteopathically. In Chapter VIII of "Rest and Pain" he describes a case of inflammation of the shoulder joint, and mentions that the joint is fixed in a position of rest as a result of the association of nerves to the synovial membrane, the muscles of the joint and the skin over the joint. Anaesthesia releases the fixedness of the joint, because the muscles do not contract after the sensory impulses are deadened by the anaesthetic. He says, "Therapeutics may certainly reach the interior of this joint and its muscles through the medium of the nerves upon the surface of the skin, and so induce physiological rest to all parts concerned in moving the joint. I mean to say that these nerves upon the surface of the skin being in direct association with the interior of the joint itself, we may reduce the muscular spasm as well as the sensibility of the interior portion of the joint, by applying our anaesthetics with accuracy and with sufficient intensity upon the exterior of the deltoid muscle, over the distribution of these sensitive filaments. The thought will occur to you at once that there is nothing very remarkable in this opinion, and that is quite true. The embrocations, however, which would ordinarily be suggested for this purpose, are not of a character sufficiently potent to alleviate the pain of the patient, and are, I believe, seldom employed with a definite idea in the mind of the prescriber. I would suggest that we should employ our fomentations strongly medicated with belladonna, with opium or with hemlock, instead of using mere fomentation of hot water. Some will say, 'Oh, hot water is quite as good;' but I can assure you practically that it is not so."

You will note that he makes use of the cutaneous reflexes to affect the interior of the joint.

A recent case, corresponding we believe, was treated osteopathically with marked success. The inflammation in the shoulder joint was not traumatic in origin nor did it appear to be rheumatic in character. Hot fomentations would give great relief, but did not give sufficient rest to the joint to permit of a cure. The fear was entertained that longer rest of the articulation would result in adhesion and loss of function in the joint. Since the circumflex nerve appeared to be the one involved, a careful examination was made of the articulations between the sixth and seventh cervical vertebrae. The circumflex nerve is made up largely of fibers from the sixth cervical nerve trunk. Tension and tenderness, together with slight rotation of the sixth cervical were noted at this point. The osteopath, instead of working over the area of distribution of the circumflex, centered his work upon this articulation to bring about right relations between the sixth and seventh cervical vertebrae. Tension and irritation were removed. The circumflex nerve ceased to manifest any undue irritation. The osteopath almost invariably works from the center to periphery instead of the reverse.

Herpes Zoster.—An example of the osteopath's use, or rather recognition of Hilton's law: A case of Herpes Zoster located along the course of the left fifth intercostal nerve was given a grave prognosis by a homeopathic physician. The patient visited an osteopath immediately, hoping that some relief might be found for the intolerable pain. The eruption extended from the spine to the median line in front, forming a band about one inch wide. The fifth rib was found rotated downward, thus lessening the fifth intercostal space and pressing on the nerve at some point in its course. This rib was raised, even though the osteopath's fingers rested directly upon the eruption, in order to force the rib upward. The result was most gratifying. Pain decreased almost immediately, and there was a rapid

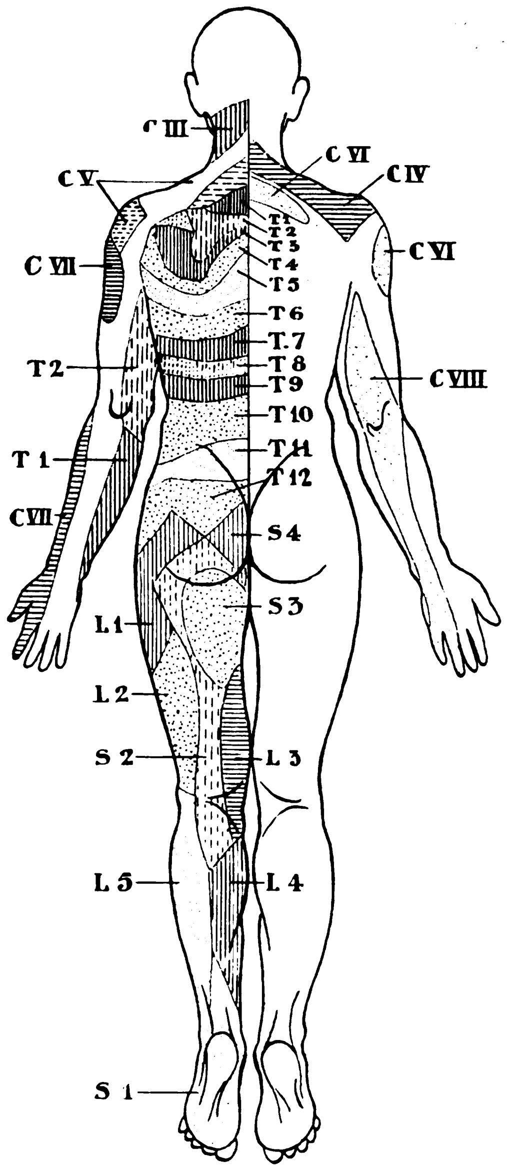


FIG. 32. Sensory dermatomes on posterior surface of the body. Drawn by John Comstock (after Head).

plemented by his statement that "every fascia of the body has a muscle attached to it, and every fascia throughout the body must be considered as the insertion of a muscle." This carries the influence of motor nerves to points covered by their sensory companions.

Head's Law.—Another law, or in this case a comprehensive statement, has been made by Head in his writings in "Brain." This is a statement of physiological transference of pain from its point of origin to a point of conscious sensation. This physiological law is stated as follows: "When a painful stimulus is applied to a part of low sensibility in close central connection with a part of much higher 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 applied."

Application of the Law.—This physiological law can be applied in two ways. First, we may consider the relative sensibility of different portions of a nerve trunk. If a stimulus is applied to a nerve trunk at some point in its course between its origin and distribution, the pain caused by the stimulus will be felt in the area of distribution of the fibers of this nerve trunk rather than at the point where the stimulus is applied. The skin, mucous or serous membrane and muscle in which sensory nerves end are areas of high sensibility compared with the trunk of the nerve. The brain is conscious of only the areas of distribution of the sensory nerves, hence stimuli applied at the points of low sensibility are referred to the areas of high sensibility. Thus all lesions causing pressure upon nerve trunks cause pain, contraction, or perversion of secretion in the areas of distribution. The patient is not thoroughly conscious of any location but the area of distribution which is an area of high sensibility.

The cases described under Hilton's law are applicable here. In the case of inflamed shoulder joint the patient was not conscious of the irritation at the spinal column—

the rotated vertebra—this was an area of low sensibility in the course of the nerve trunk. The brain attributed all the trouble to the terminations of the nerves in the tissues of the joint. All of the reflexes acted accordingly.

The second application of this law is to the relative intensity of areas of high sensibility. The areas in which sensory nerves end are all areas of high sensibility, but some are higher than others. We note in practice that sometimes a nerve trunk which supplies several structures will manifest pain in a portion of its area of distribution which is not the part in which the irritation is located. For example, the sensory portion of the obturator nerve is distributed to the hip joint and skin on the inner side of the knee. The skin seems to be an area of higher sensibility than the interior of the hip joint, because in disease of the hip joint the patient frequently complains of pain in the cutaneous area rather than in the joint where the actual disease is located.

The Viscera.—The viscera are normally non-sensitive, i. e., we are not conscious of possessing viscera. The pressure of food in the stomach and the beat of the heart make no impression on our consciousness; and so it is with all parts of the body governed by sympathetic nerves. The viscera are areas of low sensibility, not low irritability, for they are richly supplied with sensory nerves, upon the stimulation of which active functioning depends. The response to stimuli of sensory nerves in viscera is rapid, but normally this response takes place entirely outside of our consciousness, the impression is not recognized as coming from the viscera, but from a remote area of high sensibility in close central connection with the less sensitive area. As an example, pain is felt in the right shoulder, as a result of hyperaemia of the liver. The pressure upon sensory nerves in the liver does not cause pain in the liver, but refers it to a more sensitive area—the skin and muscles of the right shoulder.

Chronic inflammation of the stomach may cause no consciousness of pain in that organ, but may cause intense aching in the mid-dorsal region.

Nerves of Conscious Sensation.—Cerebro-spinal nerves are nerves of consciousness, and seem to have the duty of registering on the sensorium of our brains not only their own impressions, but the impressions derived from that part of the sympathetic system in closest central connection with them.

A close study of the segmental distribution of spinal nerves and their connection with the sympathetic system by the rami-communicantes will make Head's law of practical value in osteopathic diagnosis and therapeutics.

CHAPTER XI.

OSTEOPATHIC CENTERS.

Certain points on the surface of the body are spoken of as "Centers." This word has become a part of the osteopath's technical vocabulary. It does not convey to the mind of the osteopath the same meaning which attaches to it when used in physiological text-books.

A physiological functional center in the central nervous system is that point where the action of a certain viscus or other structure is governed.

An osteopathic center is that point on the surface of the body which has been demonstrated to be in closest central connection with a physiological center, or over the course of a governing nerve bundle.

In Chapter III, under the sub-heading Segmentation, reference is made to the division of the central nervous system into .sections which may, to a moderate degree, functionate independently. No portion of the nervous system ever functionates absolutely independently. The action of every portion affects all other portions, but certain areas in the brain and spinal cord seem to be somewhat set apart to govern or coordinate the physiological activity of certain organs. Physiology has demonstrated a large number of these centers.

"Physiology shows how not only the individual ganglia which lie in the intestines function with relative independence, but how even structures like the spinal ganglia frequently reckoned in with the central system still enjoy relative independence from it functionally."

"What we know of the anatomical structure and of the functions of the central nervous system of vertebrates forces us more and more to the conclusions (1) that even individual parts of the central system are themselves in a position to function to a certain extent independently, and (2) that even the brain and spinal cord of vertebrates are composed of a series of centers. Whether the one or the other of these is more highly developed, whether they are in connection with deeper centers, whether they have connections among themselves and with higher centers, determine the measure of the higher or lower development of the central system. We will find later, that in the course of the development of a class, individual centers connected with the central nervous system have reached a high development, while others have arrived at a certain stage (or reached a certain type) where they remain stationary, and throughout all subsequent posterity remain everywhere alike.

"One can conceive that in its essentials every nervous system is composed of afferent tracts and efferent tracts, and of tracts which form the connection of the elements among themselves."

Anatomy and Physiology demonstrate that from a certain segment of the spinal cord nerve fibers are distributed to skin, skeletal muscles, involuntary muscles and mucous membrane of viscera, and to the muscular coats of the arteries supplying all these structures.

Physiology and Pathology demonstrate that impressions made upon sensory elements in skin, mucous membrane, muscle, or other structures, are carried to a center in the central nervous system. These impressions are coordinated in this center, and affect the physiological action of all structures innervated from the same center. When we speak of two or more structures being in close central connection, we mean that they are innervated from the same segment of the central nervous system.

Diagnosis.—In diagnosis these segments serve the purpose of calling the osteopath's attention to the condition

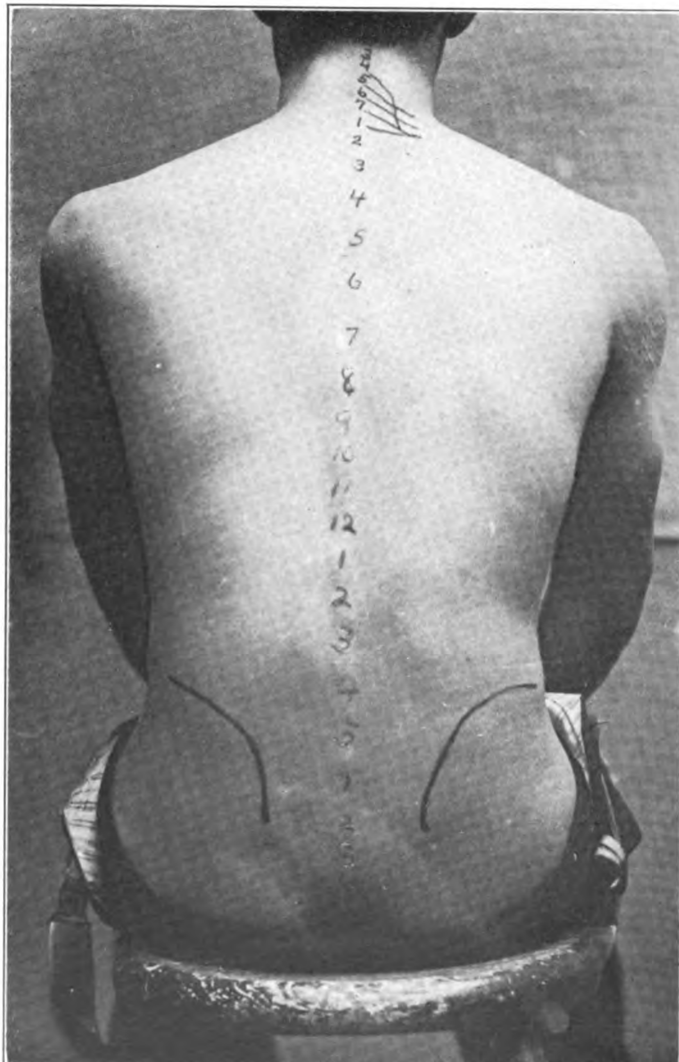


FIG. 33. Surface marking of the brachial plexus.

of several correlated structures. For example: A hyperaesthesia at any point along the spinal column fixes the attention of the osteopath upon all the structures of the body which are innervated from the segment of the central nervous system which furnishes nerves for this oversensitive area. Examination of all the structures thus supplied will probably discover the point chiefly affected.

In order to give the student a clear insight into the principles underlying osteopathic diagnosis, we will examine the osteopathic centers serially, commencing at the atlas.

First Four Cervical Nerves.—We will first divide the spinal column into sections according to the location of certain groups of nerves. Remember that these divisions are made with reference to the points of exit of the spinal nerves from the spinal column.

The first section contains the first four cervical nerves. The first cervical nerve leaves the spinal canal between the occipital bone and the atlas. A study of its distribution will inform us what structures are governed by it. Its anterior division forms a part of the cervical plexus. This division communicates with the sympathetic nerves on the vertebral artery, the pneumogastric, the hypoglossal, and superior cervical sympathetic ganglion. It innervates the Rectus Lateralis and Anterior Recti.

The posterior division of the first cervical nerve is called the suboccipital. It supplies motor fibers to the posterior Recti muscles of the head, the Superior and Inferior Oblique, and the Complexus. Sensory fibers from the scalp form part of this nerve.

Example of Hilton's Law.—With this outline of distribution before us, we can note some of the results of stimulation of this nerve. Since the anterior division supplies a few fibers to the occipito-atlantal articulation, we have an example of Hilton's law of distribution of a nerve trunk. The synovial membrane of the occipito-atlantal articulation, the muscles which govern movements of the joint, and the skin over the joint are all innervated by this first cervical nerve.

The muscles moving the occipito-atlantal articulation act according to impulses reaching the point of origin of

FIG. 34. Front view of partial paralysis of the brachial plexus.

the first cervical nerve over sensory fibers ending in the skin covering the back of the head and this articulation, also from those ending in the synovial membrane of the joint. These impulses are coordinated in higher centers of the brain which govern equilibration. The muscles of this joint act also according to our will.

The Pneumogastric Nerve.—Furthermore, the anterior division of this nerve communicates with the pneumogastric, hypoglossal, and the superior sympathetic ganglion.

FIG. 35. Side view of same case as Fig. 34.

The pneumogastric has such a wide distribution that we cannot afford to follow all of its paths of influence at this time. The student is referred to any extended work on anatomy for the details. The muscles and mucous membranes of the larynx are innervated by the pneumogastric, hence any irritation of the larynx may reflex impulses to the center of origin of the first cervical nerve and cause undue contraction of the muscles innervated by it. This muscular contraction can result in changing the relation of the bones forming the occipito-atlantal articulation until a condition exists which we call a subluxation of the atlas. Having followed the impulses from the larynx to the center of coordination and out again to the muscles of

FIG. 36. Rear view of same case as Fig. 34.

the occipito-atlantal articulation with consequent subluxation, we may profitably note the fact that sudden temperature changes may affect the skin over these muscles, arousing impulses which are carried to the center of coordination, thence to the muscles, causing them to contract with resulting subluxation. Some of the reflex im-

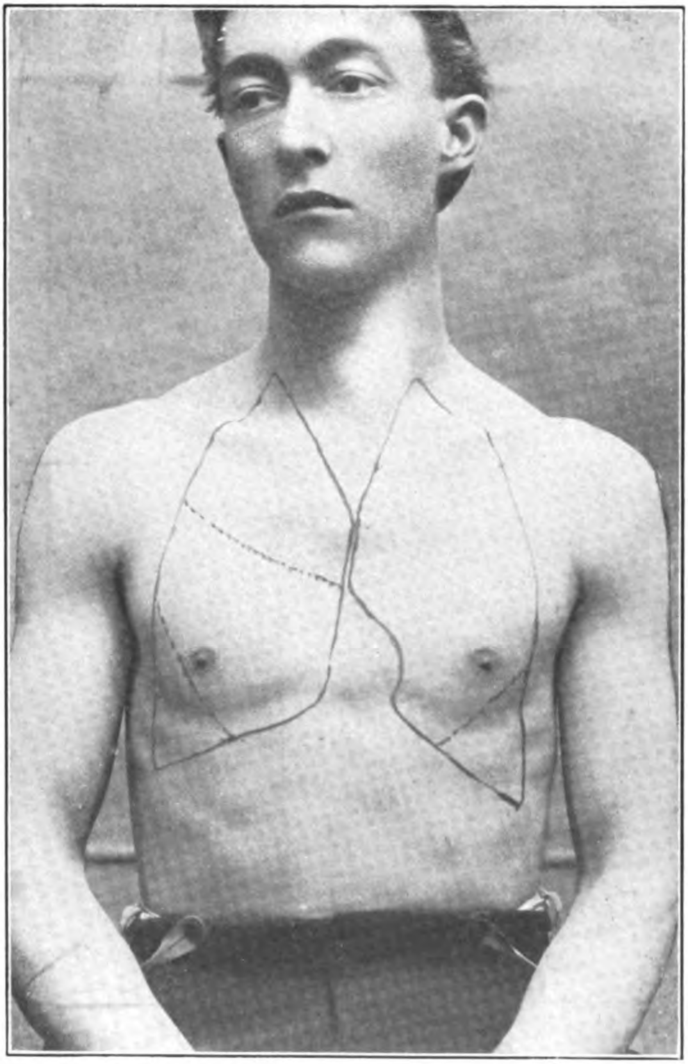


FIG. 37. Topographical outline of the lungs.

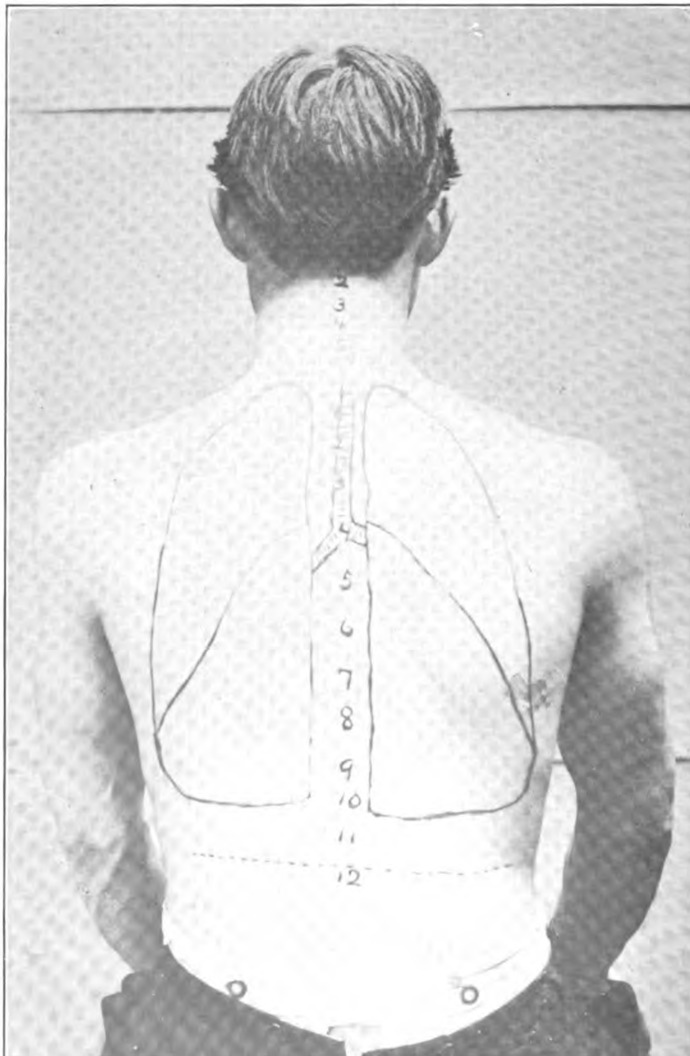


FIG. 38. Posterior surface marking of the lungs.

pulses may find their way to the larynx and cause congestion of its mucosa. The atlas may be subluxated by violence, then the sensory impulses originate in the synovial membrane of the joint and in the muscles moving the joint. These impulses may be reflected in such manner as to affect the larynx, pharynx and other structures innervated by the pneumogastric. The reflex influences existing between the first cervical nerves and the pneumogastric are chiefly confined to the larynx and the pharynx, because spinal nerves usually receive sympathetic reflexes from the segment of the body which they cover. If we should follow all of the divisions of the pneumogastrics, we would find a wonderful diversity of distribution. We do not expect that reflexes from the heart, lungs, stomach, etc., are going to be subject to coordination in the area of origin of the first cervical nerve, just because there is communication between the pneumogastric and this nerve. The pharynx and larynx are, in part, structures governed involuntarily, and hence they are in large part removed from the influence of nerves carrying voluntary impulses, i. e., spinal nerves. The pneumogastric is essentially sympathetic in character. The tissues of the larynx and pharynx are practically under the influence of the first cervical nerve. Your attention is called to Hilton's law as he has stated it in relation to mucous and serous surfaces. "This same principle of arrangement, anatomically, physiologically and pathologically considered, is to be observed, with an equal degree of accuracy in the serous and mucous membranes. Thus considered, it presents a principle which, if it has any application in practice, must be one certainly of large extent."

Since the spinal accessory forms part of the pneumogastric above the point of communication between that nerve and the first cervical, we can perceive the reason for the great influence which temperature changes, affecting the skin over the sterno-cleido-mastoid and trapezius muscles, have on the action of the muscles forming the

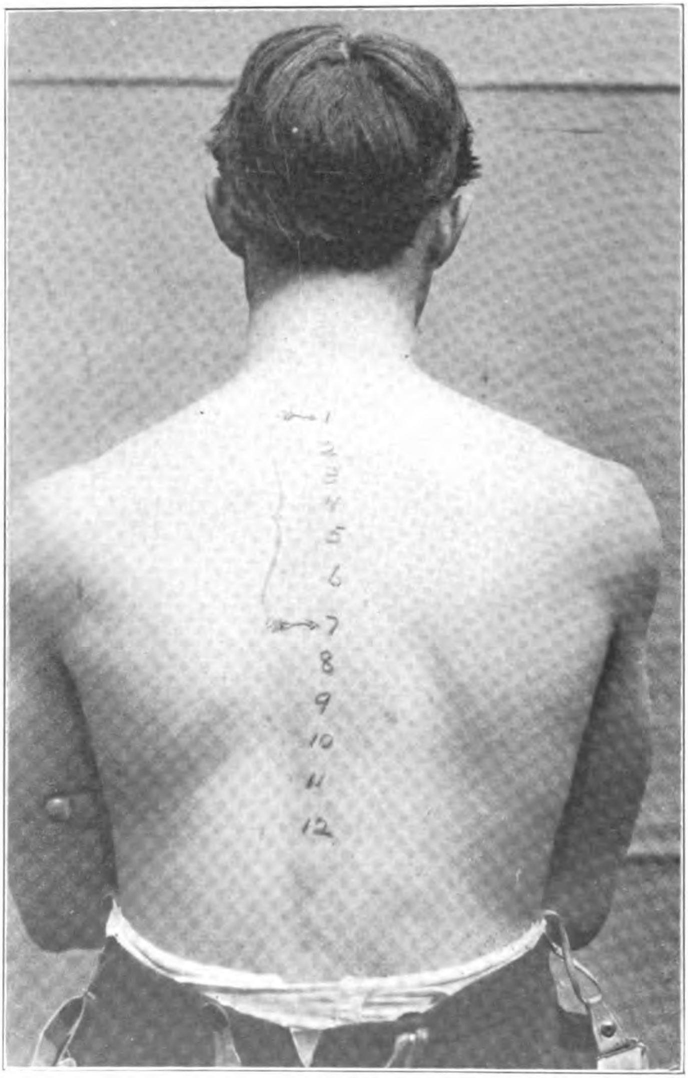


FIG. 39. The lung center.

suboccipital triangles. The spinal accessory innervates the sterno-cleido-mastoid and trapezius. These muscles will contract reflexly when the sensory nerves in the skin over them are affected by temperature changes. The action of these muscles affects the position of the head chiefly by causing movement in the occipito-atlantal articulation whose accurate adjustment depends on the muscles innervated by the first cervical nerves.

The point of origin of the first two cervical nerves is probably a bilateral center. In order to secure coordinated movements, both sides of this bilateral center must act reciprocally, but if the impulses coming into the center from one side are much greater in number and intensity than those entering on the opposite side, this reciprocity of action may be interfered with and subluxation result.

The Hypoglossal Nerve.—The hypoglossal nerve is the motor nerve to the muscles of the tongue, and to the muscles moving the larynx and hyoid bone. It communicates with the first cervical nerve. Movement in the occipito-atlantal articulation affects the relations of the points of origin and insertion of the muscles innervated by the hypoglossal; therefore, impulses passing over both nerves are coordinated at about the same area.

Superior Cervical Ganglion.—Probably the greatest cause for disturbance along the course of the first cervical nerve is the communication with the superior cervical ganglion and the sympathetic plexus on the vertebral artery. This communication subjects all the structures innervated by the first cervical to reflexes initiated in various areas of the head, neck and brain.

The superior cervical sympathetic ganglion has a vasoconstrictor influence over the blood vessels of the head, neck and brain. It is a well known clinical fact that ice applied to the surface of the neck over the occipito-atlantal articulation will cause constriction of the blood vessels of

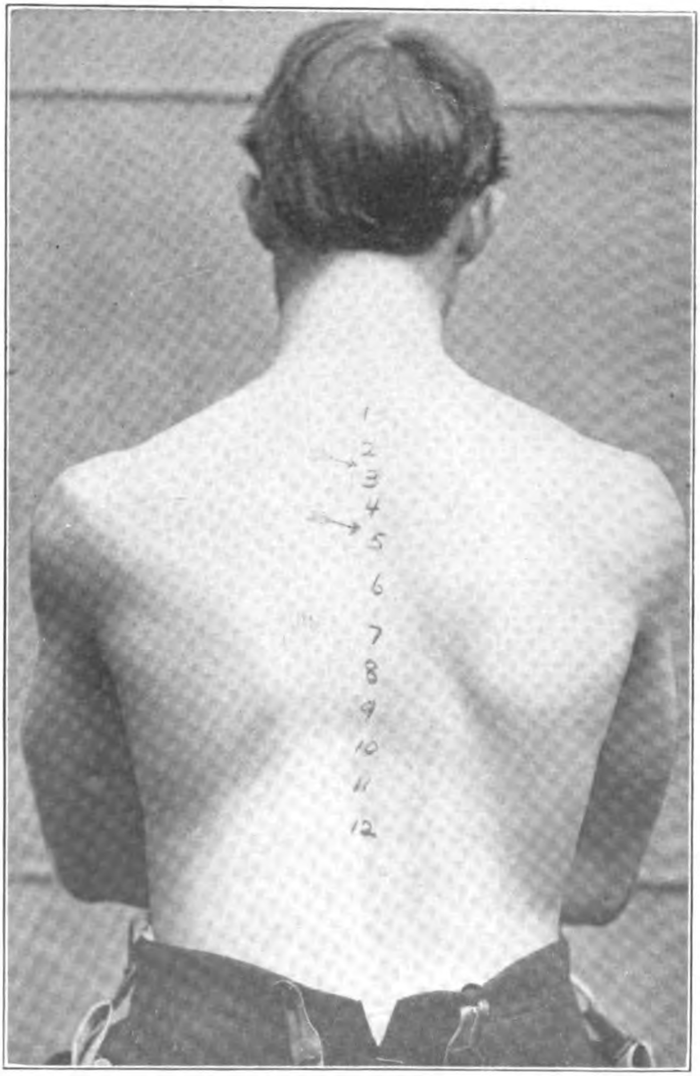


FIG. 40. Cilio-spinal and heart centers.

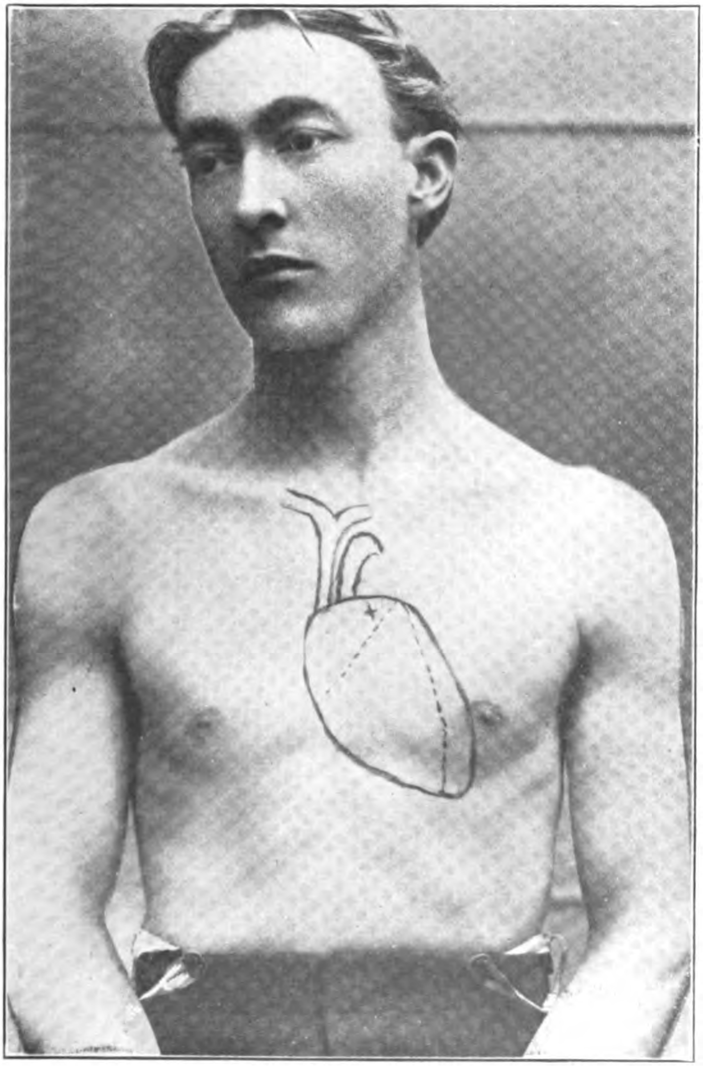


FIG. 41. Surface outline of the heart.

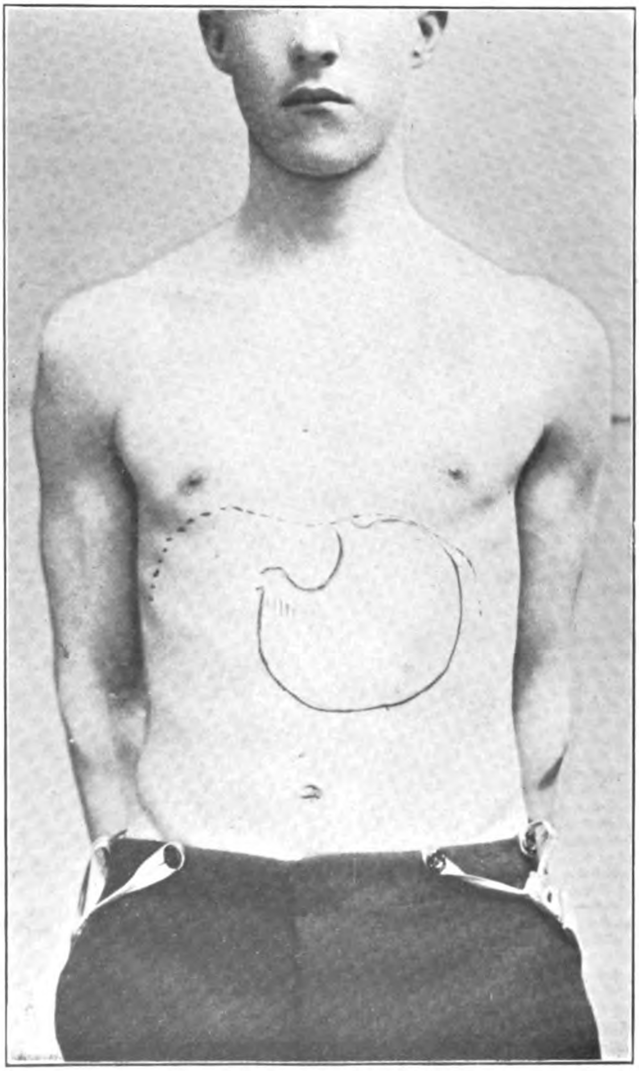


FIG. 42 Surface outline of the stomach.

the brain. This constriction is a reflex effect due to the communication of the first cervical nerve with the superior cervical sympathetic ganglion.

Subccipital Triangles.—When the first cervical nerve is sensitive to moderate pressure over the suboccipital triangles, we may be sure that it is evidence of disturbance of circulation in some part of the head, neck or face. We look for this disturbance in the structures which are subjected to the greatest amount of work, i. e., the eye, pharynx or larynx. The brain last, because it is not easily fatigued. Sensitiveness is nearly always associated with a subluxated atlas, i. e., one is indicative of the other.

Whether the subluxation is primary or secondary, it is a source of irritation and must be reduced; therefore, in practice, our treatment is applied primarily to this changed structure. The results of practice prove this to be the best method.

Patients rarely complain of sharp neuralgic pain in the area of the suboccipital triangles. A dull ache or tension is the usual subjective symptom.

We have described the characteristics of this center with considerable detail in order that the student may understand how thoroughly an accurate knowledge of anatomy and physiology enters into the work of the osteopath. Every center must be understood in this same manner. We do not deem it necessary to go into such detail in describing all of the remaining centers in order that the student can understand their significance.

In order to make the characteristics of the first cervical nerve stand out prominently, we have described it as though it were individual in its action and reaction. This is not strictly true. Analysis compels us to note ill-defined separations in the nervous system. In order to get a right
14 conception, we must view the first cervical nerve as only one of a group of four cervical nerves which act in harmony.

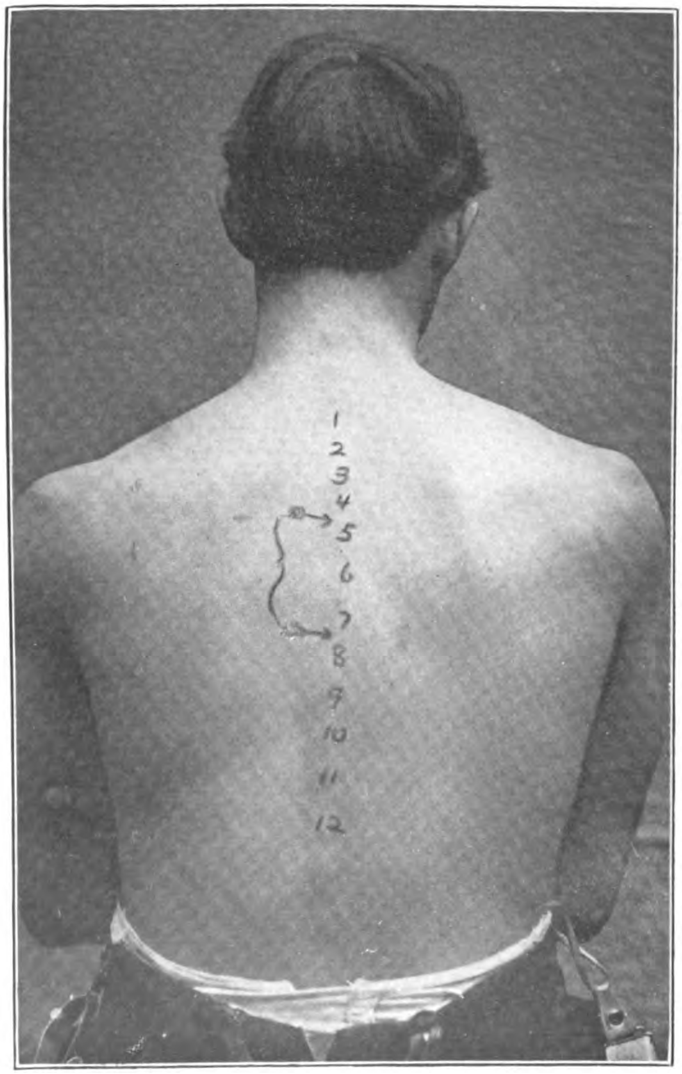


FIG. 43. The stomach center.

Cervical Plexus.—The first four cervical nerves are interwoven to form a plexus. Each distributive branch from this plexus probably contains some communicating fibers from the four primary nerve trunks. Viewing the plexus as a whole, we find that its branches are distributed according to Hilton's law. They innervate the skin of the neck as low as the fifth cervical spine posteriorly, then obliquely forward as low as the sterno-clavicular articulation anteriorly, and the acromio-clavicular articulation laterally. The skin of the posterior surface of the cranium and the ear receives sensory fibers from this plexus. These are the gross points to be remembered concerning cutaneous sensory distribution from this plexus. The muscles under this cutaneous area all receive motor fibers from the first four cervical nerves.

Anatomists divide the cervical nerves into anterior and posterior divisions, then describe these separately. This is an artificial division which does not serve any useful purpose for us. It multiplies detail without giving an adequate conception of the real character of the whole nerve. When you study the ultimate distribution of the anterior division of a nerve forming the cervical plexus, do not fail to remember that the ultimate distribution of the posterior division is a part of the same nerve. If the anterior division communicates with a sympathetic ganglion, the posterior division receives impulses from and sends impulses to this ganglion. If the anterior division communicates with the vagus and hypoglossal nerves, the posterior division is a party to this communication, and in all ways benefits or suffers by it according to the number and intensity of the stimuli applied at any point along the course of either nerve.

This upper portion of the neck is the most flexible part of the whole spinal column. It is subjected to more changes of temperature and more strains or twists than other portions of the spine. The constant effort to save the head from injury puts a severe tax upon the activity

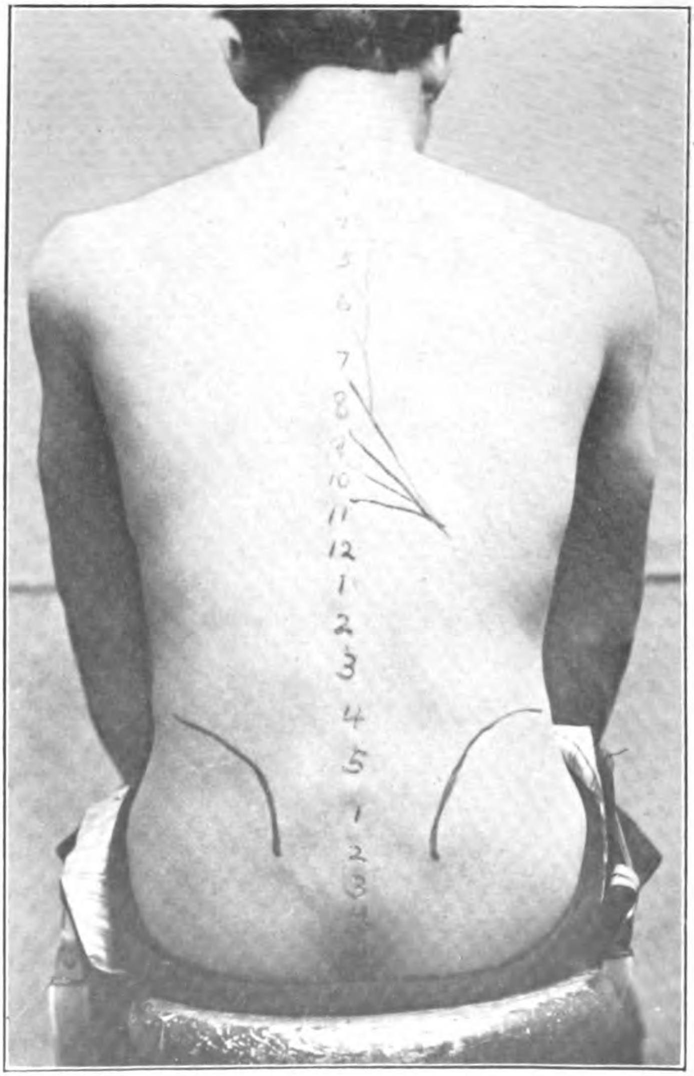


FIG. 44. The splanchnic area.

of the muscles moving this portion of the spinal column. Subluxations of the atlas and third cervical are quite frequent. Muscular lesions, contractions, are found here in connection with functional disorders of many kinds located in the brain, eyes, ears, nose, mouth or throat. Almost invariably a relaxation of these contractions will be a necessary step in relieving disorders in the areas named.

Intensity of Reflexes.—Individuals differ greatly in the intensity of their reflexes. Anatomically considered, the connections between the sympathetic and cerebrospinal systems are alike in all individuals, but physiologically considered, there is a vast difference in the degree of independent functioning of these systems. Patients will be found whose symptoms and lesions do not show any marked tendency toward reflexing impulses from one system to the other. The sympathetic nerve cells may be so vigorous that severe lesions affecting cerebro-spinal nerves do not in the least disturb the rhythm of the sympathetic system. Likewise, severe functional disturbances may exist in the area of the sympathetic control without causing very definite conscious sensations.

The Spinal Accessory.—The sterno-cleido-mastoid and trapezius muscles are innervated by the spinal accessory. This nerve arises from the spinal cord as low as the sixth cervical, therefore its impulses are coordinated with the cervical plexus in the area of its normal control.

The Phrenic Nerve—Hiccough.—The phrenic nerve is the motor nerve from the cervical plexus. It innervates the diaphragm. It is formed by branches of the third, fourth and fifth cervical nerves. The position of this nerve in its course along the anterior surface of the scalenus anticus, makes it convenient to apply direct inhibitory pressure over the nerve trunk. This pressure has a restraining influence over the impulses traveling to the diaphragm; therefore, we inhibit to stop hiccough. We have treated cases in which inhibition was of no avail. In such cases a strong movement of the head and first three cervi-

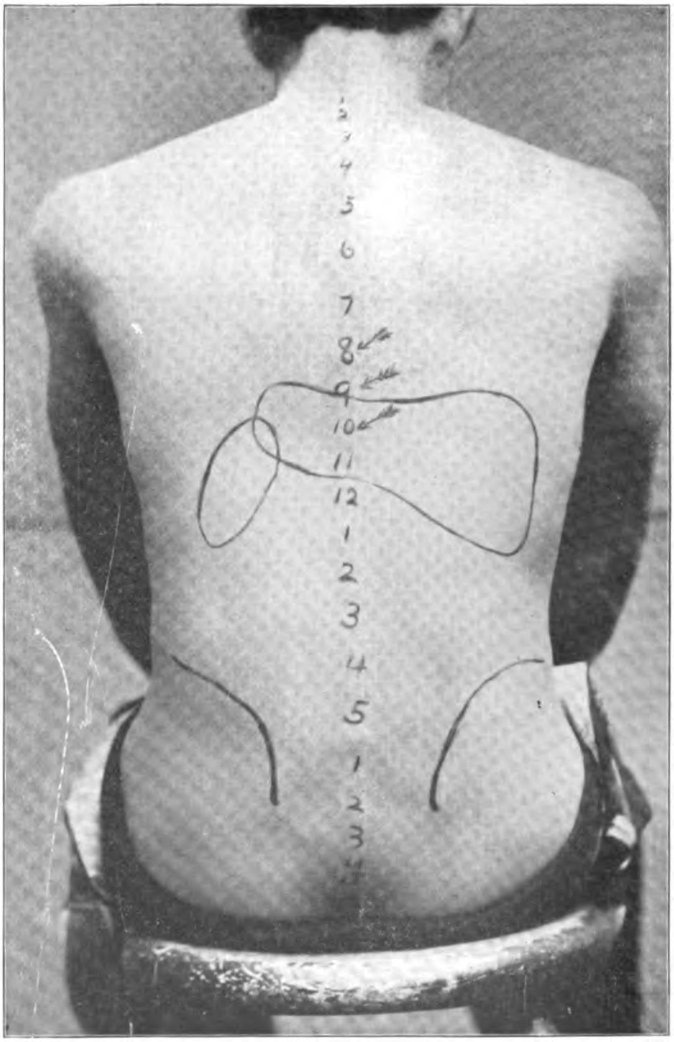


FIG. 45. Posterior surface outline of the liver and spleen with their centers indicated.

cal vertebrae, as a solid lever, to secure rotation and relaxation between the third and fourth cervical vertebrae may give good results. Since hiccough is a reflex due to stimulation of sensory nerves, especially the pneumogastric, it should not be expected that inhibition of the motor nerve, phrenic, would entirely stop hiccoughs while the sensory stimulation is continued. Clinically, we find that inhibition of the phrenic nerve is sufficient to stop the ordinary case of hiccoughs. Therefore, we call the area over the course of the phrenic nerve, as it crosses the scalenus anticus muscle opposite the fifth cervical transverse process, the "center for hiccoughs." See Fig. 266.

The Trapezius and Splenius Capitis et Colli Muscles.—The cervical plexus communicates with the brachial plexus; therefore we expect that those large muscles, such as the trapezius and splenius, which are innervated by nerves from segments of the spinal cord, at various levels, will transmit by their action the influence reflexed to them at the point of their serial innervation. The spinal accessory innervates a large part of the cervical fibers of the trapezius. The third and fourth cervical nerves send branches to this muscle. Therefore any disturbance along the course of these nerves, or along the course of other nerves in close central connection with them which may cause abnormal contraction of the trapezius, will influence, more or less, all the points of attachment of that muscle. The trapezius is seldom abnormally contracted. Any lessening in the normal range of its action is quickly noted by the patient. The contractured condition is easily removed by a willed action. We use the trapezius muscle as a means of transmitting power to various portions of the spinal column, i. e., in our efforts to move one or more vertebrae.

Vaso-motion, Head, Face and Neck.—The superior cervical ganglion communicates with the first four cervical nerves, therefore the area over the spines of the first four

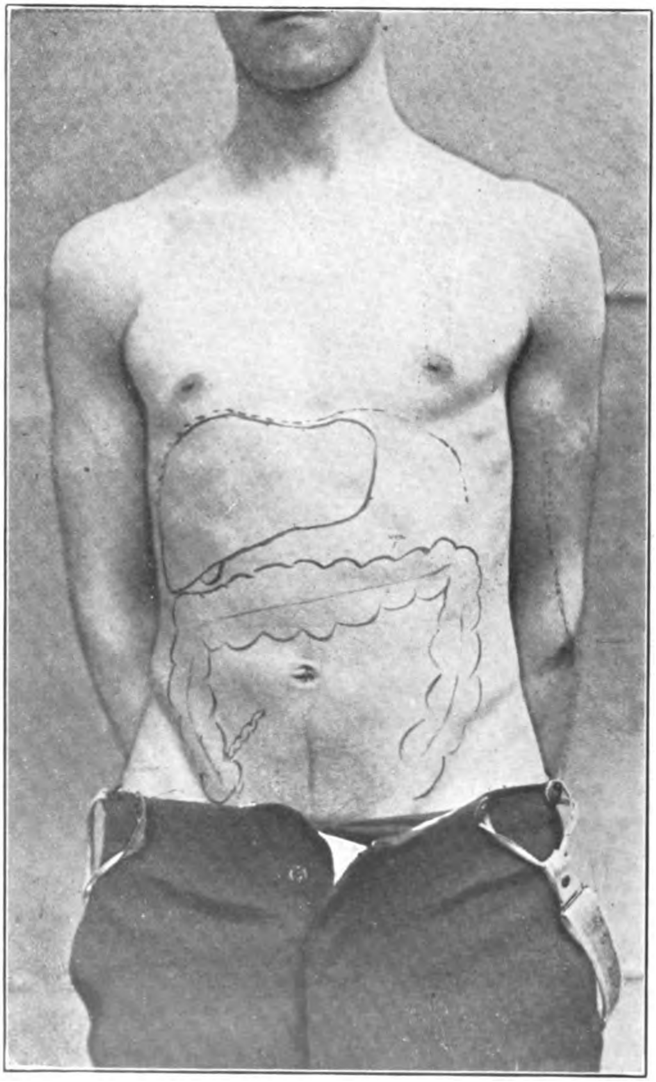


FIG. 46. Anterior surface outline of the liver and large intestine.

cervical vertebrae is called a vaso-motor center for the head, face and neck.

Affections of the Cervical Nerves.—These upper cervical nerves are seldom paralyzed. Paralysis in this region would stop the action of the diaphragm. Neuralgia may affect the nerves of this group. Spasmodic contraction of the muscles innervated from this area is not uncommon.

Brachial Plexus.—The four lower cervical nerves arise from the cervical enlargement of the cord and form the brachial plexus with their anterior divisions, while their posterior divisions supply motor fibers to muscles on the sides and back of the neck, and sensory fibers to the skin over these muscles. The anterior division of the first dorsal nerve forms a part of the brachial plexus.

Fig. 33 illustrates the superficial area in which the reflexes from the skin and muscles of the arm are manifested. Subluxations or muscular contractions, in this area may affect one or more branches of this plexus.

Affections of the Brachial Nerves.—Neuralgia, paralysis or spasm may affect the area innervated by this group. Cervico-brachial neuralgia is quite common. A lesion will usually be found affecting the painful nerve at its point of exit from the spinal column. Paralysis rarely affects this plexus independently of the nerves leaving the cord at a lower level. Spasm is represented by such a condition as writer's cramp.

Lesions causing cramp or neuralgia may be located at the point of exit of the nerve from the spinal column, but the clot or other pressure causing paralysis is usually located in the brain. Paralysis of the brachial plexus is a part of a hemiplegia; it does not occur independently of the more general condition. Paralysis of certain groups of muscles of the arm, forearm or hand can usually be traced to the direct injury of individual nerve trunks in the arm.

Hemiparesis Below Fifth Cervical Vertebra.—Figures 34, 35 and 36 illustrate the results of pressure upon the spinal cord at a point between the fourth and fifth cervical

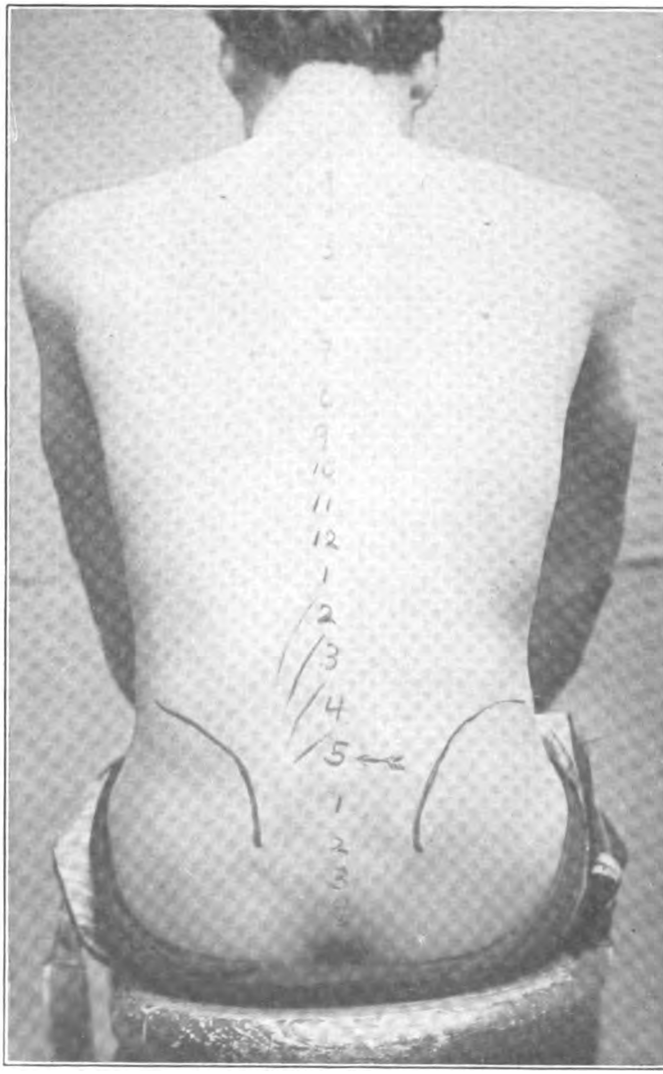


FIG. 47. Center for large intestine. The arrow marks point of close connection of cerebro-spinal nerves with the hypogastric plexus.

vertebrae. The child was not very strong at the time of the injury. A slight fall, while playing, subluxated the fifth cervical. No notice was taken of this slight fall. The next day, while bathing the child, the mother noted a peculiarity in the position of the shoulder. The arm could not be raised above the head. The author examined this case the day the mother discovered the change in the shoulder. At first glance from the side, it appeared to be a sub-spinous dislocation of the humerus, but palpation disproved this. Careful examination showed a hemiparesis of the whole left side below the fourth cervical nerve. None of the normal movements were lost, but it required the utmost effort of the patient to make them. Now and then the left toe would strike the floor too soon and slightly trip her. Palpation of the fifth cervical vertebra showed a lateral subluxation. The slightest pressure at this point caused the patient to cry out with pain.

After our examination (these photographs were taken at that time) the child was taken to a surgeon, who prescribed a surgical operation to stitch the latissimus dorsi to its proper position on the lower angle of the scapula. He did not recognize the paretic condition of the whole left side. After a short time, the child was brought to us for treatment. Our sole effort was to reduce the subluxation of the fifth cervical vertebra. The tenderness was so great that this was manifestly out of the range of possibilities with a delicate child. After two weeks of relaxing around this articulation a direct movement was made to reduce the subluxation. The alignment was perfected, but no immediate good results were noted. A continued increase in nerve power has gradually, in large measure, overcome the deformity.

Subluxation of the Scapula.—The deformity is the effect of uneven contraction of muscles. The latissimus dorsi, rhomboids and serratus magnus are weakened while the levator anguli scapuli and cervical fibers of the trapezius are contracting with their customary power. The muscles innervated by nerves from above the lesion are acting normally, but their action is not resisted. This results in subluxation of the scapula.

The Nerve of Wrisberg.—A division of the first dorsal nerve forms the first intercostal nerve. The inner side and back of the arm receive cutaneous branches from the first dorsal nerve. There is communication between the cutaneous nerves to this area and the second intercostal nerve by means of the nerve of Wrisberg, hence pain is frequently felt along the inner surface of the arm in cases of heart trouble, intercostal neuralgia in the second space, or pleurisy.

The Interscapular Region.—The division of the spinal column between the first and seventh dorsal vertebrae is commonly called the interscapular region. It is an exceedingly important one. It is sometimes called the pulmonary region, because it is the area from which the lungs derive many nerves. . Sensory impulses from the lungs are coordinated in this area.

Figure 37 illustrates the anterior surface outline of the lungs, while Fig. 38 shows the outline on the posterior surface of the thorax. These markings were made on the surface according to physical methods of diagnosis. They represent the average position of the lungs in a healthy man.

Lung Center.—Figure 39 illustrates the lung center within which sensory impulses from the lungs are coordinated. A large proportion of cases of bronchitis, pulmonitis or pleuritis of either the simple or bacterial types, are accompanied by great sensitiveness in this area. This sensitiveness is in the contracted muscles, or, when the shape of the thorax is greatly changed, at the angles of the ribs. Subluxations of ribs or vertebrae in this area are sometimes found in connection with the inflammations above named. Whether they are the cause or the effect of the inflammation can only be told by the history. Because the two conditions, that is, inflammation in the thoracic vîscera and osseous subluxation, exist at the same time is no reason for saying that the subluxation is necessarily the cause of the inflammation. That is a mere dogmatic assertion which lacks scientific proof.

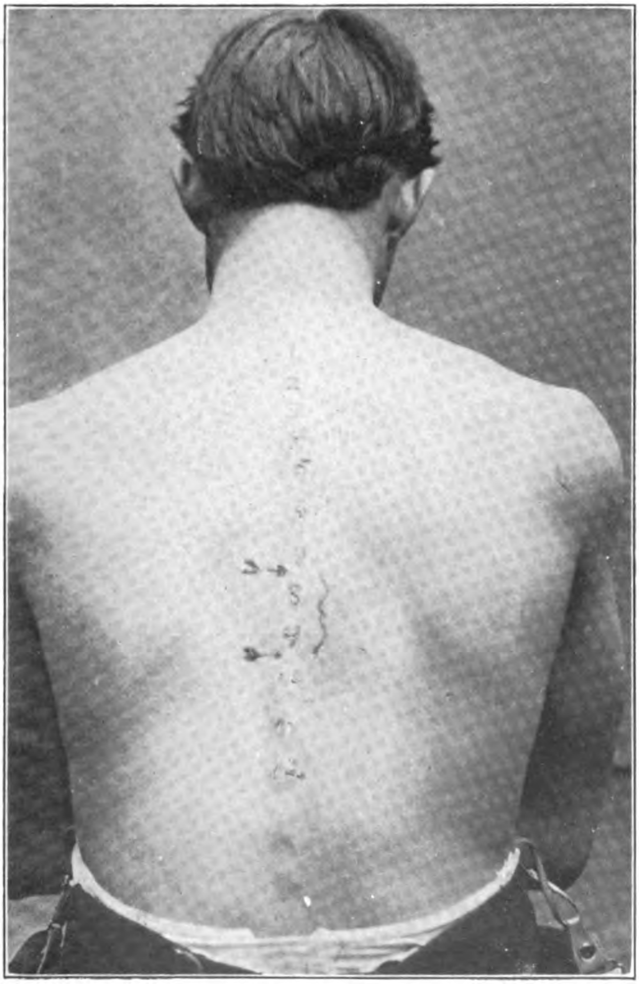


FIG. 48. Center for chills.

The condition might be just the opposite. We do not desire to confuse our readers in the least, but it should be remembered that before making a dogmatic statement such as "disease is the result of anatomical abnormalities followed by physiological discord," we should be certain

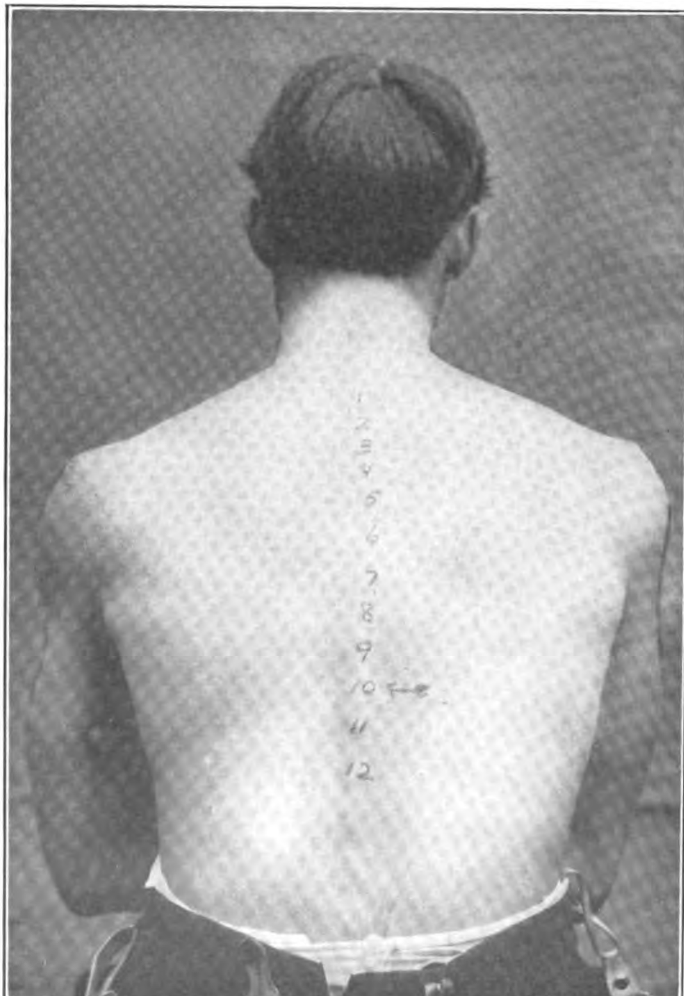


FIG. 49. Center for the gall bladder.

that our statement is not based on a series of selected coincidences. The old saw: "It's a poor rule that does not work both ways," is decidedly applicable to nerve reflexes.

Cilio-Spinal Center. — Tenderness in this area is not necessarily indicative of physiological disturbance in any thoracic viscus. Fig. 40 indicates two centers. The one between the second and third dorsal is called the cilio-spinal center. Detail concerning this center will be found in the chapter on the Sympathetic Nervous System.

The fact that the vaso-constrictor fibers to the cervical sympathetic ganglia leave the spinal cord below the second dorsal vertebra shows that some reflexes from the head, face and neck may be coordinated in the interscapular region.

Heart Center.—The point between the fourth and fifth dorsal spines is noted as a heart center. We have not found any text-book authority for this statement. Clinical experience leads the author to locate a heart center at this point. What the absolute influence of this center is we do not know. From observation of cases of angina pectoris it appears to be a sensory and vaso-motor center for the heart. Stimulation of this center by a quick percussion stroke of the fingers will bring on an immediate attack of pain in the heart, blueness of lips and finger tips. Heavy digital pressure at this point relieves the pain. Steady extension of the whole spinal column does not stimulate such cases, but as the pull is reduced and the vertebrae are drawn closer together, this point is frequently stimulated. In order to avoid an attack after extension, it is necessary to lessen the force of the pull very gradually and evenly.

Fig. 41 illustrates the surface markings of the heart. This organ has three centers. (1) The pneumogastric nerve exerts an inhibitory influence. This nerve can be stimulated in the neck. See Fig. 267. (2) The accelerator center includes second, third and fourth dorsal. See Chapter VI on the Sympathetic Nervous System. (3) Vaso-motor and sensory center is found between fourth and fifth dorsal.

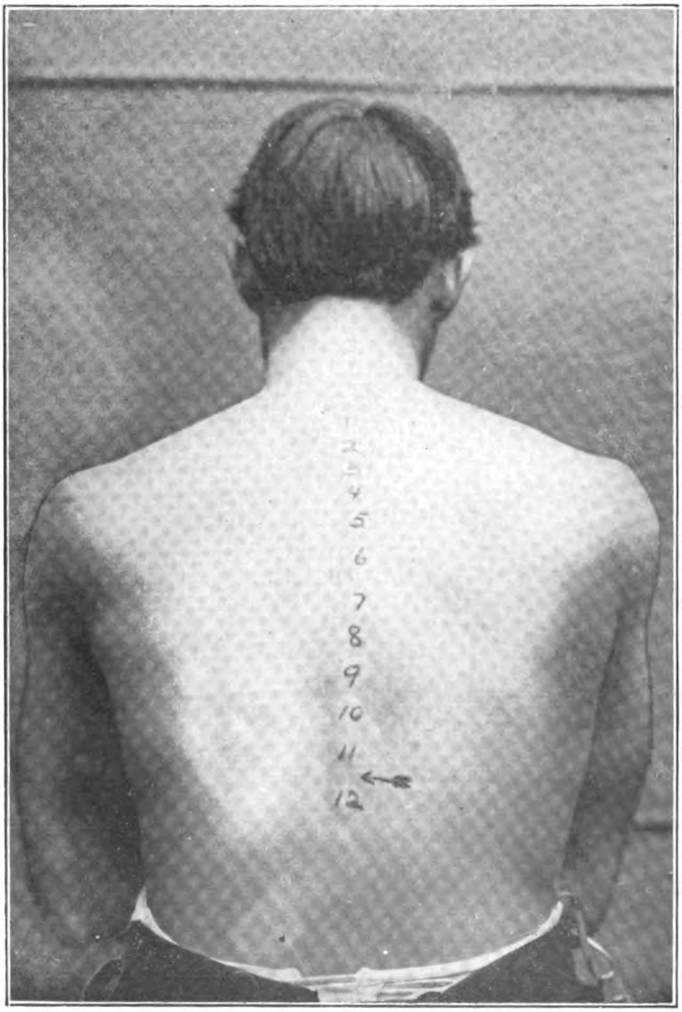


FIG. 50. Center for the ovaries. Reflexes from the ovaries may follow the ovarian plexus to the aortic and reach the cerebrospinal system at this point. This is true for the testes also.

Stomach Center.—The surface outline of the stomach is given in Fig. 42, while its reflex surface center on the back is indicated in Fig. 43. This center lies wholly within the pulmonary area, therefore it will be readily noted that there is opportunity for much careful reasoning in order to determine whether a lesion between the first and seventh dorsal vertebrae is connected with disturbance of the lungs, pleura, heart, eyes or stomach. Clinically, we distinguish somewhat as follows: A lesion covering a large part of this area is probably pulmonary. A lesion in the lower half and extending below the seventh spine is probably gastric in character. When the lesion is at the third or fourth and decidedly limited, i: e., the tenderness is sharply circumscribed in this area, it is impossible to tell, except by further examination of the heart, bronchi and eyes, to which it belongs. The experienced diagnostician can frequently estimate the probable relation of a lesion by his power of reading the signs of disease as evidenced by expression, posture and general indications.

The splanchnic area is a large and important one. It is indicated in Fig. 44. We have noted in this photograph the upper connections of the splanchnic nerves in the pulmonary area. This explains the high position occupied by some reflexes from the first part of the gastro-intestinal tract. Wonderful influences can be secured in this area, over circulation in the abdominal viscera.

Liver and Spleen Center.—The liver and spleen receive their sensory and vaso-motor innervation from the eighth, ninth and tenth dorsal nerves. The surface markings and center are indicated by Fig. 45. The liver frequently reflexes its disturbed sensory influences to the right shoulder. We have noted cases of gastric disorder or enlarged spleen which reflexed sensory impressions to the left shoulder.

Large Intestine.—Fig. 46 pictures the surface markings of the liver and large intestine. These average normal outlines should be thoroughly remembered and used

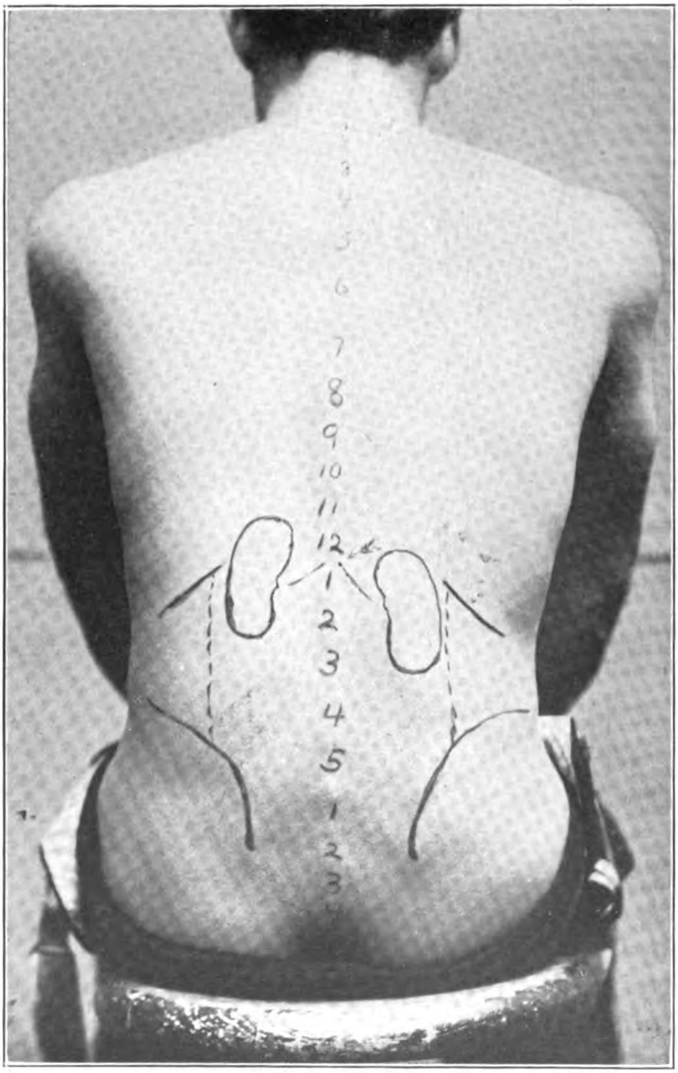


FIG. 51. Posterior surface outline of the kidneys.

when making a physical examination. The spinal center of the large intestine is indicated by Fig. 47.

Small Intestine.—The first portion of the small intestine, duodenum, is innervated from about the same area as the liver. Fig. 45. It must be borne in mind that the splanchnic area is a large one and comprehends these smaller centers. Many of these points indicated as centers are the areas which clinical experience has noted in connection with visceral disturbance. The repeated experience of many cases gives them value for diagnostic and therapeutic purposes.

Center for Chills.—Within the area indicated by Fig. 48, there is a center usually described as the eighth dorsal, which has received the name of "the center for chills." Our first observation of the action of this center was in connection with a case of malarial fever. Heavy inhibition of this area lessened the severity of the chill. We have observed the effects of inhibition of this center in many cases of chill due to nervousness, onset of La Grippe or other infectious diseases, and to abscess formation. In all cases the treatment was distinctly helpful to the patient.

The Language of Pain.—Homeopathic medical practice notes variations in the character of pain, and uses these characteristics as indications for the administration of special drugs, as though a nerve fiber expressed a language of pain. To the osteopathic physician, it is sufficient that a nerve express a disturbance at some point of its course. This cry of the nerves calls for just one thing, remove the cause. Search is made for this cause along its entire course, and the course of its connections.

Osteopathic View of Pathology.—Another particular in which the osteopathic pathology differs from other schools of medicine is in the way we view varying conditions of a viscus. To the medical practitioner, simple

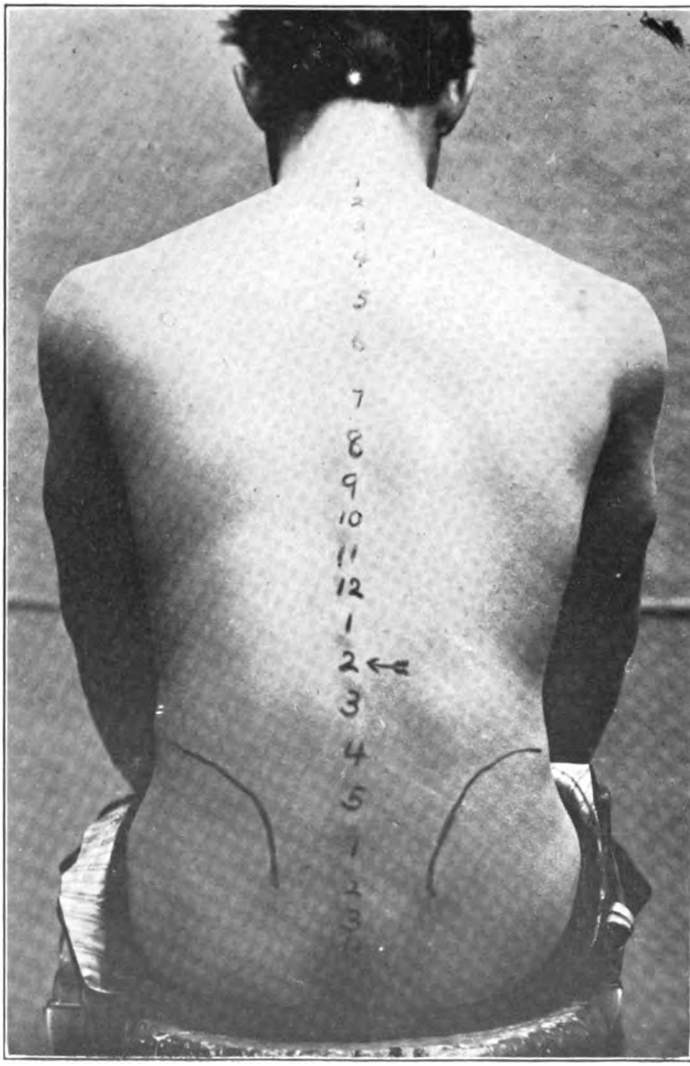


FIG. 52. End of the spinal cord. Physiological center for parturition, defecation and micturition.

gastritis is a vastly different condition from gastric ulcer. To the mind of the osteopath, these conditions differ in degree, not in kind. The same organ, the same blood supply, the same nerves are involved in both conditions, therefore we treat these structures. Our dietetic treatment takes account of the differing activity of the stomach, but our manipulative treatment does not.

We apply this same method to all organs. Our manipulative therapeutics are based on structure more than on function.

Center for Gall Bladder.—The gall bladder lies under the anterior extremity of the tenth rib. In cases of gall stone the area of the tenth dorsal spine has been found to be sensitive. All of the structural and functional changes connected with gall stones have seemed to center at this area, and along the tenth rib. Fig. 49 indicates the center for the gall bladder at the spine.

Intestines.—The small intestines are governed from the lower part of the splanchnic area, ninth, tenth, eleventh and twelfth dorsal. The large intestine is controlled by nerves from the lumbar region. There is a segmental distribution of these nerves to the large and small intestines. This segmental arrangement is exemplified in cases of diarrhoea. If the large intestine is the part affected, our manipulation is devoted to the lumbar region. Reflexes from the bowels may be found at any point between the ninth dorsal and the fourth sacral.

In five consecutive cases of appendicitis, the reflex was located at the third and fourth lumbar spines. Fig. 47 indicates the area concerned in reflexes from the large intestine.

Uterus.—The position of the arrow in Fig. 47 indicates the point of apparently close connection between the hypogastric plexus and the cerebro-spinal system. This point is frequently the seat of great tenderness which is entirely reflex in character. All of the pelvic viscera

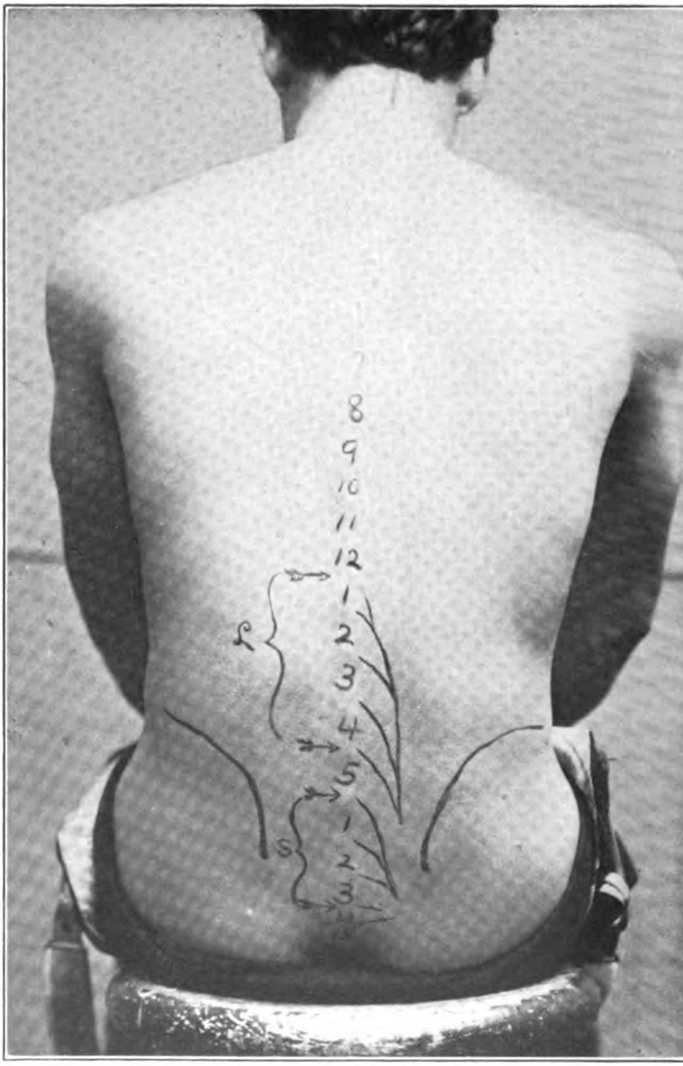


FIG. 53. Areas of the lumbar and sacral plexuses.

at times send reflexes here. The uterus more than any other pelvic organ manifests its disturbed condition by tenderness at this point.

The uterus is such a changeable organ that it is the chief disturber of sympathetic rhythm in a woman's body. A change in its position causes a change in its blood supply, followed by congestion of its mucosa. This congested condition sets up a series of impulses in the sympathetic system which may never reach the cerebro-spinal system. They spend their force on the various organs governed by the sympathetic nervous system, the heart, stomach, bowels, etc. Fig. 55 illustrates the difference in the heart's rhythm in the same patient. The first sphygmogram was taken while the patient had considerable difficulty in moving about on account of the heart's very irregular action. The uterus is prolapsed. Patient has worn a stem pessary for years. When the patient takes the genu-pectoral position and inhales strongly, while pulling upward on the abdominal muscles there is great relief, but when the heart becomes as irregular as this sphygmogram indicates, she is afraid to take this position. After twenty-four to seventy-two hours of irregular action, the heart regains its rhythm. The position of the uterus becomes changed by the moving of the patient in bed. The perineum is badly torn and the uterine ligaments are greatly lengthened, hence the organ cannot be kept in one position. She has refused operation.

Many different points are named as centers for the uterus, but they all rest on the fact that after the organ has initiated a large number of impulses in the sympathetic system, they may be passed to the cerebro-spinal system at any point of union of the two systems.

Ovary and Testes.—These organs receive their sympathetic innervation from the plexus which lies on their arteries. The ovarian plexus is given off from the aortic plexus which receives fibers from as high as the eleventh and twelfth dorsal ganglia. Therefore a lesion in the

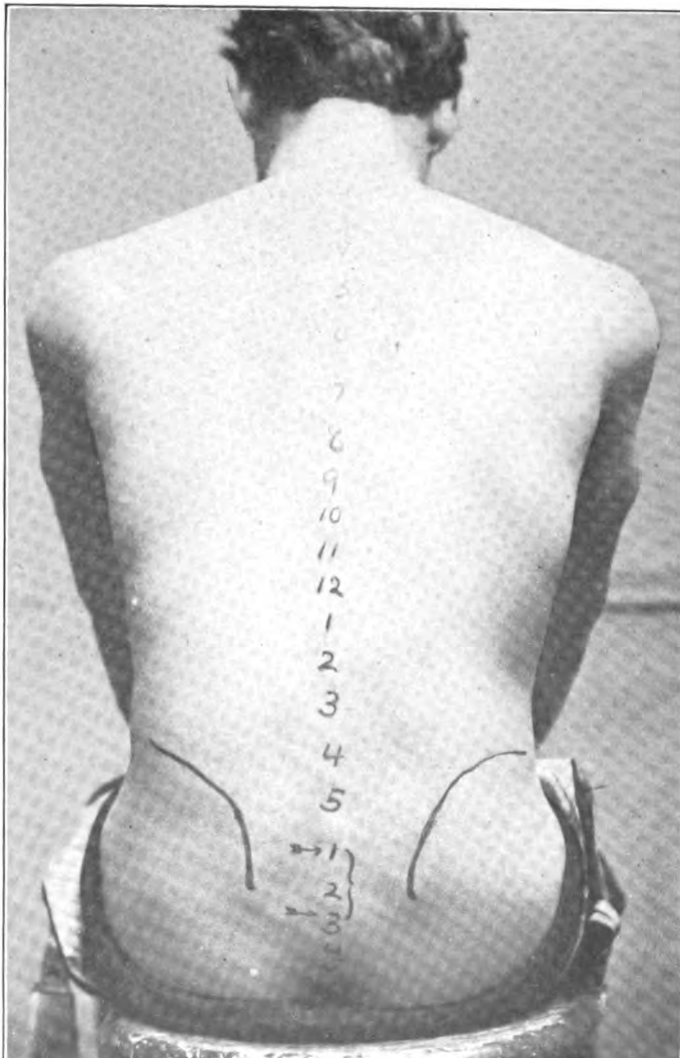


FIG. 54. Center for the bladder.

area of the eleventh and twelfth spinal nerves is frequently in connection with the ovaries or testes. Fig. 50 indicates the height of the influence of the aortic plexus through its direct connection with the cerebro-spinal system.

Kidneys.—Fig. 51 indicates the surface marking of the kidneys and the junction of the last dorsal and first lumbar vertebrae. Lesions of either the eleventh or twelfth dorsal may affect the kidneys.

The reflexes of this organ may reach the cerebro-spinal system over the renal splanchnic. The articulation of the last dorsal and first lumbar allows considerable movement. It is probably the weakest part of the back. The area of the twelfth dorsal nerve is usually sensitive when the kidneys are affected. This sensitiveness may extend a short way upward, as far as the tenth dorsal.

In patients whose abdomen is moderately thin, it is possible to affect the renal sympathetic plexus by deep manipulation above the umbilicus. The kidneys lie above the level of the umbilicus. Have the patient lie in the dorsal position with flexed thighs so as to relax the abdominal muscles. The balls of the fingers of both hands should be pressed deeply into the abdomen about two inches above the umbilicus, then move the fingers laterally toward the kidneys. Pressure is thus brought to bear upon the renal artery. The mechanical stimulation of the renal plexus usually results in vaso-constriction of renal arteries.

Second Lumbar.—The lumbar enlargement of the spinal cord is the physiological center for several functions performed in the pelvis. Defecation, micturition, and parturition, are all reflexly controlled at this point, second lumbar. The spinal cord ends at the lower border of the first lumbar vertebra. The second lumbar vertebra is indicated in osteopathic literature as a center for the three functions named above. We understand by this that an injury at this point may involve the functional ac-

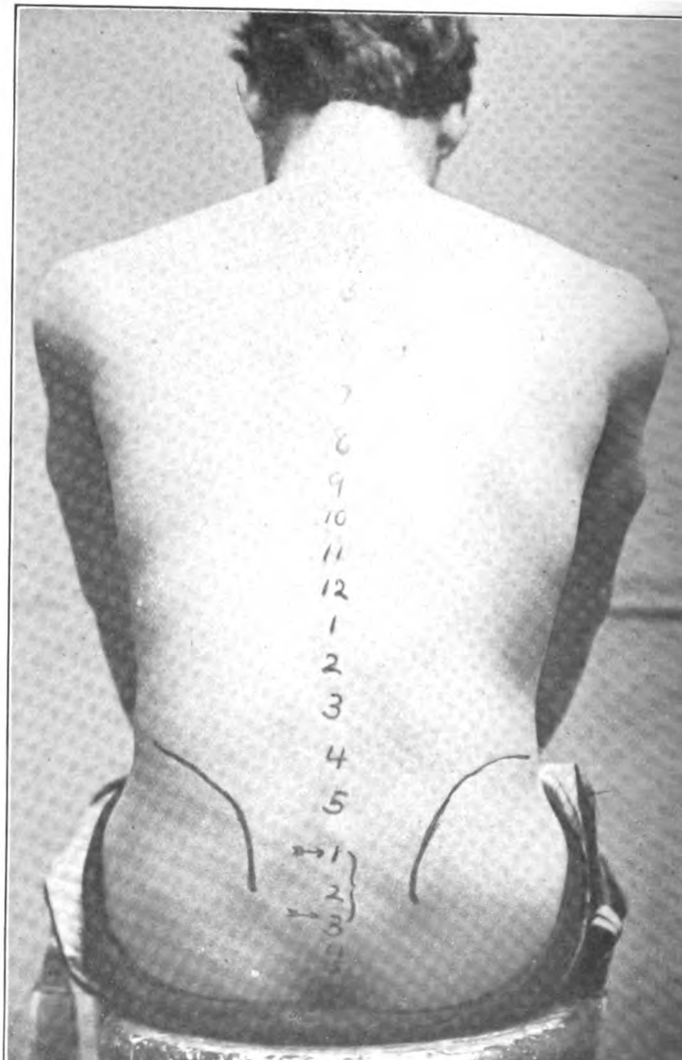


FIG. 54. Center for the bladder.

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tivity of the rectum, bladder, or uterus. Disturbances in these viscera are not necessarily manifested to the osteopath by tenderness around the second lumbar vertebra. Any point along the spinal column below the second lumbar may be sensitive as a result of disturbance in the pelvic viscera. Fig. 52.

During parturition there is conscious aching along the whole lumbar area, thus demonstrating that the sensory nerves of the uterus can reflex their irritation to all the lumbar nerves. Injury of the spinal column at the junction of the dorsal and lumbar portions may affect motion, sensation and nutrition of all the structures innervated by the cauda equina. An injury below the second lumbar vertebra will not have as far-reaching effect as an injury of the same character above that point.

Paraplegia.—When the back is broken at the dorso-lumbar articulation, paraplegia results. It is not necessary to actually break the back in order to cause paraplegia. A severe strain caused by a fall may induce such an exudate around this articulation that pressure is exerted on the lumbar enlargement of the cord. Many of the so-called broken backs, which are spoken of as causative of paraplegia, are not broken at all, but the ligaments are badly sprained. The same condition exists here as in other sprained joints. There may be marked kyphosis, but this does not necessarily indicate dislocation. The paraplegic condition may be perpetuated by the pressure of connective tissue formed in the repair of the injury. This is especially liable to follow if some form of manipulative treatment is not persisted in for from one to three years. The author has fortunately been able to observe the slow regeneration of nerve tissue following complete paraplegia as a result of injury of the dorso-lumbar articulation. This case has been observed by us during nearly four years. During all of this time, she has received osteopathic treatment. This method of treatment was not begun until ten months after the accident, therefore, synovial adhesions had formed to such an extent in the joints of the limbs that much painful manipulation of these joints has been necessary.

Following the accident, there was motor and sensory paralysis of the extremities, bladder and rectum. Control of the bladder and rectum returned after two months of osteopathic treatment. Sensation and motion have returned to the extremities. There is deformity as a result

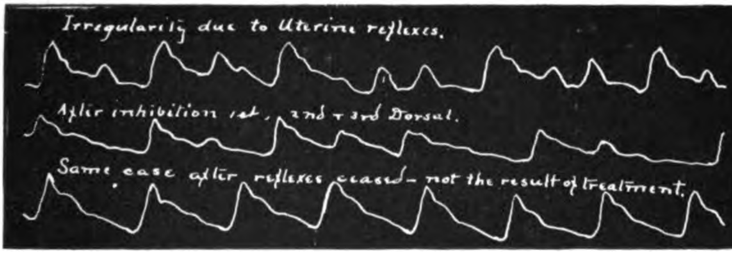


FIG. 55. Sphygmograms illustrating the effect of uterine reflexes on the heart.

of the adhesions formed during the ten months previous to the first osteopathic manipulation. The patient had been massaged during the ten months mentioned.

Lumbar and Sacral Plexuses.—From the nerves of the cauda equina are formed two large plexuses, the lumbar and sacral, indicated in Fig. 53. The branches of these plexuses innervate the muscles of the lower extremities. The spinal area from which these plexuses receive their fibers should be carefully examined whenever any difficulty of movement or sensation in the lower extremities is presented.

The student should learn the sensory and motor distribution of each branch of these plexuses, so that peripheral disturbance can be immediately associated with the point of emergence from the spinal column of the affected nerve or nerves.

The Bladder.—Fig. 54 indicates the superficial area in which reflexes from the bladder are most frequently

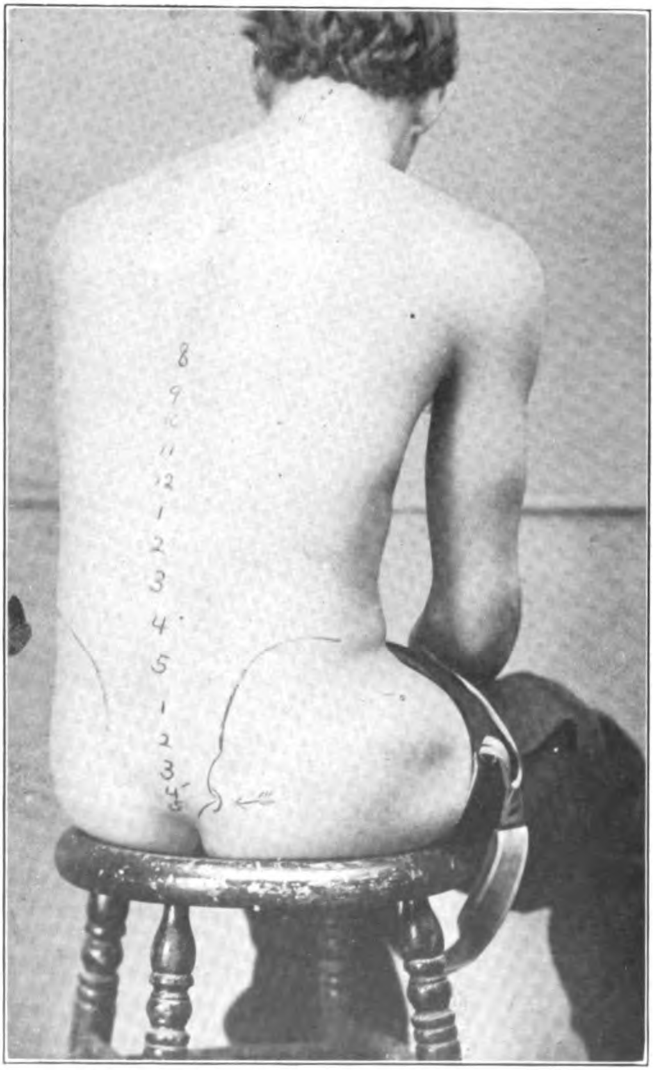


FIG. 56. Surface marking of the pudic nerve.

found. The sensory fibers to the bladder are found in the first, second, third and fourth sacral nerves. The first to third give the strongest evidence of sensory disturbance. When the mucous lining of the bladder is congested, these sensory nerves are stimulated. Motor fibers to the bladder are found in the second and third sacral nerves. The stimulation of the sensory nerves results in reflex stimulation of the motor nerves, which cause contraction of the muscular tissue of the bladder. Inflammation of the bladder is accompanied by almost continuous desire to micturate.

The sacral spinal nerves take a more direct and uninterrupted course to the pelvic viscera than do nerves from other portions of the spinal column to their respective areas of distribution.

Inhibitory pressure over the sacral foramina has a very marked effect on the sensory nerves of the bladder. This pressure does not directly affect the anterior divisions of the sacral nerves, nevertheless the effect is the same as though the anterior divisions were subjected to the inhibitory pressure. This is evidence of the close harmony between the two divisions of a spinal nerve. The inhibitory pressure not only lessens conscious pain in the bladder, but also changes the vaso-motor conditions. In this respect it much resembles the action of heat applied to the surface.

Sphincter Vaginae.—The sphincters of the vagina and rectum are controlled from the area of the third and fourth sacral nerves. When the vulva, vagina or rectum are highly sensitive, we usually find a hyperaesthetic area at the third and fourth sacral spines. When this area is sensitive, the point where the pudic nerve crosses the ischiatic spine is also decidedly sensitive to pressure. Fig. 56 indicates the superficial relation of the pudic nerve. This nerve is sensory and motor to the skin and muscles of the perineum. This point will be found sensitive when the prostate is enlarged; in fact, almost any disorder of the male sexual organism is accompanied by this sensitive condition.

Inhibitory movements over the back of the sacrum and ischiatic spine will result in relaxation of the perineal muscles. It affects spasmodic stricture of the urethra in a wonderful manner. The local anaesthetic effect of inhibition is not so easily demonstrated in any other portion of the body as in this sacral area.

When the uterus is turned either backward or forward or prolapsed, there are impulses aroused in sensory nerve fibers in the rectum or bladder. These impulses are reflexed to the sacral area, while those aroused in the uterus pass to higher points in the spinal column. Inhibition of this sacral area will have a temporary effect. The only treatment worth while is the correcting of the position of the uterus.

Conclusions.—There are many more so-called "centers" mentioned by osteopathic writers. We have not attempted to even recapitulate those other centers which seem to us to be quite too fanciful for practical use. The centers mentioned in this chapter are those which can be demonstrated in daily practice, and hence are used continually, both as guides for diagnosis and as indications for the application of manipulative therapeutics. No sympathetic spinal centers for "sensation," "motion" or "nutrition" can be demonstrated. These are characteristics of nerve fibers in general, and it is entirely misleading to limit these characteristics to any one portion of the spinal column. Every osteopathic center should be capable of demonstration anatomically, physiologically and clinically. Only those which can pass this test satisfactorily are worthy of our consideration.

CHAPTER XII.

THE BACK.

The Spinal Column.—The back is characterized by the spinal column, which constitutes the long axis of the body. This column consists of twenty-four movable vertebrae, the sacrum and coccyx. The movable bony segments are separated from each other by fibro-cartilaginous discs. Each vertebra is characterized by a body and an arch which extends from the posterior lateral portions of the body. The body serves to give strength, stability and weight-carrying capacity to the column. The arches serve to form an incomplete bony canal for the protection of the spinal cord and its membranes. Although these arches form a fairly complete protection to the contents of the canal in the upper dorsal region, the approximation of the laminae is not nearly so perfect in the lumbar region. It is through the gaps between the laminae in the lumbar region that puncture can most easily be made.

Spinal Ligaments.—The discs of fibro-cartilage are very strongly attached to the bodies of the vertebrae and the fibrous tissue of these discs interweaves with the fibers of the common ligaments which extend from end to end of the spinal column on the anterior and posterior surfaces of the bodies. After cutting the neural arches, at their junction with the bodies, we have left a strong column of bony segments, separated by fibro-cartilaginous discs which are strongly adherent. Both bones and cartilages are very strongly bound together by the anterior and posterior common ligaments.

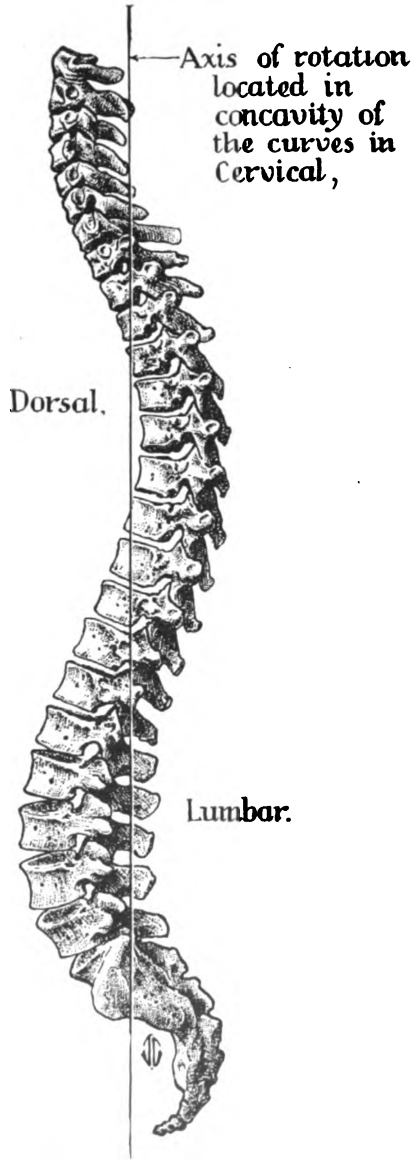


FIG. 57. Drawn by John Comstock.

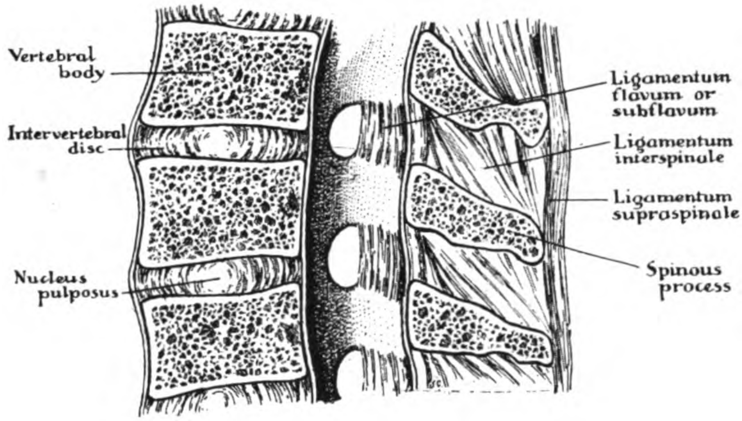


FIG. 58. Mesial section through a portion of the lumbar part of the spine. Drawn by John Comstock (after Cunningham).

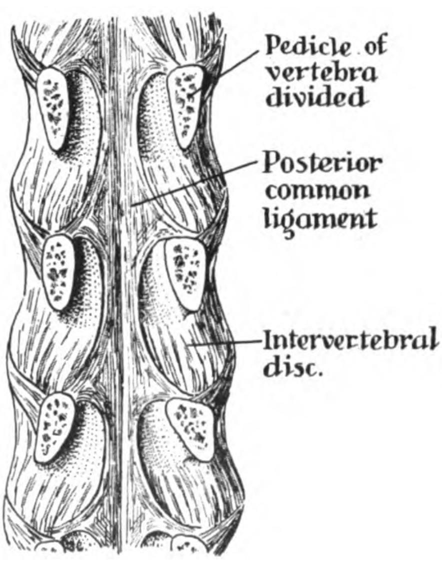
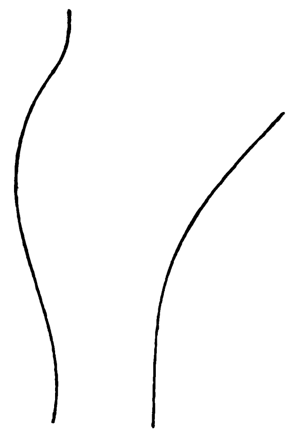


FIG 59. The posterior common ligament of the vertebral column. Drawn by John Comstock (after Cunningham).

Flexibility.—This column is characterized by moderate flexibility and certain curves. The elasticity is due to the structure of the fibro-cartilaginous discs. The center of the discs is a very soft mass of fibro-cartilage, thicker than the margins and containing the remains of the chorda dorsalis of the embryo.



A B

FIG. 60. Curves of the vertebral column (Fick). A, with intervertebral discs; B, without intervertebral discs.

Normal Spinal Curves.—The curves are due to the unequal thickness of the anterior and posterior portions of the discs. The discs are thicker anteriorly in the cervical and lumbar regions, thicker posteriorly in the dorsal region, thus producing anterior curves in the cervical and lumbar, and a posterior curve in the dorsal. The bodies of the vertebrae also vary slightly in thickness anteriorly and posteriorly, i. e., the anterior depth of the bodies is less than the posterior so that without the discs the whole column presents a posterior curve with a loss of the anterior curves in the cervical and lumbar regions. These curves and the characteristics of the centers of the inter-vertebral discs give the column its resilience. In bending this column to the side, rotation of the vertebral bodies is inevitable.

Limitation of Flexibility.—The anterior and posterior common ligaments of this column of vertebral bodies and inter-vertebral discs tend, by their inelastic fibrous tissue, to limit flexibility. By adding the neural arches with their ligaments the flexibility of the column is still further limited. Besides the common ligaments binding the bodies there is one other ligament which extends the whole length of the column, i. e., the supraspinal ligament, consisting of inelastic fibrous tissue extending over the spinous processes from the sacrum to the seventh cervical, where its structure changes to yellow elastic fiber and is known as the ligamentum nuchae through its continuation to the cervical spinous processes and the occipital bone. This ligament limits flexibility in the dorsal and lumbar regions. The remainder of the spinal ligaments are intervertebral, i. e., extend between two vertebrae. They are inelastic with one exception, the ligamenta subflava connecting the laminae of the neural arches. There are many other things which are factors in limiting the inherent flexibility of the spinal column, viz., the articulation with the ribs to form the thorax, the articulation with pelvic bones, the contents of abdomen and thorax and the bulk of the soft tissues which round out the body.

Articular Processes. — Although the spinal ligaments and other structures limit the flexibility of the spinal column, the character of its evident flexibility is largely governed in the various regions by the shape and position of articular processes, which form a series of gliding joints between the neural arches. The articular processes are located at the junctions of the pedicles and laminae. They consist of two superior and two inferior for each vertebra.

Cervical Region.—In the cervical region the articular processes are placed very obliquely. The surfaces of the superior look upward and backward and are somewhat

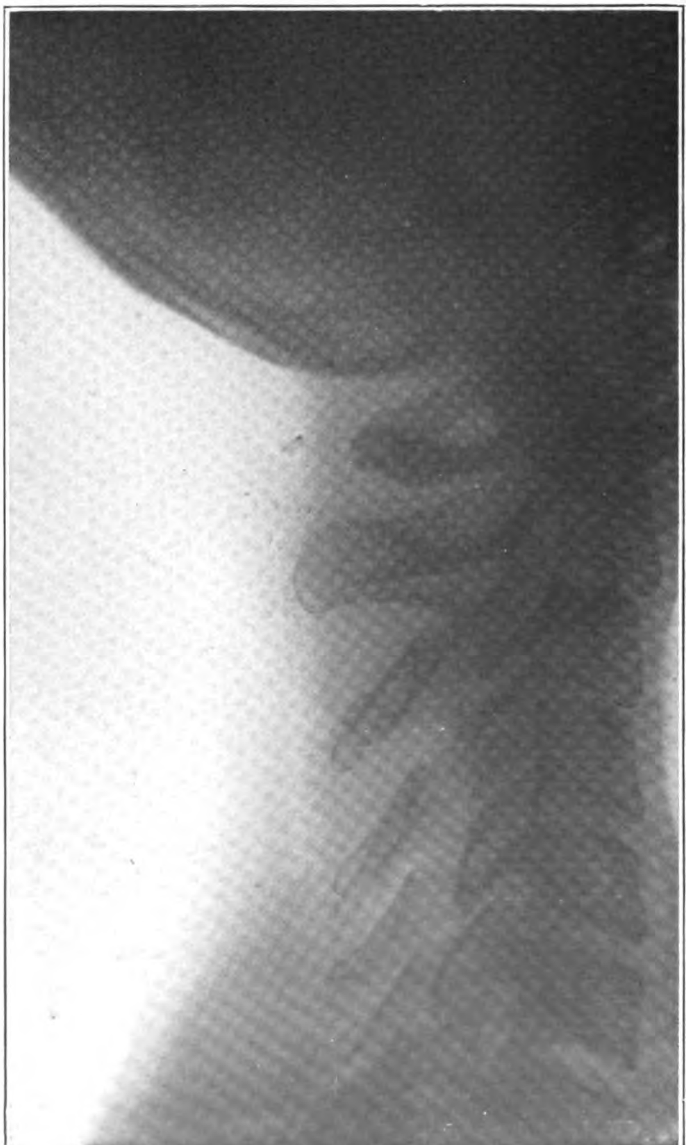


FIG. 61. Radiograph of the cervical region in position for balancing the head erect.

FIG. 62. Radiograph of the cervical region in extension.

arched to fit the slight concavity of the inferior which look downward and forward. This arrangement permits flexion, extension and side bending accompanied by slight rotation. These are recognized as the physiological movements for this region of the column. The highly specialized articulations between the occipital bone and atlas, the axis and

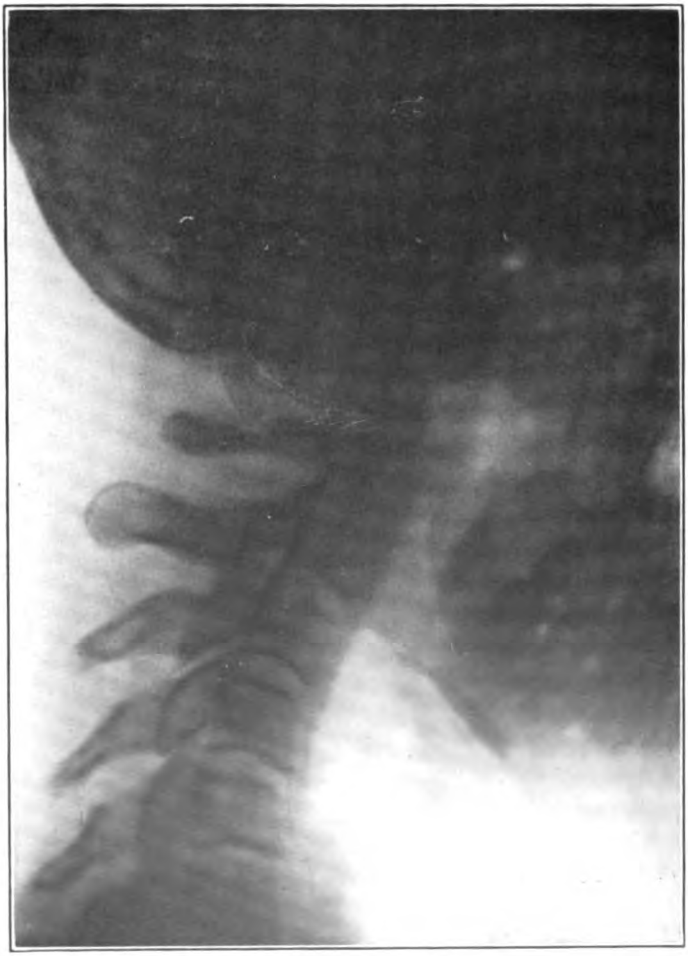


FIG. 63. Radiograph illustrating normal flexion in the cervical region.

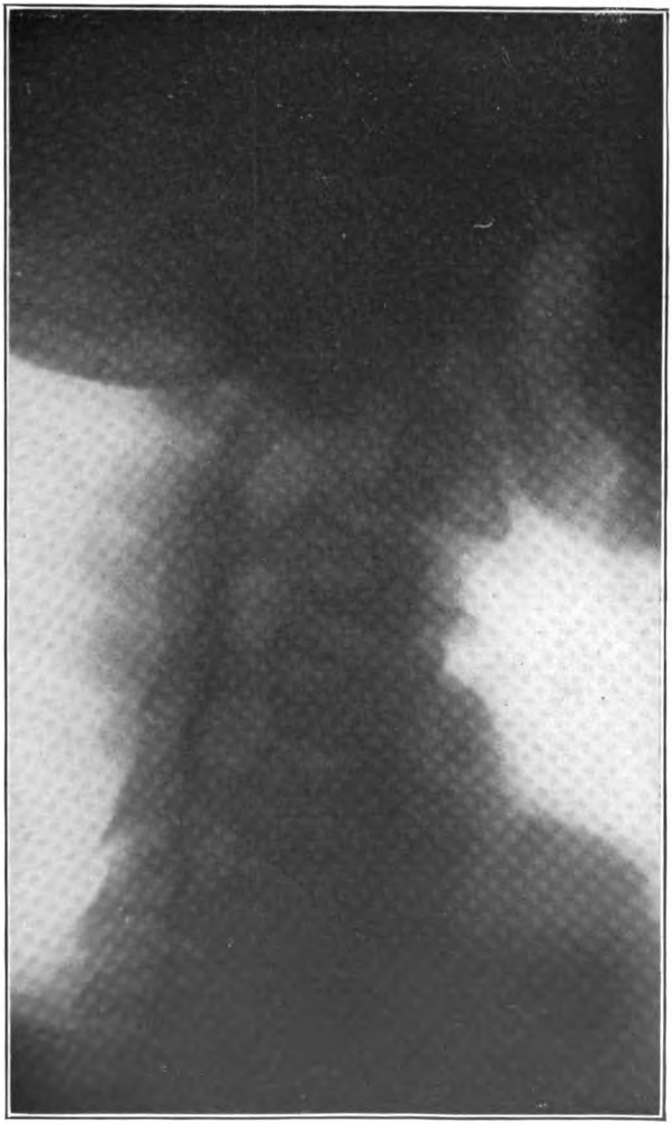


FIG. 64. Radiograph of the cervical region in rotation.

atlas are worthy of more detailed consideration. (See Chap. XIV.)

Dorsal Region.—The surfaces of the dorsal articular processes are vertical, the superior facing backward, the inferior forward. The surfaces are slightly curved from side to side thus forming parts of the surface of a theoretical cylinder having its axis located in front of the body. The movements permitted by this structural arrangement are the physiological ones known as flexion, extension and side bending rotation. Rotation is the most characteristic of the movements in this region. It is greatest in the upper dorsal articulations and decreases as the articular processes begin to take on lumbar characteristics. The eleventh, sometimes the tenth, dorsal verterbra marks the limit of this characteristic dorsal movement. All movements are limited in the dorsal region, not only by the inherent form of the vertebral articulations but also by the attachment of the ribs. The typical costovertebral articulation is characterized by the head of the rib articulating with the bodies of two vertebrae while the tubercle of the rib unites with the articular facet on the transverse process of the lower of these two vertebrae. The first, eleventh and

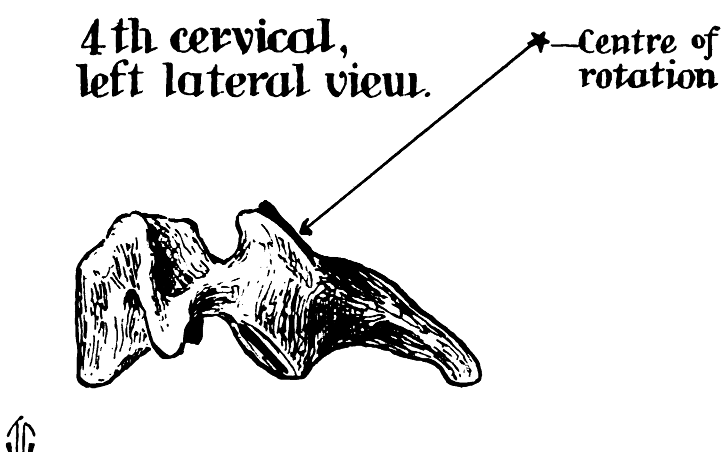


FIG. 65. Drawn by John Comstock.

twelfth costovertebral articulations are exceptions. The junction of the upper ribs with the sternum serves still further to give stability to the thorax and limit movement in the upper portion of the dorsal division of the column.

Lumbar Region.—The articular processes in the lumbar region are vertical. The surfaces of the superior and inferior face almost directly inward and outward, respectively. These surfaces are curved in the opposite direction from those in the dorsal region, so that they would form parts of a theoretical cylinder having its axis posterior to the spinous process.

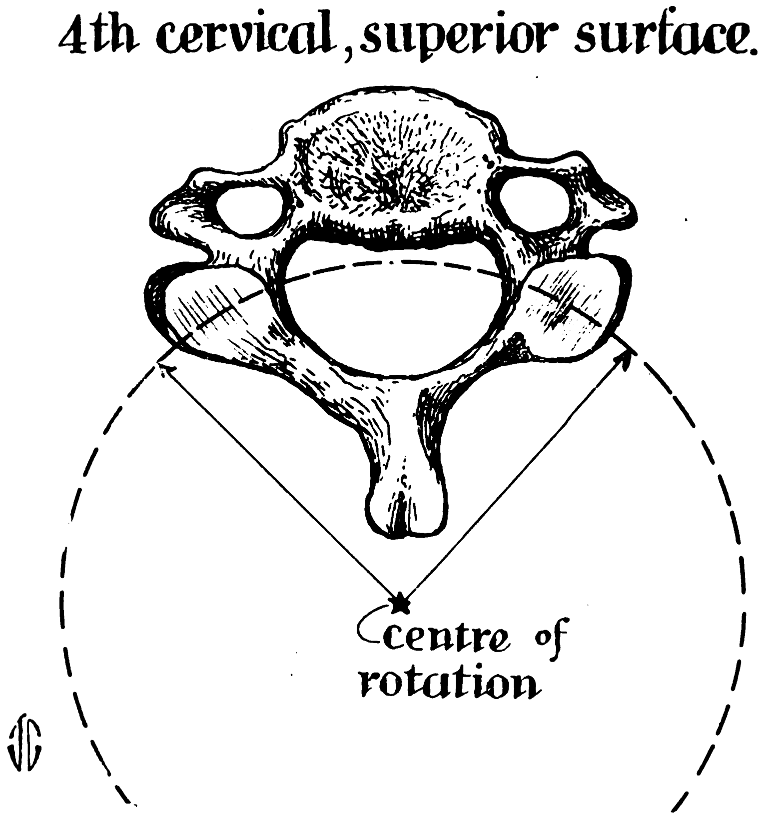


FIG. 66. Drawn by John Comstock.

Flexion and Extension.—Since the arrangement of the articular processes is an index to the character of movement normally permitted between the vertebrae in the various regions of the spinal column, it is advisable that we call attention to a few points concerning them. It is readily seen that flexion is a fairly free movement in all portions of the column, with the exception of that portion of the dorsal which articulates with the seven true ribs. Extension is likewise free in these same sections, i. e., where flexion is free it is met by fairly free extension.

Side Bending Rotation.—Side bending, of a column having antero-posterior curves, is characterized by rota-

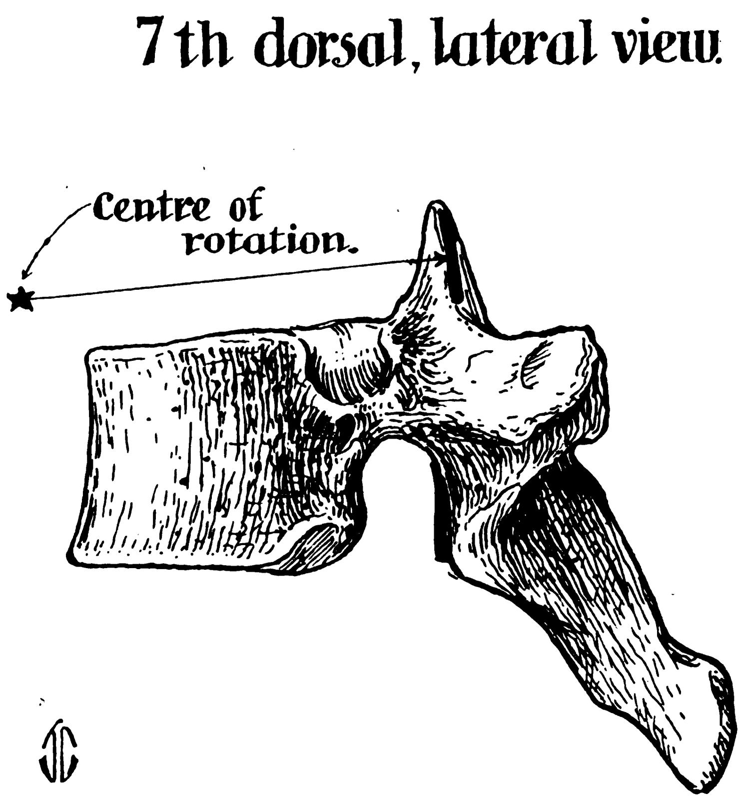


FIG. 67. Drawn by John Comstock.

tion. This inherent rotation of the segments of the spinal column will naturally take place with a center of rotation theoretically located on a line extending directly from end to end. This line would pass on the concave side of the curves, i. e., be posterior to the bodies in the cervical region, anterior to the bodies in the dorsal and posterior to the bodies in the lumbar. A study of the articular processes will show how this action is favored by the facing of their articular surfaces. Lines drawn perpendicular to the surfaces of the superior articular processes of a typical cervical, i. e., the fourth or fifth cervical, will meet at a point behind the spinous processes and about three inches above

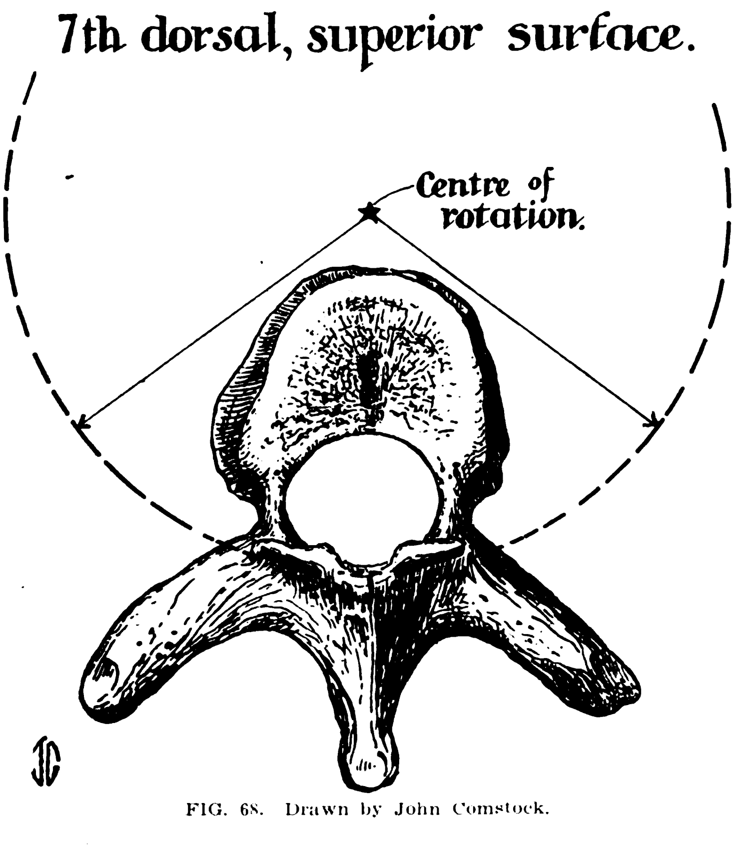


FIG. 68. Drawn by John Comstock.

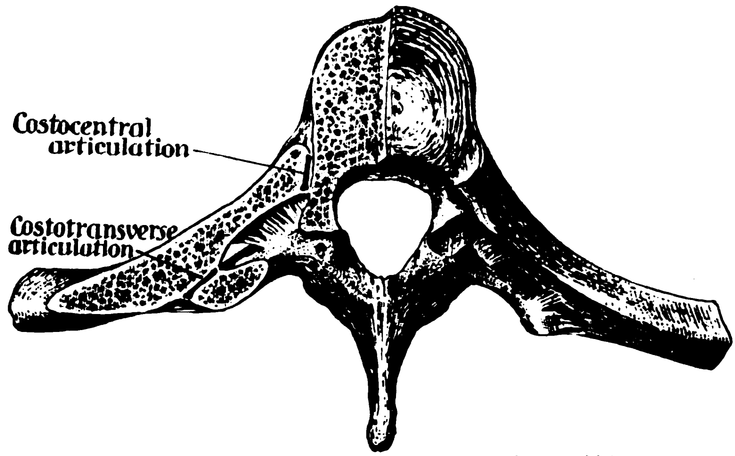


FIG. 69. Drawn by John Comstock (after Toldt).

3rd lumbar, lateral view.

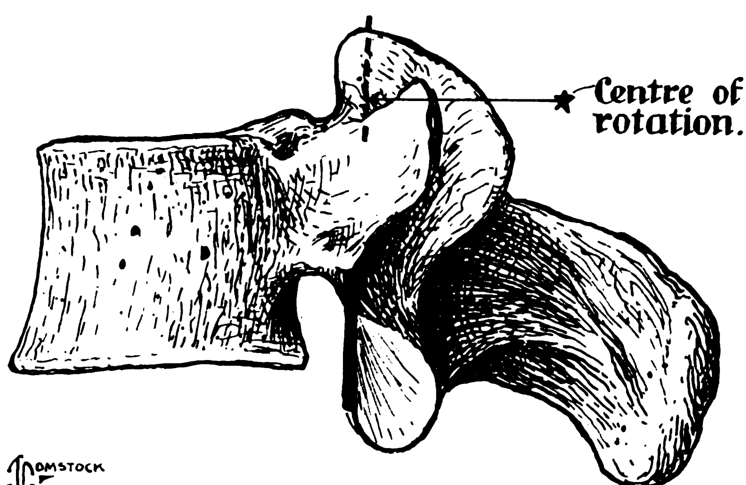


FIG. 70.

the level of the body of the vertebra. These lines incline backward, upward and inward.

Best Position for Freest Movement. — The range of movement in any joint is favored by relaxation of its ligaments, therefore any characteristic movement will be greater when the relation of the joint surfaces to each other is least limited by the ligaments. This position will be practically attained when the surfaces are in their normal position for weight-carrying, i. e., balance. The weight of the head upon the neck is balanced by the muscles governing the movement in the arthrodial articulations so that there is no sense of strain. This erect position favors rotation. The extent of rotation diminishes as the neck is flexed. It

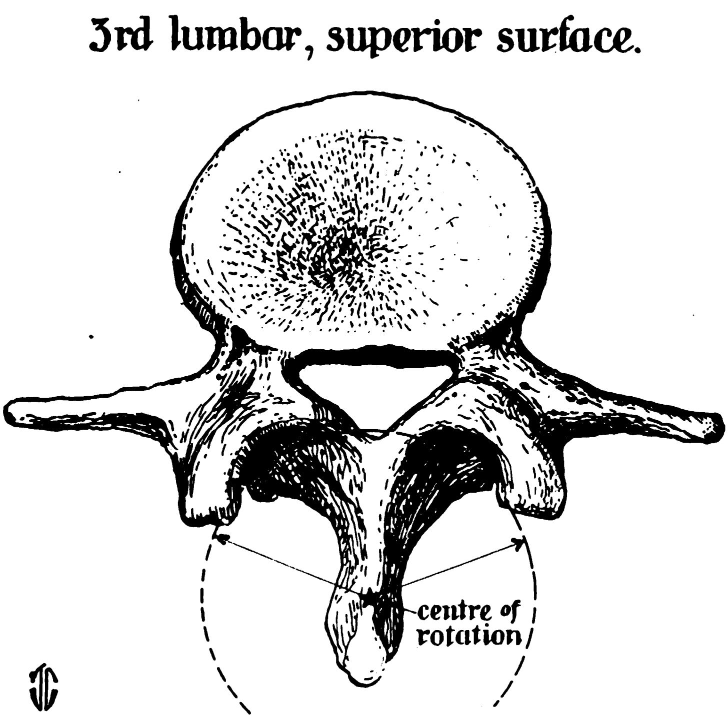


FIG. 71.

also diminishes as the neck is extended. In either flexion or extension, a series of ligaments becomes tense and hence limits the extent of another movement, which requires freedom of this tense ligament. The erect position of the neck

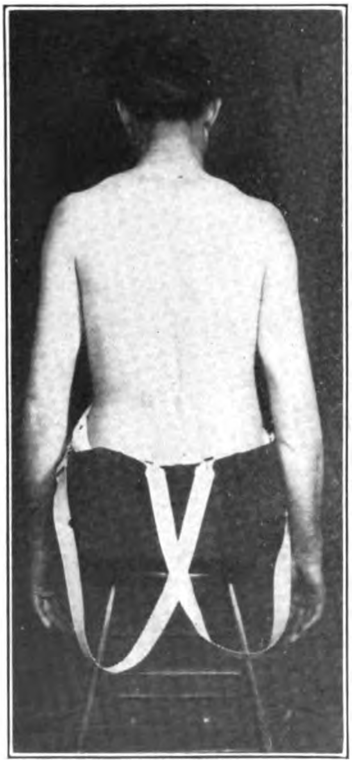


FIG. 72. Left dorsal—right lumbar curvature, progressive in type and therefore painful. Bodies of the dorsal vertebrae rotated to the left. Bodies of the lumbar vertebrae rotated to the right.

FIG. 73. Bodies of the lumbar vertebrae are rotated into proper alignment by elevating right buttock.

signifies ligamentous relaxation and is therefore the position of election for reducing subluxations in the cervical region. The seventh cervical marks the change in direction of the facing of the articular processes. Its superior surfaces adhere to cervical characteristics while its inferior become more vertical and lines perpendicular to them meet at a point in front of the column. There is frequently a gradual change in the facing of the cervical articular pro-

FIG. 74. Shows greatest right lateral flexion in concavity of the dorsal curve.

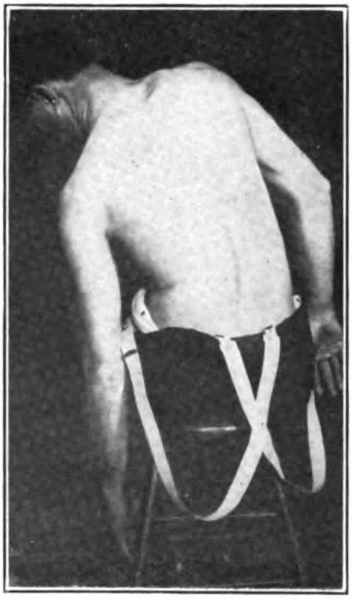


FIG. 75. Shows greatest left lateral flexion in concavity of the lumbar curve.

cesses which begins at the sixth cervical. The inferior processes of the sixth may face so as to bring their perpendicular lines together in front of and below the body.

Rotation in the Dorsal Region. — The articular processes in the dorsal are characteristically vertical and theoretically move in line with the surface of a cylinder having its axis anterior to the bodies of the vertebrae. Thus rotation in the dorsal appears to move on a fixed point, just anterior to the bodies of the vertebrae and hence the spinous processes make an actually as well as apparently greater excursion to right or left. The same rule with relation to freedom of movement being greatest in the normal poised position, applies here. Rotation is greater in the upper

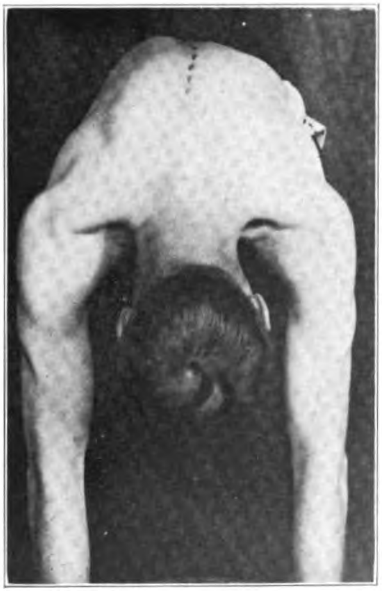


FIG. 76. Illustrates the degree of rotation of the bodies of the lumbar vertebrae in this case of left dorsal-right lumbar lateral curvature.

FIG. 77. Illustrates the degree of rotation of the bodies of the dorsal vertebrae in this case of left dorsal-right lumbar lateral curvature.

dorsal and decreases downward, disappearing at the variable point where lumbar characteristics begin to influence the form of the articular processes. This variable point is found from the ninth to eleventh dorsal. Rotation with the axis of movement anterior to the vertebral body usually ceases at the articulation between the eighth and ninth dorsal. The lateral flexion between the ninth and tenth, tenth and eleventh and eleventh and twelfth, is characterized by very little rotation of either the dorsal or lumbar type. In this short region of the dorsal we have an almost pure lateral flexion. Rotation in the upper dorsal is decreased in the flexed or extended position, for the same reasons given for the cervical. All movements in the upper dorsal are lessened by the costovertebral articulations. Since the head of a rib articulates with the bodies of two vertebrae

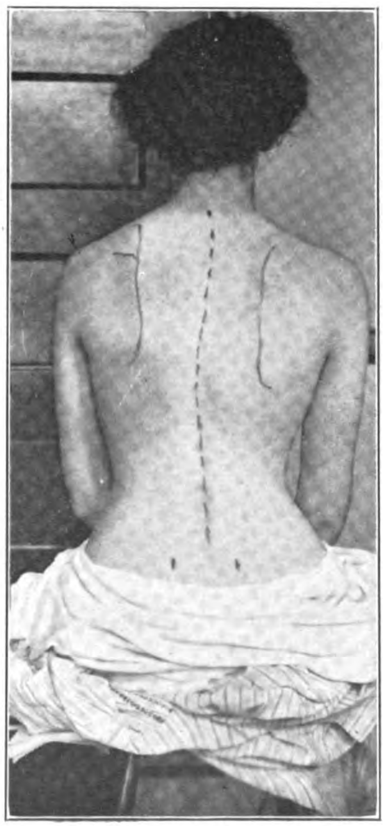


FIG. 78. Structural lateral curvature in the upper dorsal region, due to partial paralysis of the left rhomboideus major and minor. Compensatory rotation has taken place in the lumbar region, as shown by the relative outline of the body.

17

and their interovertebral disc, it is apparent that this would tend to block the movement of one vertebra on the other and hence greatly limit rotation. Although a study of the mechanics of this portion of the column seems to show a

FIG. 79. Flexion to the left, in case shown in preceding illustration. The point of greatest flexion is located in the concavity of the right lumbar curve.

FIG. 80. Flexion to the right, in case shown in the preceding illustration. The point of greatest flexion to the right is about the ninth dorsal, i. e., about the center of the concavity of the left lateral part of the curvature.

very solid and unyielding construction, the fact exists that we have a considerable amount of movement in the upper dorsal articulations. Rotation is probably the most pronounced of the upper dorsal movements and it is in this region of the column lateral subluxations are found. Flexion and extension are readily demonstrated from first to fourth and from eighth to twelfth dorsal, i. e., in these regions they are more pronounced than in the mid-dorsal.

Characteristic Movement in the Lumbar Region.—The lumbar articular processes are vertical and face so that they move in line with the surface of a theoretical cylinder having its axis running in the tips of the spinous processes.

FIG. 81. Slight lateral curvature of the structural type, as is evidenced by rotation of the bodies of the lower dorsal vertebrae to the left, the bodies of the lumbar to the right.

There is much variation in the form of the lumbar articular surfaces. Since they have much greater weight for their bearing surfaces to support they are heavily developed. Exaggeration of the normal lumbar curve during the developing period causes them to take on a greater weight carrying function than normal and hence changes the bearing movable surface so as to decrease the range of movement. The more nearly the bodies of the vertebrae tend

FIG. 82. Lateral flexion to the right, is greatest in concavity of the dorsal curvature.

FIG. 83. Lateral flexion to the left, in this case, is greatest in concavity of the lumbar curve.

to support the superincumbent weight the greater freedom of movement will naturally exist in the arthrodials between the articular processes. The characteristic form of the lumbar articular surfaces is not conducive to rotation, as a well defined movement, such as we find in the upper dorsal and cervical, but nevertheless, side bending in this region is characterized by rotation having its center in a line drawn vertically through the spinous processes. Thus we note that rotation in the three regions of the column places the center of movement on the concave side of the curve. Any corrective movements made with reference to any portion, or the column as a whole, must be made with reference to these points of normal rotation. As in the

FIG. 84. Illustrating the presence of rotation in the lumbar region, coexistent with lateral curvature.

other regions of the column, rotation in the lumbar is lessened proportionally by flexion or extension. Flexion is a greater check in this region than extension.

Rotation Toward Concavity of a Curve.—It is readily noted that, in each region of the column, movement toward the concavity of the curve is less of a check on rotation than the reverse. Movement in the opposite direction compresses the intervertebral disks and hence lessens their resilience.

Adaptability of Position to Body Weight.—Flexion and extension in the lumbar are normally quite free, hence there

FIG. 85. Illustrating the presence of rotation in the dorsal region, coexistent with lateral curvature.

is great adaptability to the position of the body weight. A decided deviation of a single spinous process is seldom found in this region. The direction of the articular surfaces tends to prevent such deviation.

CHAPTER XIII.

THE PELVIS.

The Fifth Lumbar.—The fifth lumbar vertebra presents some points of importance. Its massiveness is an evidence of its weight-carrying capacity. The depth of its anterior margin is markedly greater than that of the posterior portion of its body. The intervertebral disc between the fifth and the sacrum still further accentuates, by the relatively great thickness of its anterior margin, the angle formed by the articulation of the fifth with the sacrum. The inferior articular processes are wider apart than those of

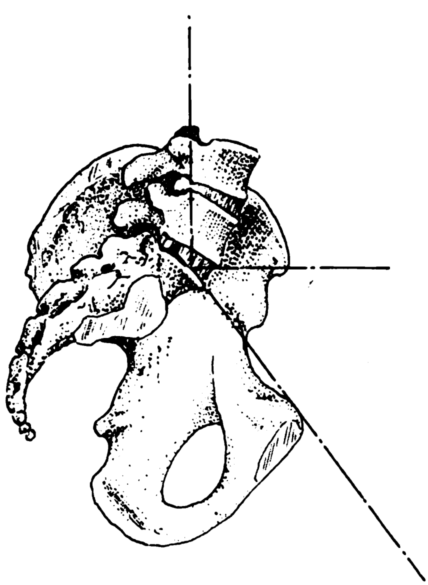


FIG. 86. Drawing of pelvis, showing sacro-vertebral angle. Drawn by John Comstock (after Holden).

other lumbars. The transverse processes are usually heavily developed, but the spinous process is apt to be smaller than those of the other lumbars. This vertebra joins the sacrum at a rather abrupt angle forming a decided projection, the sacro-vertebral angle. A line drawn through the intervertebral disc between the fifth lumbar and the sacrum would form an angle with the horizontal of about 30 degrees. It is evident that the inferior articular processes of this vertebra have a considerable function of weight carrying. If it were not for the bracing action of these processes, the superincumbent weight would tend to slide the body of the fifth forward on the base of the sacrum.

Loss vs. Exaggeration of Normal Curves.—As a general proposition, it may be stated that, the loss of a normal curve in the spinal column is apt to cause more discomfort than would the exaggeration of a normal curve. There is probably no better example of this, than the effects noted in changes of the lumbo-sacral articulation. It is manifest that extension in the arthrodial articulations, between the articular processes of these two bones, serves to hold them more firmly together and make the sacro-vertebral angle more prominent. This serves to make the lower abdomen more prominent and makes the line of division between abdomen and pelvis more marked.

Motion in Lumbo-Sacral Articulation.—Flexion, of the fifth on the sacrum, compresses the thick anterior margin of the intervertebral disc and slides its articular processes upward on those of the sacrum, thus tending to greatly decrease the sacro-vertebral angle and make the spinous process of the fifth become more prominent. It is conceivable that forced flexion in this articulation could cause a complete dislocation of the articular surfaces. Flexion and extension are so free in this articulation that much of the movement, ascribed to the lumbar region as a whole, is contributed by it. Loss of motion here, as in lumbago,

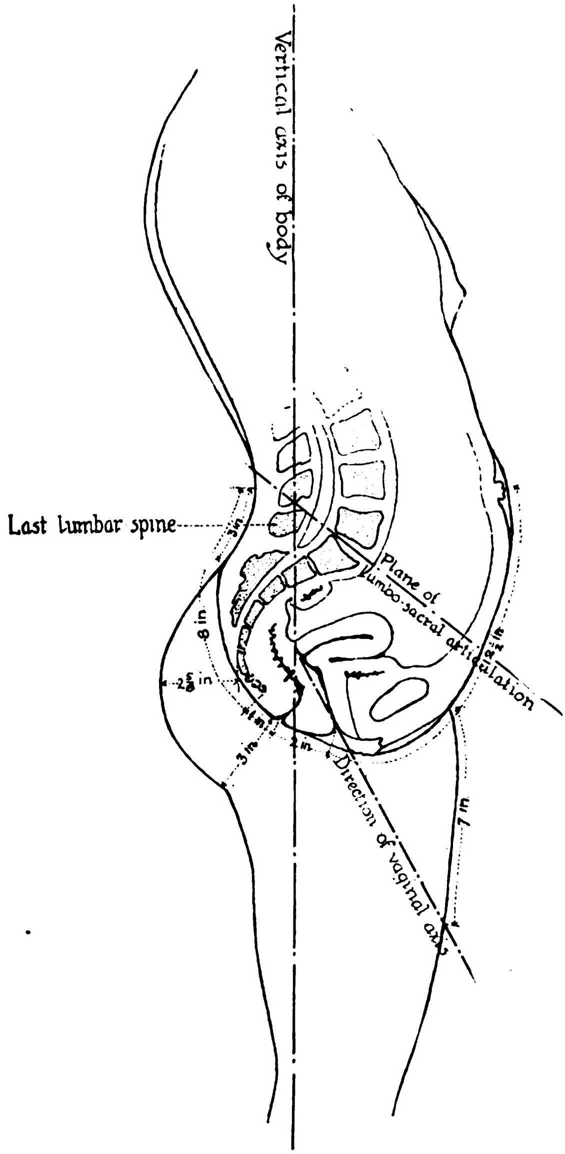


FIG. 87. Showing sacro-vertebral angle of the average female pelvis. Drawn by John Comstock (after Crossen)

is characterized by a rigidity which causes the stride in walking to be greatly shortened.

Adaptation in Lumbo-Sacral Articulation.—In cases of unequal length of legs as a result of injury, flat-foot, slight bend of an inflamed knee or hip, there is a tilting of the fifth, on the base of the sacrum, in order to balance the weight of the body. There is unequal movement in the

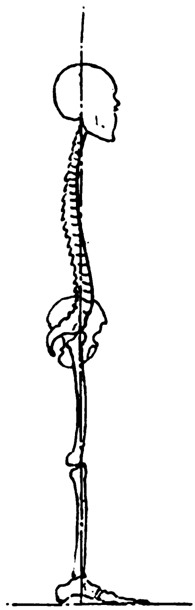


FIG 88. Normal poise of the body. Drawn by John Comstock (after Holden)

arthrodials formed by the articular processes, i. e., the joint on the side of the shorter leg extends, while the opposite one flexes, thus producing a tendency to rotate. This rocking action permits a great range of adaptation in this joint, an action which is absolutely essential to the maintenance of balance in the upright position.

Stability of the Lumbo-Sacral Articulation.—The anterior common ligament is so placed as to lend support to

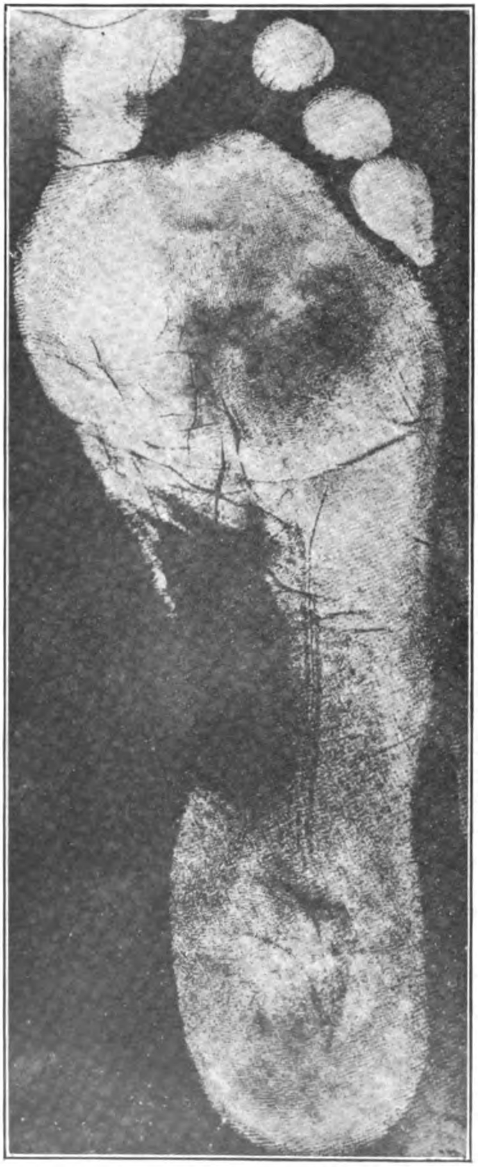


FIG. 89. Plantar impression of a case that sought relief for a sacro-iliac subluxation. The use of an arch support corrected the supposed lesion. The effort at adaptation in the lumbo-sacral articulation caused a fatigue pain.

this articulation in the extended position. Ligaments ordinarily limit motion but are extensible tissues when under continuous strain, hence the weight of the body tends always to be transmitted from bone to bone. To change this arrangement and thus put the strain continuously on ligamentous tissue, leads to relaxation in the joint. There are many joints in the body which, so far as the adaptation of the articulating surfaces of the bones which form them are concerned, furnish no stability. The knee joint is a good example of this. It has sixteen ligaments which serve to furnish it a stability not warranted by the form of the articulating surfaces of tibia and femur. The lumbo-sacral articulation has a stability in its normal angle due to the locking of its articular processes. The more these processes are locked, as in hyperextension, the greater the tendency to transmit weight through them. This is unnatural and hence produces fatigue, both by continuous pressure on the articular surfaces and by stretching of the anterior common ligament. This is the condition caused by a pendulous abdomen.

Decompensation of the Lumbo-Sacral Articulation.—Flexion of the lumbo-sacral articulation causes a straightening of the lumbar thus bringing the weight of the body more completely on the column of bodies and changing the lumbo-sacral angle, so that the axis of the pelvic cavity is brought more nearly in line with that of the abdomen. The obliteration of the normal lumbar curve produces a general curve, i. e., coincides with the dorsal and thus becomes part of a general posterior curve. This puts a great strain on the posterior spinal ligaments. This is a state of decompensation of the normal spinal curves, which necessitates a decided effort to balance the body.

Part of the Pelvis.—Obstetricians count the fifth lumbar as a part of the pelvis, since it is bound to the innominates by ilio-lumbar ligaments, which extend from the tips of its transverse processes to the crests of the ilia. These ilio-lumbar ligaments tend to compel the fifth lumbar vertebra to act somewhat as though it were a portion of the solid pelvis.

Characteristics of the Sacro-Iliac Articulations.—The articulations between the sacrum and innominates are normally immovable. They may become physiologically movable, in the pregnant woman, in order to facilitate the birth of the child, i. e., they exhibit functional adaptation. Following the act of parturition they normally become immobile, i. e., exhibit functional adaptation to weight carrying. Failure of either of these forms of adaptation is an abnormality. In case the articulations do not relax in the parturient woman, the whole process of adapting the birth canal and its contents, is exhibited by the head of the child. Normally the bony birth canal and the child's head mutually undergo adaptive changes. In case these articulations

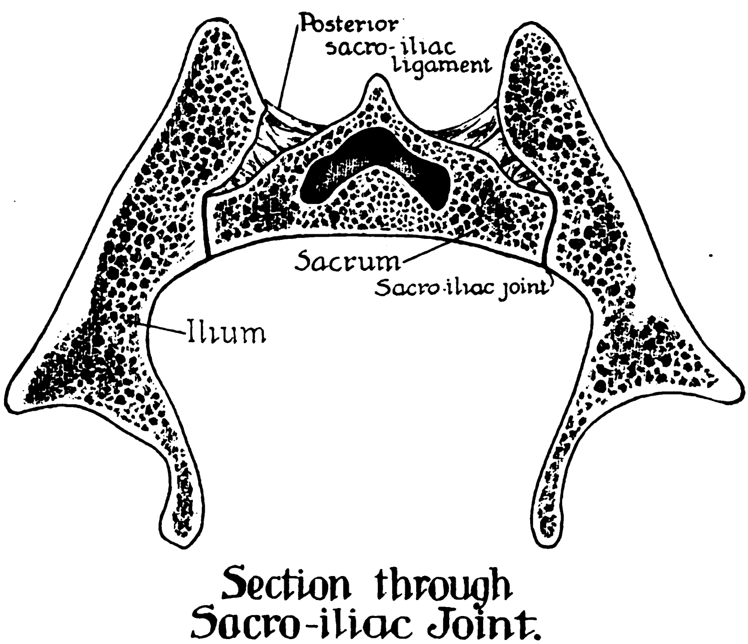


FIG. 90. Drawn by John Comstock.

do not regain comparative immobility, following parturition, a condition of instability will exist, which will express itself in a disturbance of the statics of the body. Balancing and weight-carrying functions will be injured.

Physiological Relaxation.—The menstrual periods in many women are characterized by relaxation of the pelvic ligaments, with consequent disturbance of the weight-carrying power of the sacro-iliac articulations.

The Male Pelvis.—The male pelvis never exhibits any form of normal relaxation of ligaments, therefore the existence of any instability in the sacro-iliac articulations is pathological, i. e., due to debility or trauma. The trauma may be direct and forceful enough to strain the ligaments suddenly, or it may consist in a form of fatigue, which eventually allows the ligaments, engaged in the weight-carrying functions of these joints, to become strained.

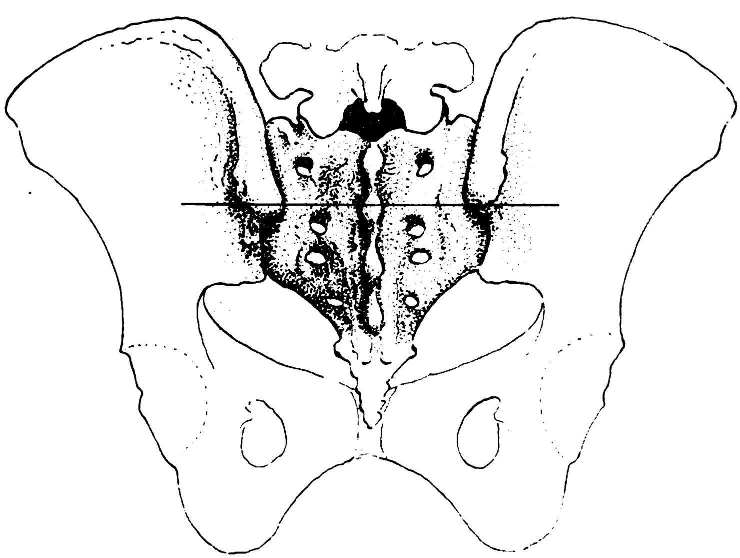


FIG. 91. Drawing of posterior aspect of pelvis, showing relation of second sacral to the posterior superior iliac spines. Drawn by John Comstock.

Loss of Stability.—It is axiomatic that loss of stability, in the pelvic girdle, will weaken its weight-carrying capacity and hence disturb the normal static condition of the whole body. In view of this fact, we must make a rather careful study of the structure of these joints and note any evidences of inherent weakness, i. e., observe at what points unusual force might most easily produce a lesion.

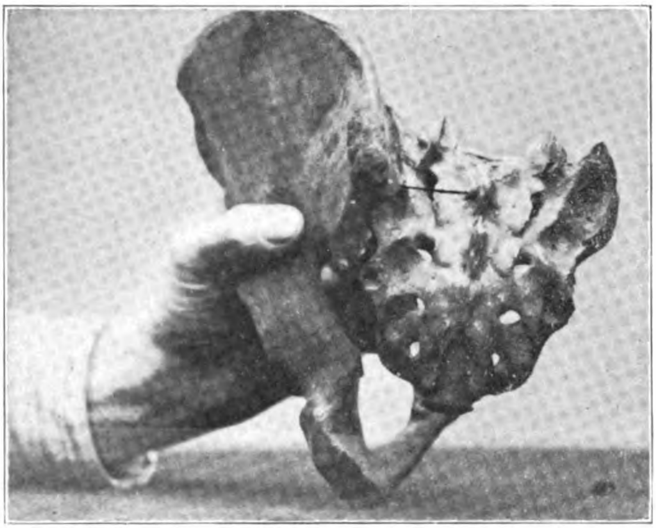


FIG. 92. Normal relations of sacrum and ilium.

Analysis of Sacro-Iliac Articulations. — Dissection of these joints discloses the existence of the same structures found in other joints, i. e., bone, cartilage, synovial membrane and ligaments. The fact that these structures do exist in the sacro-iliac articulations, naturally classifies these joints as having possible mobility. These joints serve to absorb shocks transmitted through the legs to the pelvic girdle. The slight movement, normally possible in them, subjects them to much the same conditions which serve to injure other joints.

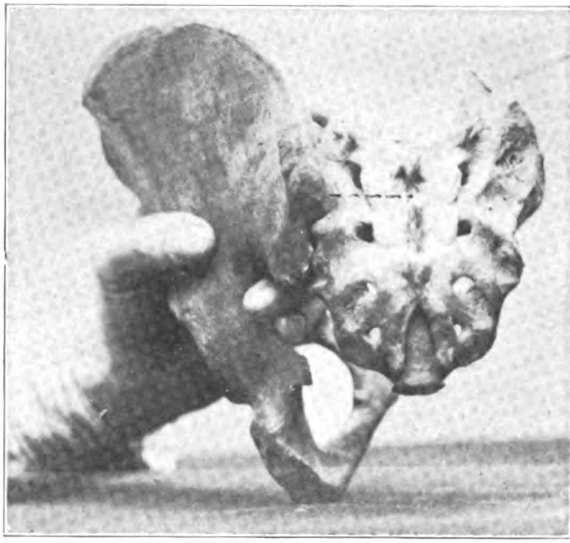


FIG. 93. Ilium forced upward and forward.

FIG. 94. Ilium forced upward and backward.

Relation of Sex to Sacro-Iliac Lesions.—Clinically we have found disturbances of these joints in both men and women, hence we are forced to believe that sex does not control the character of the lesions. They are much more frequent in women than in men. This is undoubtedly due to the necessarily greater functional adaptability of the female pelvis.

Inherent Weakness in the Character of the Structure.—The sacro-iliac articulations are inherently weak, so far as any bony interlocking is concerned. Their stability is a matter of ligamentous strength. The sacrum is wedge-shaped from above downward and from anterior to posterior. The anterior surface, being broader than its posterior, does not serve well to offer resistance to the superincumbent weight of the spine. The sacrum articulates by its auricular surfaces with those of the ilia. The articulating surfaces of both bones are covered with cartilage. The joints are surrounded by capsular ligaments and contain synovial

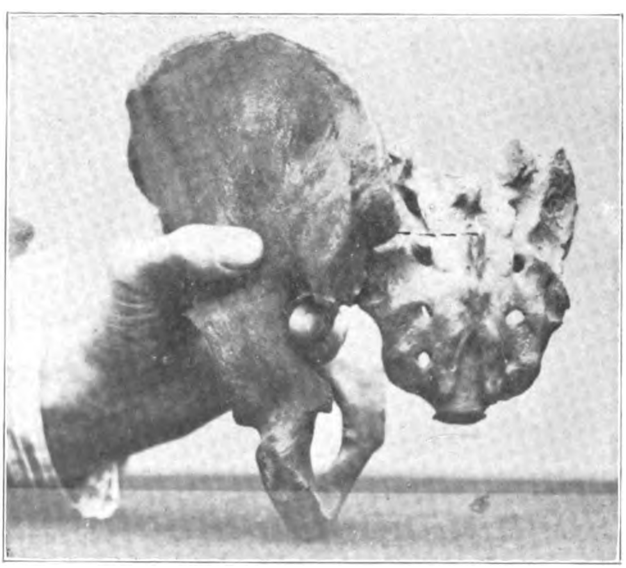


FIG. 95. Posterior superior spine of the ilium is too prominent.

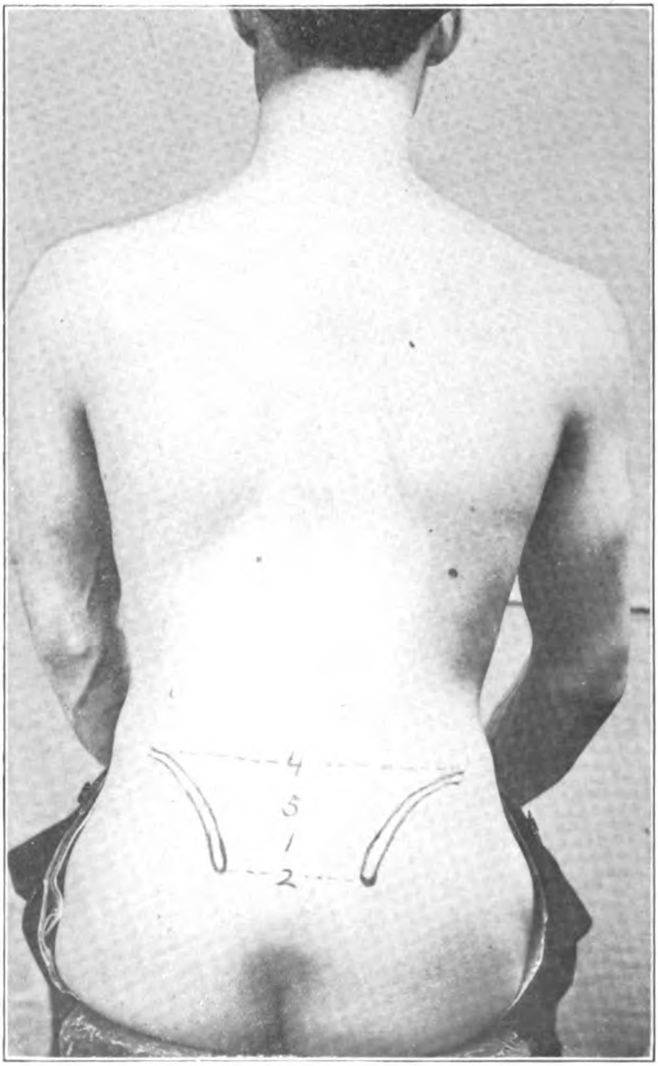


FIG. 96. Normal surface markings of the relations of the sacrum and ilia.

sacs. The apposing auricular surfaces are reciprocally, slightly, uneven but not enough so to sustain any weight without ligaments. The illustration, Fig. 90, shows clearly the relation of the form of the sacrum to the direction of the weight it sustains. The structure of the sacro-iliac synchondroses indicates that movement is possible and, in fact, probable. The primary object of the movement is to produce elasticity in the pelvic girdle and interrupt shocks which would be transmitted from the legs to the trunk. A further object would be, in the female, adaptation of the birth canal to its contents.

Causes of Subluxations.—Clinically we recognize the existence of disturbances in these joints as due to relaxation of ligaments due to pregnancy, menstruation, general debility, or trauma. Functional adaptability in the female pelvis makes women easily subject to changes in these joints, and likewise permits easier correction. The male pelvis is practically never disturbed except as result of debility or trauma, and is therefore more difficult to correct.

Rotation.—The motion in these joints is described by various authors. Judging from clinical experience the motion seems to be in the nature of rotation. This rotation takes place on an axis which passes through the articulating surfaces of the sacrum and ilia on a level with the posterior superior spines of the ilia and the second sacral spine. This makes the second sacral spine and the posterior superior spines of the ilia the bony landmarks indicating the position of the joint surfaces. Rotation of the ilium forward would make the posterior superior spine less prominent and slightly higher, so that a line drawn across the sacrum through its second spinous process would pass through the lower border of the posterior superior spine, instead of its apex. Rotation of the crest of the ilium backward makes the posterior superior spine more prominent and slightly lower than normal. All the positions described by various authors can be reduced by analysis to the two

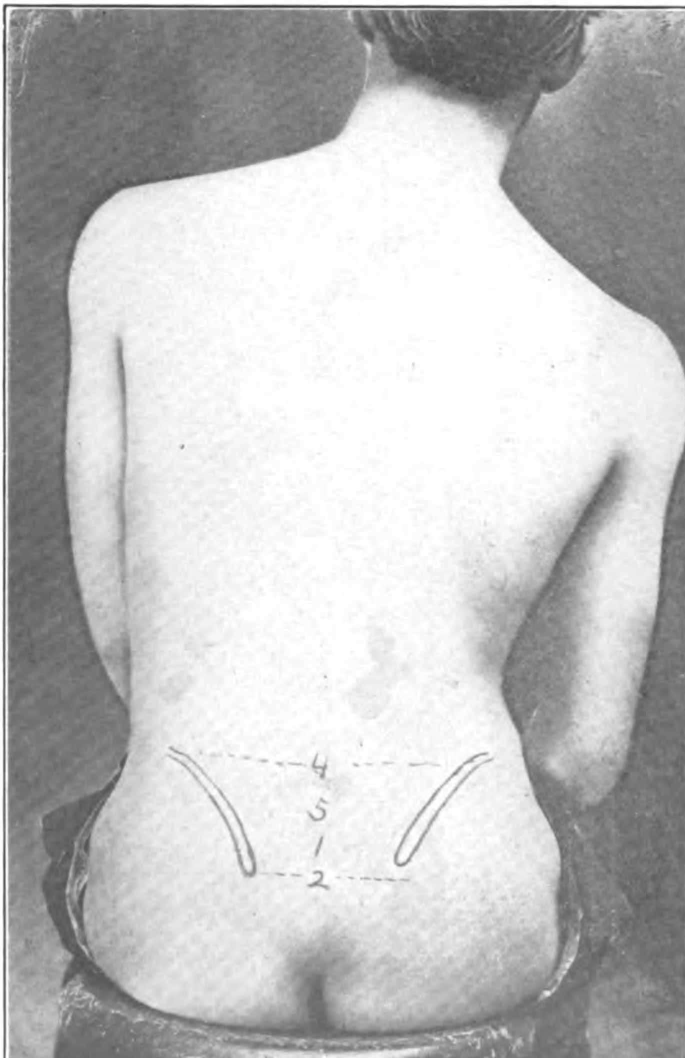


FIG. 97. Rotation of the ilium, forward.

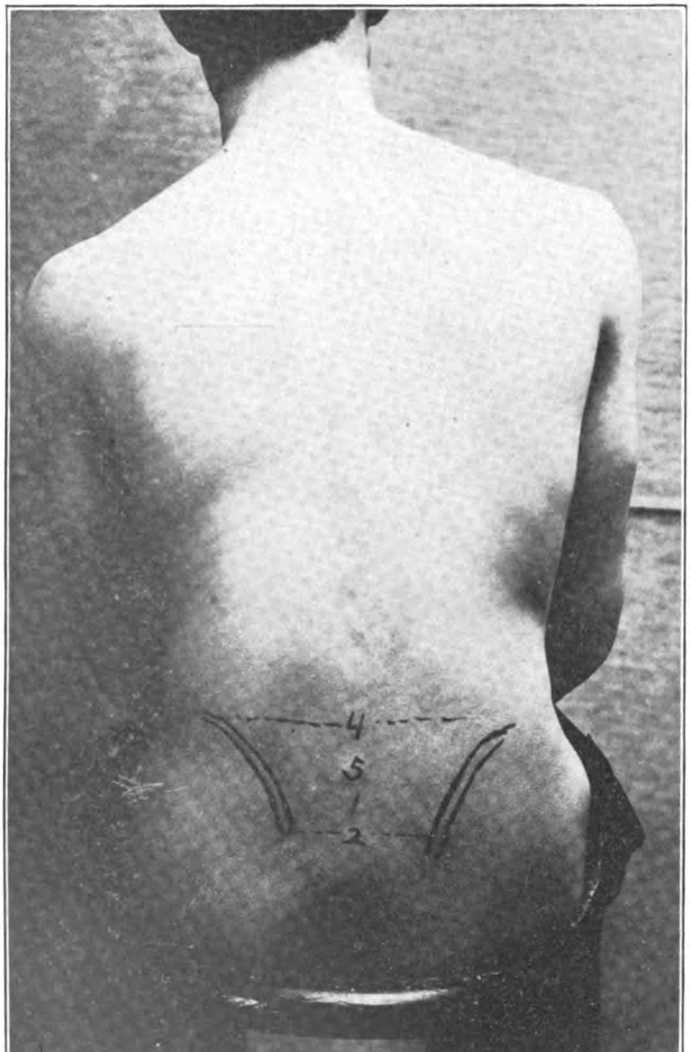


FIG. 98. Posterior superior spine of the ilium is prominent, and slightly below the second sacral spine.

rotations just described. Since these rotations are unilateral, the pelvic distortion results in a slight apparent difference in the length of the legs so that when the patient lies on the back, on a hard surface, with the legs stretched out as evenly as possible, the heels will be found not to be equal. In order to compensate for this apparent inequality in length, the pelvis will be found to be tilted, with relation to the spinal column. This compensatory tilt is the same phenomenon that is present in every case having unequal

FIG. 99. A case of posterior right iliac which was characterized by persistent pain in the right sacro-iliac and the sacro-vertebral articulations.

length of leg support. In order to make sure which joint is the one at fault, one must use those bony landmarks which are a part of the pelvis, i. e., posterior superior iliac spines and the second sacral spine. An apparent difference in the length of the legs might be due to a lumbar condition, irrespective of any change in the relation of the bones of the pelvis.

Compensatory Pelvic Tilt.—It should be remembered that no change in a sacro-iliac synchondrosis is ever unaccompanied by a compensatory effort of the body to transmit the body weight through the normal half of the pelvis. This produces a slight spinal curvature, which is part of the compensatory tilt of the pelvis, to avoid transmitting body weight through the weakened joint of the pelvic girdle.

Classes of Cases.—Two classes of cases complain of pain which may be traced to disturbance in these joints. The first group comprises those of both sexes, who are debilitated, and hence do not have normal tone in muscles and ligaments. These cases either are bed-fast or inclined to assume the recumbent position. Cases compelled to lie on the back for a long period following surgical operations are apt to suffer distress in these joints. The second group comprises those who are over-weighted in the abdomen, and hence tend to lordosis in the lumbar region. Both of these classes are greatly helped by corrective manipulation and bandages.

The debilitated individual is toned by corrective manipulation, and the weakened ligaments reinforced by some simple form of girdle which helps to hold the pelvis firm. The individual with the over-weighted abdomen is physiologically rested by corrective manipulation and the use of a support which will assist the back in carrying the excessive weight which lies anterior to its normal weight-carrying structure.

The really difficult sacro-iliac lesion to correct is the traumatic. Such a lesion has all the elements which make perfect recuperation problematical in any joint.

FIG. 100. Elevation of the foot in a case of posterior rotation of the right ilium. This is not sufficient, in such cases, to correct the compensatory changes in the lumbar articulations.

Symptoms.—The symptoms of sacro-iliac lesions are usually pains located in the lumbar, gluteal and thigh regions. The pains are described by patients as being usually a dull heavy ache whenever the weight of the body is transmitted through these joints. Close analysis will be required to determine whether a given case is in reality a sacro-iliac lesion. The only physical test worth trusting is the alignment of the posterior superior iliac spines and the second sacral spine, when the patient is standing. The pains may be due to many different strains. The hyperesthetic points about the sacro-iliac joints may accompany other conditions. Flat-foot will, in some instances, produce all the sore spots in the lumbar and sacral region which may be present with a sacro-iliac lesion. The backache, due to tilting of the pelvis, to compensate for a sacro-iliac lesion, is practically similar to that due to the effort to compensate for a change in statics due to flat-foot.

Plan of Treatment.—A sacro-iliac subluxation is due to relaxation of ligaments, or trauma. To correct such

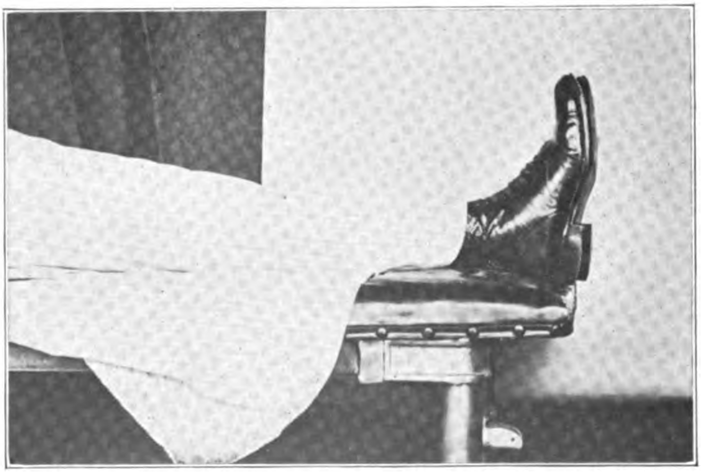


FIG. 101. Showing the average amount of inequality in the length of the legs in a case of posterior rotation of the right ilium.

subluxations, the cause is the controlling factor as to the means to be employed, i. e., debility must be controlled by general means, so that local reinforcement of weakened ligaments will not be continuously necessary. It is usually easy to make a specific correction of the lesion in a debilitated case, but not easy to maintain the correction. It is difficult to correct a traumatic lesion, but when once corrected, the vitality of the tissues tends to make the correction permanent. In all debilitated cases voluntary exercise must form an important part of the treatment. Climbing on rough ground is the best aid in such cases, because no two steps are alike, and hence the tissues are not fatigued by repetitions of similar movements.

CHAPTER XIV.

SUBLUXATIONS.

Definition.—The word subluxation was so new, to the general medical profession, that much ridicule was heaped upon the osteopaths because they advocated such a ridiculous theory as that "all diseases are caused by dislocation of bone." We are not so sure but that this ridicule was, to a large extent, well merited by the osteopaths. The loose way in which the words luxation, dislocation and subluxation are used in some of our literature shows that they do not always cover a definite idea in the mind of the writer. They can not be used interchangeably. The word subluxation should be used to denote a definite condition. Subluxation is defined as a partial dislocation in which the normal relations of the articulating surfaces are but slightly changed.

Da Costa describes subluxation of the shoulder, also of the head of the radius. For the latter condition he has collected eight different explanations. We have not been able to find the term used in reference to any other articulations. The osteopath uses the term to define certain inequalities in the arrangement of vertebrae and ribs, sacro-iliac and other articulations. Perhaps we hear the term used in connection with the atlas more than with any other bone.

Characteristics of Subluxations.—Subluxations allow considerable movement in the articulation, but to the trained hand there are evidences of malposition. Pain is developed when the complete normal movement is attempted by the operator. Digital pressure around the joint causes deep pain. There is usually a history of accident, exposure or visceral disorder.

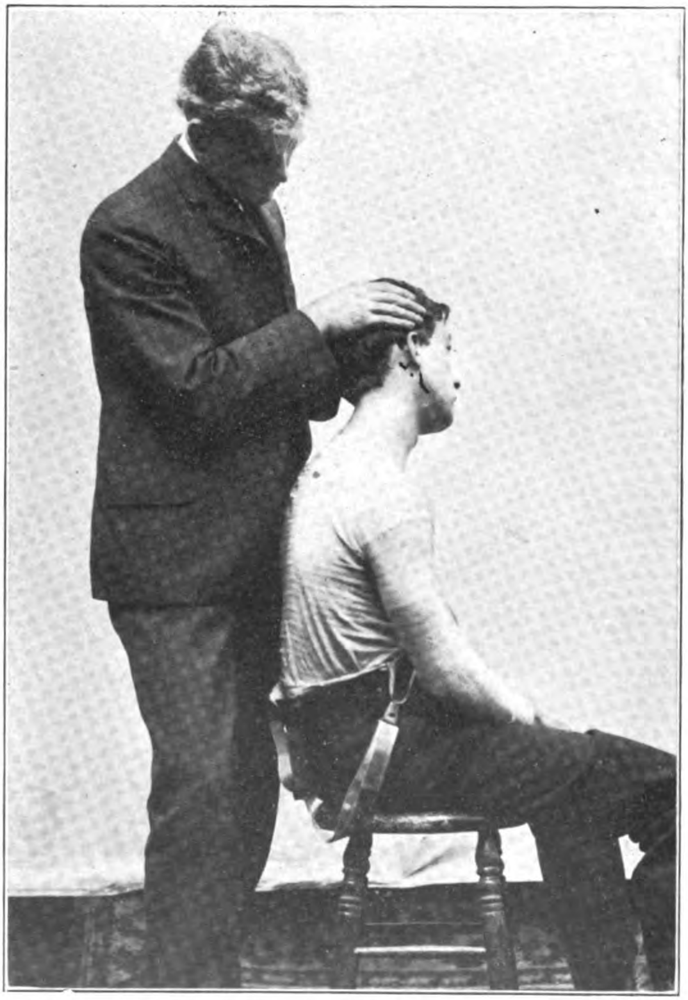


FIG. 102. Normal surface marking of the transverse process of the Atlas.

Primary or Secondary Lesions.—From experience we know the frequency of very evident malpositions of vertebrae, commonly spoken of as subluxations, and as being true or primary lesions causing disordered function in the area of peripheral distribution of the nerves from that segment of the spinal cord.

The Characteristic Structure of Joints.—In order to get at a true understanding of what subluxation is, we must make a careful study of the structures which form a joint and their vital manifestations. The bones of the skeleton are bound together by ligaments and muscles. The opposing surfaces of bones forming movable joints are covered with cartilage. The muscles execute and the ligaments, or soft parts around a joint, limit the motions of the articulation. All movable articulations have their bony parts maintained in their normal relations either by the form of the bones and cartilages attached to them or by the equal tension of all the controlling muscles. Enarthrodial joints have freest movements and yet are the least dependent on muscles for retention of their normal position. Air pressure and the form of the bones are responsible for the integrity of these joints. These joints are less frequently subluxated than those possessing more limited motion. Arthrodial joints depend upon the equal tension of their governing muscles to keep the opposed surfaces in their proper relations. Coordination of the muscular tension is usually so perfect that the joint surfaces are perfectly opposed to each other. The disturbance of this nicely balanced muscular tension results in the drawing of one or both bony surfaces away from their true relations; not entirely, but sufficiently to make it possible for the physician's fingers to note the change.

The Atlas.—The atlas is placed not only first in the vertebral column, but also first in importance to the osteopath on account of the great possibilities for slight displacement between it and the occiput. All the conditions are present which make a very movable joint and close at hand are important nerves and blood vessels whose slightest maladjustment causes instant disturbance at the very fountains of life. No physical examination is considered complete without noting accurately the position of the atlas. There being no spinous process all reckoning must be made from the transverse processes.

Occipito-Atlantal Articulation.—According to Gray's Anatomy: "The movements permitted in this joint are flexion and extension, which give rise to the ordinary for-

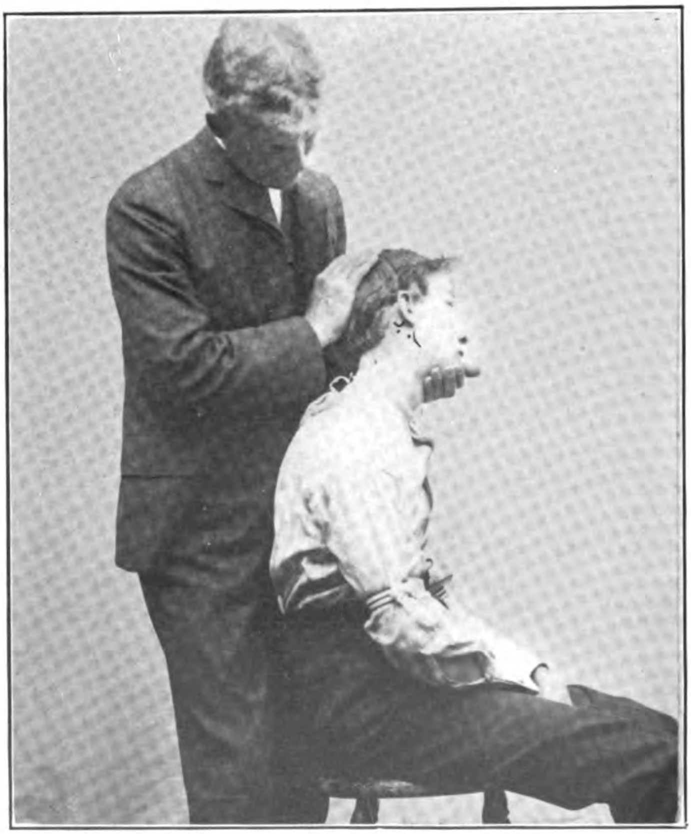


FIG. 103. Abnormal surface markings of the transverse process of the Atlas.

ward and backward nodding of the head, besides slight lateral motion to one or the other side. * * * The Recti Laterales are mainly concerned in the slight lateral movement. According to Cruveilhier there is a slight motion of rotation in the joint." According to Gerrish: * *

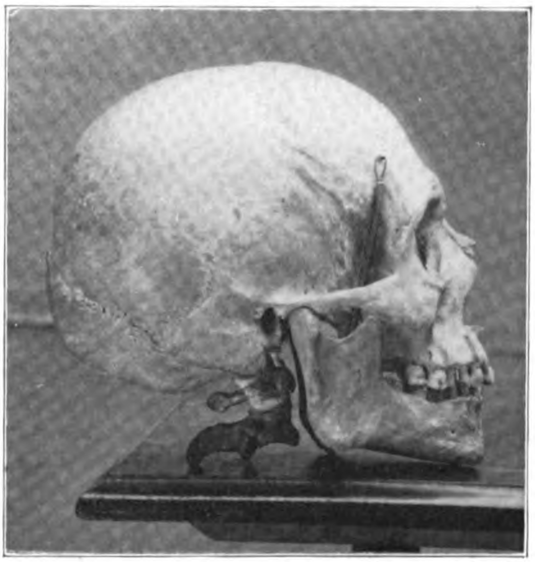


FIG. 104. Normal relations between the atlas and occipital bone.

* "Some lateral gilding is also allowed, by which the outer edge of the condyle on the one side is depressed and on the other is elevated in relation to its socket. Or the movement may be obliquely lateral, one condyle advancing slightly at the same time that it is depressed toward the median line, while the opposite condyle takes the reverse position. This is the position of greatest stability, and is assumed in the most easy and natural attitudes. Lateral movements are restrained by the check ligaments and the lateral parts of the capsules. No true rotation is allowed."

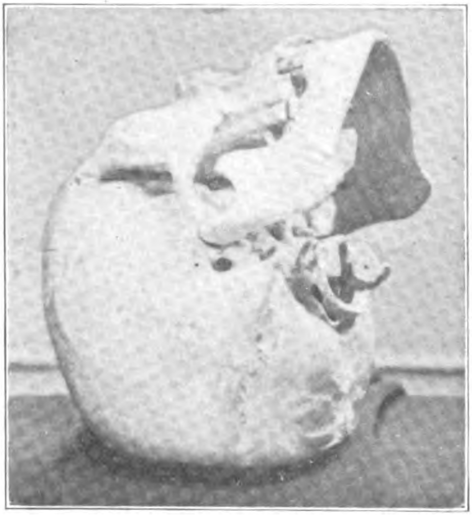


FIG. 105. Normal relations between the atlas and occipital bone.

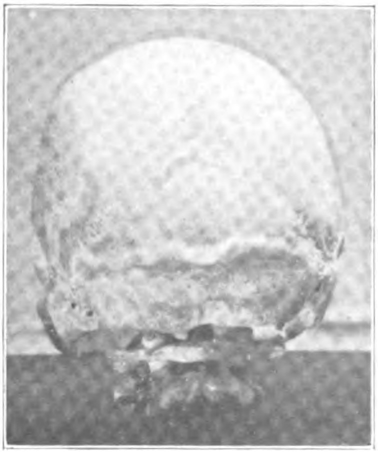


FIG. 106. Right transverse process of the atlas too far posterior.

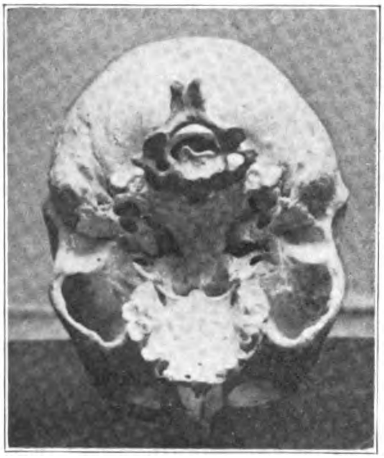


FIG. 107. Right transverse process of the atlas too far posterior.

FIG. 108. Twisted atlas-rotation.

The capsular ligaments are very loose, hence the strength of the joint lies in the anterior, posterior and lateral ligaments. There is no cartilaginous disk between the atlas and occiput, hence motion is limited only by the ligaments named.

FIG. 109. Twisted atlas-rotation.

If one should judge of the prevalence of dislocations of the atlas by the number of times such a condition is mentioned in osteopathic literature, we would draw the conclusion that everyone's atlas is dislocated. The term dislocation is a strong one and ought not to be used in connection with the atlas. Its dislocation would cause death instantly. Subluxation is the proper term to use. Subluxations can be readily diagnosed; the fact that they exist can not be doubted; all positions between the normal relations and complete dislocation are possible. The complete dislocation of this bone from the occiput means death; intermediate positions, subluxations, mean irritation of nerves direct and both direct and indirect disturbances of circulation; direct disturbance by pressure exerted on arteries and veins, indirect disturbance by excitation of vaso motor nerves.

The Causes of Subluxations.—It is difficult to account for these subluxations of the atlas without bringing in the contraction of muscles. This seems to us to be the most prevalent cause of misplacement of the atlas. Even though we recognize the numberless jars, twists and strains of this articulation, still the resultant bad effects are maintained by the unequal contraction of opposing groups of muscles which is brought on by these accidents. Take, for instance, the various twists of the atlas found by osteopathic methods of physical diagnosis. Gray says: "The Recti Laterales are mainly concerned in the slight lateral movements." This is the movement concerned in a lateral subluxation. The position in which we usually find the atlas is an oblique one, having the right transverse process hugging the angle of the jaw while the left is too close to the mastoid process. Gerrish describes this position as the "obliquely lateral," a normal movement. We also consider it normal if it possesses the ability to slip back into a position having similar relations on both sides. It is a subluxation when it can not get out of that position without assistance. If there is free movement in the occipito-atlantal articulation, every change of the position of the head will change the relations in this joint. Our bodies are constructed so that when the bones, forming a joint, are moved to their fullest extent, pressure is usually exerted on the soft tissues around the joint. This is normal, but when these normal relations are retained too long and the bones do not resume their easy resting position the condition becomes abnormal; it is then a subluxated joint.

There is no articulation in the body whose bony parts are abnormally related when the extreme movement in the joint is made. (We will except the sacro-iliac articulation, because it is not ordinarily considered a movable joint.) The subluxation consists in the relation of the bony surfaces in a position other than that which they should hold during relaxation or equal tension of all the muscles. The normal position of the transverse processes of the atlas is pictured in Fig. 102. The subluxations are pictured in Fig. 103.

Normal Relations of the Atlas.—The normal relations of the atlas are illustrated by photographs of the skull and first vertebra in Fig. 104. Fig. 105 shows an oblique side view. In Fig. 106 the atlas is slightly twisted, so that the right transverse process is posterior. This rear view shows the distance between the left mastoid and left transverse process increased. The right transverse process is prominent. The same relations viewed from below are shown in Fig. 107. The right transverse process is slightly posterior to the mastoid.

Abnormal Positions of the Atlas.—Fig. 108 and Fig. 109 show side and lateral views of a twisted atlas. In preparing these bones for photographing, it has been borne in mind that the articulating surfaces must be kept in close apposition. The relations illustrated are normal to the articulation, but abnormal when retained in these positions after relaxation of opposing muscles.

The Effect of Muscle Contraction.—If, as Cruveilhier says, there is a slight rotation in this joint—and osteopathic practice proves Cruveilhier's statement true—, then what muscle could by its persistent contraction cause this rotation to be maintained? The Rectus Capitis Anticus Minor is so placed as to cause this movement. It arises from the anterior surface of the lateral mass and root of transverse process of the atlas and passes obliquely upward and inward. It is inserted into the basilar process of the occipital bone. This muscle has as its external relation the superior cervical ganglion of the sympathetic, and as a contracted muscle is thicker than an uncontracted one, pressure may be exerted on this ganglion which may also be irritated by the transverse process of the atlas being pulled toward it, thereby lessening its normal space in more than one direction.

The reflexes originated by this irritation of the superior cervical ganglion, or its connections, may initiate changes in the caliber of the blood vessels of the brain, eyes or any other circulatory area under control of the ganglion.

The Effect on Circulation.—The influence exerted directly on circulation by the subluxation of the atlas is probably most active where the vertebral arteries pass through the foramena in the transverse processes. It might be argued against this view that nature has not failed to provide a certain amount of elasticity in the artery and surrounding structures to meet just such a condition. Nature has certainly done this, but not with the idea in view that any such exaggerated condition is to be maintained for any great length of time.

Effect on Superior Cervical Ganglion.—Subluxations of the atlas are found in connection with a great number of disturbed areas, but the condition in each is the same. For example, there is no difference between a hyperaemia in the nasal, pharyngeal or laryngeal mucosa and a congestion of the retina, except in location. We must not view the phenomena of retinitis as especially different from those of laryngitis. If we should do so, we fix our attention on symptoms and see a picture which conceals causes. When the superior cervical ganglion has its function of vaso-constriction inhibited by continued irritation, the work of maintaining vascular tone is passed along to peripherally placed ganglia. If the eyes are strained by overwork, the resistance of their nerves is decreased. This, added to the weakened vaso-constrictor action of the superior cervical ganglia, allows congestion, a retinitis. Wearing high collars weakens the resistance of nerve endings in the skin of the neck. This, added to low power in the ganglionic station, leads to congestion in the pharynx or larynx. Treatment must be applied to the structures around the ganglion, and peripheral nerve power increased by gradually exposing the skin to the atmosphere.

Atlo-axial Articulation.—The articulation between the atlas and axis is the most intricate in the whole spinal column, consisting of four distinct joints. Rotation takes place between these bones, but this motion is limited by the check ligaments. Dislocation of the odontoid process causes instant death by pressure on the lower part of the medulla oblongata. The articulations between the articular processes of these bones are arthrodial. The articulation between the odontoid process of the axis and anterior arch of the atlas holds the bones firmly together. Most of the rotation in the cervical region is in this joint. Although there is so much movement allowed by these articulations, we seldom find the axis subluxated.

Unequal Development.—Deviation of the spine of the axis from the median line is a frequent condition, but in the majority of cases is its normal relation on account of uneven development.

Caries.—Hilton describes cases of disease of the articulation between the atlas and axis, showing how destruction of the transverse ligaments allows the head to tip forward, thereby causing the odontoid process to impale the medulla.

Dislocation.—We may safely say that dislocation of the atlo-axial articulations is probably the rarest condition we will ever meet. Various degrees of rotation may be met with which are in the nature of subluxations due to muscular contractions.

Spontaneous Reduction.—Since the above paragraph was written, an article in the Medical Record, March 3, 1900, has come under my observation. The article is entitled "Spinal Fracture—Paraplegia." The author, Dr. Robert Abbe, exhibits a radiograph illustrating a case of dislocation of the neck. The dislocation is between the articular processes of the atlas and axis. The most interesting feature of the case is the spontaneous reduction of the dislocation while the patient was asleep. The author thinks that the relaxation of sleep and the restlessness of the patient combined to reduce it.

Cervical Vertebrae.—The remaining cervical vertebrae are occasionally forced from their proper relations by violence. Quite a number of cases are on record which show how great the disturbance is in such conditions. Those cases recorded in medical literature are complete disloca-

FIG. 110. Normal relations of the cervical vertebrae.

FIG. 111. Third cervical vertebra subluxated to the right. The superior articular process of the fourth cervical is visible.

tions, and hence can not be classed with subluxations such as are met with in osteopathic practice. In order for complete dislocation to take place, i. e., so that the articular processes are both locked, the intervertebral disks would have to be torn and would probably bring great pressure on the cord.

All grades of subluxation are found between cervical vertebrae. Where the violence has not been sufficient to cause locking of the articular processes, it has exaggerated the normal movement sufficiently to injure the ligaments or muscles, which therefore maintain the subluxated position.

Disproportion Between Cause and Effect.—We cannot estimate the extent of the systemic effects of a lesion in the spine. What might appear to us to be a very slight lesion might be the cause of a very profound nervous disorder. The position of the lesion is the chief means of estimating results.

Example.—To illustrate this point, we may mention the case of Mr. Norton Russell. A lesion of the sixth cervical vertebra was found. The vertebra was slightly twisted. Mr. Russell had not slept during one hundred nights and days without the use of sulphonol or morphine. The first osteopathic treatment applied to the sixth cervical vertebra made it difficult for him to keep awake until he reached his home and then he fell into a profound sleep. There was a history of severe accident. Muscular contraction was very evident.

Unequal Development of Spinous Processes in Cervical Vertebrae.—Fig. 110 illustrates the appearance of the posterior surfaces of the cervical vertebrae, second to the seventh, when all the vertebrae are in normal position, i. e., articular surfaces evenly opposed to each other. The changing character of the spinous processes is readily noted. Nearly all of these processes are unevenly developed, showing that palpation of these prominent points can not help being unsatisfactory. The tubercles on the back and outer surfaces of the inferior articular processes present a much more uniform development and they can be easily palpated after one has become accustomed to the feel of the cervical muscles. Fig. 111 shows the third cervical subluxated to the right. The tubercle on the left inferior articular process is made more prominent. The muscles over this point will be found contracted.

Palpation of Dorsal Spinous Processes.—When the spines of the dorsal vertebrae are palpated, the trained fingers may find individual spines which are not in line with those above and below, or that the spacings between the spines are not equal. The deviations from the normal are indicative of changed relations between the vertebrae.

Normal Dorsal Movements.—The normal movements in the dorsal region are flexion, extension and rotation. The lesions in this region correspond with these movements.

False Lesions.—We must guard against being misled by the deviations which we find, especially lateral ones. Fig. 112 illustrates a decided lateral inclination of the third dorsal

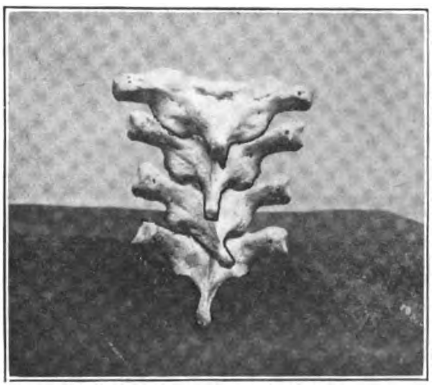


FIG. 112. Abnormal development of the spinous process of the third dorsal vertebra. A false lesion.

FIG. 113. Lateral subluxation of a dorsal vertebra.

FIG. 114. Flexion in the dorsal region showing spinous processes separated and superior articular processes partially uncovered.

FIG. 115. Lateral view of same condition as Fig. 114.

spinous process. Such a deflection from the median line would be noted by the unskilled touch of a layman. This deflection has no diagnostic significance, unless there is pronounced sensitiveness around it, and then it is the hyperaesthesia and not the osseous formation that must be noted. A

FIG. 116. Extension in the dorsal region showing approximation of the spinous processes.

very skillful osteopathic diagnostician might be misled by this lesion. There does not appear to be any way to protect against a wrong interpretation in a case like this except the experience of the physician in weighing all the evidence.

Lateral Subluxation.—Fig. 113 illustrates a genuine lateral subluxation of a dorsal vertebra. The arrangement of the Rotatores Spinae account for such a lesion as this. They arise from the upper surfaces of the transverse processes and insert into the laminae above. The subluxated vertebra in this group is the fifth. The digitation of the Rotatores Spinae between the right transverse process of the sixth and lamina of the fifth must contract in order to produce this condition. This digitation may respond to a severe visceral reflex and cause a subluxation of this character. Direct violence may cause it, also a cutaneous reflex initiated by temperature change in the atmosphere.

Muscular Contraction.—Muscles contract as a result of excessive straining or wrenching, or exposure to cold and of reflex irritation. If opposing muscles under all conditions of temperature, mechanical and reflex irritation would continue to exert equal influence on a joint, then nothing but a complete dislocation would be possible. A movable joint is enclosed in a synovial membrane which facilitates the rapid return to a normal position. All the mechanical conditions in and around a joint are conducive to the quick return to normal. It is the vital and not the mechanical principle which keeps up a condition of maladjustment. No intermediate position is possible, there being no unevenness of surface to become locked, unless we take into consideration the vital activity as manifested in a contracted muscle.

Comparison of Effects of Muscular Contraction.—J. E. Stuart, D. O., has made an apt comparison between the pull of the muscles of the back on the individual vertebrae and the well recognized insufficiencies of the ocular muscles. All physicians recognize the serious effects of long continued insufficiency of an ocular muscle, but few, indeed, have given any thought to the possibility of a similar condition affecting structures less movable, or less sensitive, than the eyeball. The relation of a vertebra with its fellows is of great importance to the delicate nervous tissue which it surrounds. It is not necessary for a vertebra to press upon the spinal cord, or nerve fibers coming from or going to it, in order to produce irritation. There is a nerve strain in connection with these lesions which is not the result of direct pressure but of the efforts of the central nervous system to balance and coordinate the contraction of the muscles pulling on the vertebra. It is not necessary for divergent or convergent squint to be so marked that the expression of the eyes is instantly noted by all observers before any symptoms of eye strain are felt by the patient. Neither is it necessary for a vertebra to be dislocated in order to create a disturbance. It is conceivable that a completely dislocated vertebra might, after a time, cause as little irritation as an eyeball which is so divergent that no effort is made to use binocular vision. The body becomes accommodated to the change.

Separation of Spinous Processes.—Figs. 114 and 115 give two views of the fifth, sixth and seventh vertebrae, illustrating the separation of the spines, as in extreme flexion. Note that the superior articular facets are uncovered by the movement. The vertebrae assume this position in kyphosis. We frequently find that there is a gap between two spines while the spacing above and below is quite even. Either the space directly above or that below this gap is lessened. Fig. 116 shows the spine of the fifth, sixth and seventh dorsal vertebrae in the position of extreme extension. The spines crowd hard upon each other. These illustrations all show normal positions, but they are the ones which our fingers discover as lesions of the vertebrae.

Approximation of Spinous Processes.—When two spines are closely approximated, as in Fig. 116, there is necessarily a widening of the next space above or below, depending upon which vertebra is affected. The contracted space will usually be sensitive to digital pressure. There is a contractured condition of the muscles causing this extreme movement of extension. This contracture disturbs the rhythm of nerve impulses from that section of the spinal cord in closest relation with the disturbed vertebra. There is lack of coordination of movement in the affected joints. When several vertebrae are tightly bound together a straight, non-flexible spinal column is the result. The muscles are tightly contracted and more or less sensitive to digital pressure.

Primary Subluxations.—These conditions, as here illustrated, are what osteopaths usually designate as spinal subluxations which are causative factors in disease. They are sources of irritation to the spinal nerves in direct central relation with them, and these nerves convey disturbed or arythmical impulses to the viscera and blood vessels, thus causing the various perversions of function which are recognized as symptoms of disease.

Secondary Subluxations.—These lesions must also be recognized as structural changes resulting from excessive irritation to the peripheral end of sensory nerves, either those ending in skin and subject to the temperature changes or those ending in the visceral muscosa and subject to irritation from the presence of food of an indigestible character, products of fermentation, etc. We must recognize the fact that sensory nerves are subject to excessive stimulation in cases of gluttony or masturbation. Both of these bad habits may result from the stimulation of a spinal lesion, but experience with humanity teaches the physician that mankind in general delights in gratifying the senses. We do not wish to place spinal lesions at the bottom of man's moral weaknesses.

Limited Area for Lateral Subluxations.—Lateral subluxations may exist as low as the tenth dorsal spine. The articular processes of the eleventh and twelfth dorsal

FIG. 117.—Posterior view of five lower dorsal vertebrae, normal relations.

FIG. 118. Side view of five lower dorsal vertebrae, normal relations.

vertebrae take on the character of the lumbar, hence rotation is practically impossible. There is a digitation of the Rotatores Spinae between the eleventh and twelfth dorsal vertebrae.

Lower Dorsal Vertebrae.—Figs. 117 and 118 give a posterior and lateral view of the five lower dorsal vertebrae. The changing characteristics of the spinous processes of these vertebrae should be carefully noted, so that the student may not be misled as to the significance of that which his palpation may discover. The eleventh dorsal spine takes a horizontal direction, and in some cases this makes either a very narrow space between it and the tenth or a very wide space between it and the twelfth.

Dorso-Lumbar Articulation.—The junction of the dorsal and lumbar regions is very flexible. A large portion of flexion and extension of the spinal column is made in this articulation. The most common condition noticeable in the lower dorsal region is increased prominence of the spines, and incipient kyphosis. This condition frequently affects the junction of the dorsal and lumbar regions.

Kyphosis—Lower Dorsal.—A slight kyphosis in the lower dorsal region is indicative of loss of tone in the extensor muscles governing the articular surfaces. The spines are separated farther than normal and the inferior articulating surfaces are partly uncovered by the superior ones. This weakened condition of the back may be brought on by injury, or reflexes from the bowels or kidneys. Continual vibration of the spinal column, as in cases of street car men, weaken the back and then functional disturbances of the kidneys are noted.

Lumbar Region.—Figs. 119 and 120 illustrate the lateral and posterior appearance of the normal lumbar vertebrae. The spinous processes are easily palpated in this region. Their development varies enormously in different individuals. The formation of the articular processes prevents any rotation, hence we do not find any lateral subluxations in this region. The position of individual vertebrae is rarely affected. "Breaks," that is, separations of the spines, are sometimes noted, but not often. Violence is the chief cause of these separations. The muscles in this region are

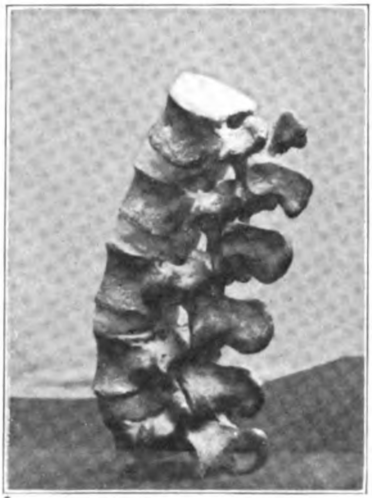


FIG. 119.—Lumbar region. Side view —normal.

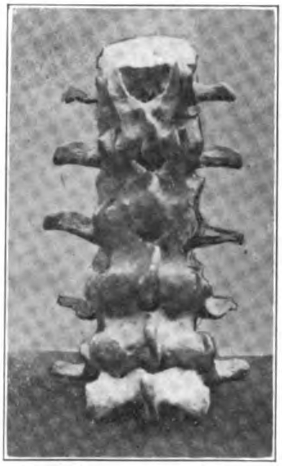


FIG. 120. Lumbar region, rear view—normal.

thick and powerful, hence their influence is not exerted so much on individual vertebrae as upon the whole series of vertebrae. Therefore we find curves instead of subluxations in this region. Exaggeration of the normal movements is responsible for kyphosis, lordosis or scoliosis. Extreme weariness, as a result of maintaining a sitting or standing position, leads the individual to shift the weight of the body so as to take some advantage of the ligaments which limit a movement. The strength and flexibility of the lumbar region is frequently a very good criterion of the patient's bodily vigor. It is easier to affect this portion of the spinal column, by leverage movements, than any other region.

Examination of the Ribs.—The position of the ribs is always noted by the osteopathic physician. It is noted, in medical text-books on diagnosis, that the general conformation of the thorax is indicative, to a variable degree, of either the past medical history of the individual or is evidence of the present existence of predisposition to certain diseases. A full, round, nonflexible chest denotes asthma or emphysema; flat chest denotes tendency to tuberculosis, etc. These statements are generalizations based on long observation, and are usually very near the truth. The respiratory movements should be noted, whether full and free, compared with the capacity of the thorax. The osteopathic physician goes farther than these excellent generalizations in his diagnosis. The relation and position of each individual rib are extremely important. The condition of the whole thorax and its contents is dependent on the relations of the bones which form it. With this idea in mind, a careful examination of each rib is made.

The ribs are, normally, quite movable. Their spinal articulations are so arranged that an easy rise and fall of the shaft of the rib is permitted. The rise and fall is the result of rotation of the rib on an axis passing through the costo-central and costo-transverse articulations.

Costo-central Articulations.—The costo-central articulations of the first, tenth, eleventh and twelfth ribs have no interarticular ligament. The movement of the heads of these ribs is limited by the capsular ligaments. The heads of all the other ribs are held in place by interarticular ligaments attached to ridges on the heads of the ribs and to the intervertebral disks.

Costo-transverse Articulations.—The tubercles of the ribs articulate with the transverse processes of the vertebrae forming arthrodial joints. The superior costo-transverse ligaments prevent the dropping down of the costo-transverse articulation. There is very limited gliding movement in this articulation. As before stated, the movement in the costo-central and costo-transverse articulations is rotary. The shaft of the rib lies obliquely downward, therefore the rotation of the rib during inspiration turns the anterior extremity upward and outward. The axis of the rotation through the costo-vertebral articulations is obliquely downward, therefore the lateral position of the shaft of the rib is elevated during inspiration and the lower border is turned outward.

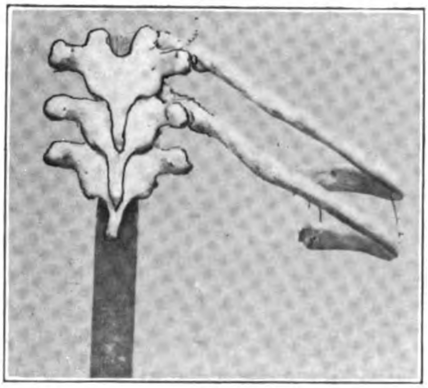


FIG. 121. Normal relations of the fifth and sixth ribs.

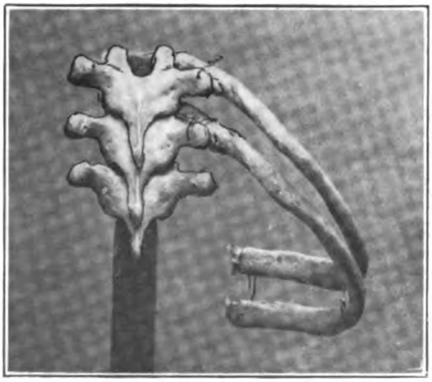


FIG. 122. Approximation of the fifth and sixth ribs.

Coordination.—Fig. 121 illustrates the normal obliquity of the fifth and sixth ribs. When the contraction of all the muscles of respiration is properly coordinated, the intercostal spaces are all equal in width. The respiratory rhythm should be equal in all parts of the thorax.

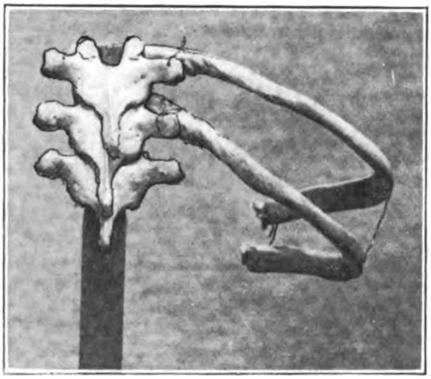


FIG. 123. Separation of the fifth and sixth ribs.

Incoordination.—When through some nervous reflex inspiration is made difficult, the inspiratory muscles expand the thorax to its fullest extent and retain the expansion. Then the diameters of the thorax are increased. This position of extreme inspiration is typical of the asthmatic chest. There may be lack of coordination of the muscles in any intercostal space. This incoordination may be manifested by too much contraction or relaxation. The result is a change in the normal width of an intercostal space.

Nervous Control of Respiration.—Respiration is carried on by a complicated mechanism. Its chief center of normal control is in the medulla, but subsidiary centers, in linear series, exist in the spinal cord. Each spinal nerve which innervates intercostal muscles, or other muscles of inspiration, arises from a subsidiary respiratory center. One of these subsidiary centers may become too active or passive as a result of local irritation, due to circulatory changes.

The muscles governed by this disturbed center will not act harmoniously, hence the rhythmical movement of all the ribs is interfered with.

We have noted that spinal muscles contract unevenly as a result of direct spinal injury, exposure of the skin over them to cold, or from visceral reflexes. The respiratory muscles are subjected to the same conditions. A lateral subluxation in the dorsal region carries its articulated rib with it. Palpation will discover their changed relations. A kyphosis in the dorsal region causes the ribs to rotate upwards, thus increasing the diameters of the thorax. Lordosis in this region has the opposite effect.

Costal Subluxations.—Figs. 122 and 123 illustrate the changes in spacing of the ribs due to incoordination of muscular contraction. These positions of the ribs are spoken of as costal subluxation. In Fig. 122 the upper rib is rotated downward as a result of a contraction of the intercostal muscles in the space below it, or the relaxation of those above it. Palpation elicits sensitiveness at the lower border of this fifth rib. The sensitiveness is usually found where there is compression due to the dropping of the rib and the contraction of the muscles. This rib might have become displaced as a result of violence, or the patient might have been exposed to cold air while sweaty, or some disease of another part of the body might have caused sufficient weakness to allow this rib to drop as a result of pressure occasioned by the position in bed or otherwise.

Whatever the cause of these subluxations, they certainly become sources of great irritation to the nervous system. Sometimes the body becomes accommodated to these subluxations, but the fact that cases of asthma have been cured after years of suffering, by reducing these malpositions, is prima facie evidence that accommodation is something that can not always be depended on.

The heads of the second to ninth ribs cannot be dislocated without rupture of the interarticular ligaments. Considerable change in the position of the shaft of the rib occasions very little change in the position of the head of the rib.

First Rib.—The first rib does not move in the same manner as those below. The attachment of the scalenus anticus keeps the shaft always raised. No matter how flat the remainder of the thorax may be, the first rib stands out prominently. The chief change in its position is due to the contraction of the scalenus anticus, therefore it needs to be depressed rather than elevated.

Tenth Rib.—The head of the tenth rib is articulated with the body of the tenth vertebra; there is no interarticular ligament. This allows freer movement. Its anterior extremity is insecurely articulated to the cartilage of the ninth rib. This connection is frequently broken, thus making an added floating rib.

Eleventh and Twelfth Ribs.—The eleventh and twelfth ribs are very loosely articulated to the vertebrae. They have no costo-transverse ligaments, hence depend on the action of muscles to hold them in place. They are frequently found rotated upward or downward.

We have endeavored to show that the normal movements of the ribs, as a whole, may become very abnormal when made individually, or out of rhythm with each other. The depressions or elevations of individual ribs have not dislocated their articulations; they have merely carried and retained them in positions out of harmnoy with the remainder of the ribs. They have become discordant members of a harmonious body, and unless made to cooperate for the general welfare, they will rapidly make other members inharmonious.

Effect of Position of Vertebrae on Position of Ribs.—Lack of symmetry in the dorsal vertebrae causes a change in the position of the ribs. Both conditions can be corrected by reduction of the vertebral subluxations.

FIG. 124. Traumatic lesion of right sterno-clavicular articulation, followed by enlargement of right lobe of the thyroid gland.

The Clavicles.—The clavicles may be elevated or depressed by muscular contraction. Their depression affects the vessels crossing the first rib and from the upper extremity. The subclavius is responsible for the depression of the clavicle.

Summary.—Every individual has his or her particular development. When examining patients this must be taken into consideration. All subluxations must be judged according to the condition of the reflexes along the nerve tracts which they might influence.

A subluxation is evidence of unequal activity of opposing muscles, caused by twist, strain, fall, thermal change or reflex irritation from viscera. It is an evidence of vital activity unevenly manifested. The mechanical condition which we call a lesion, may be only evidence of a lesion which lies in the excessively active muscle or at some other point in close nervous connection.

A subluxation may be called a primary lesion when it results from accident. It is secondary when due to reflex action. It is not always possible to determine whether a lesion is primary or secondary, but in general it is best to reduce them wherever found, if any disturbance can be traced to them.

In rare instances one treatment has been found sufficient to reduce a subluxation. The fact that the majority of cases must be treated two or three months proves that they are not easily kept reduced.

CHAPTER XV.

THE DIAGNOSTIC VALUE OF BACKACHE.

Elasticity.—It is frequently said that "a man is as old as his arteries." It may with equal significance be said that a man is as old as his spinal column. In either case a loss of elasticity lessens one's youthfulness out of all proportion to one's actual years.

A Field for Study.—The use of the back and the spinal column as a field for initiating an effort to diagnose the physical condition of human beings, has many advantages, both for eliciting objective and subjective information. Probably few physicians realize how much of physical distress is mirrored in symptoms consciously or unconsciously referred to the back.

Objective and Subjective Symptoms.—In order that we may have something for reference we will pass a few facts in review. As diagnosticians we are always desirous of knowing whether the structure of the back is normal and whether there is any distress, i. e., pain of any character, in the tissues of the back. Here we have the old division of objective and subjective symptoms.

Pain.—Pain is the symptom which usually leads a patient to seek relief or advice, hence we are interested in seeking the cause of the pain. The simplest possible cause of the pain should naturally be the first thing considered. Since many localized peripheral and visceral pains either are caused by conditions in the structures of the back, or at least reflexly produce areas of associated hyperaesthesia there, we seek to discover what structural fault or referred sensitiveness may exist.

Poise.—The first observation should be addressed to determining the poise of the body, i. e., statics. It is very important to note the poise of the body. There are many deviations from normal which are only slightly apparent but nevertheless give rise to bodily distress. Postural faults in adults lead to distress due to fatigue of the tissues and, as the bones are not plastic, pain is felt. The child's bones are plastic, hence the same force that produces distress in mature persons causes structural distortion in children, i. e., the static conditions which in children produce spinal deformity produce in mature persons spinal distress.

Structural Defects.—Pain in the back is of such frequent occurrence that it is advisable for us to consider some of the general and special conditions which may be more or less characterized by backache. Since we are exponents of a system of corrective manipulation we naturally look first for possible structural defects. The simplest structural defect would be a bad posture with its consequent imbalance in the muscle groups which maintain the body erect.

Statics.—1. Statics. Under this head we must consider backache as a possible result of any change in structural support. The muscles of the back must compensate, by altered tension, for any change in the length of a leg, such as that present in flat-foot, slightly flexed knee, knock-knee, or a sacro-iliac lesion. The pain due to flat-foot is one of the most common complaints. Many cases of so-called "innominate lesions" are nothing more than backache caused by the effort to compensate for a weak arch. Manipulation of the muscles of the back gives relief but does not remove the cause. The longer such a condition exists, i. e., flat-foot, the more widespread will be the back pains. Segments above the lumbar are gradually involved until it is hard to recognize where the vicious cycle began. Backache due to disturbed statics is a fatigue pain, i. e., is evidence of tired muscles or strained ligaments. All such backaches are relieved by manipulation. They disappear under the influence of tonic exercise, such as mountain climbing, because the un-

FIG. 125. Right dorsal-left lumbar lateral curvature. Note the outline of the body.

evenness of the ground necessitates constant variation in muscular tension. Walking on pavement rapidly produces fatigue, because each movement is a replica of the preceding one.

General Debility.—General debility may lead to static errors with consequent distress. Many static errors make their appearance during a slow convalescence and then per-

FIG. 126. Position which shows, by the outlines of the vertebral borders of the scapulae, that rotation of the vertebral bodies exists as high as the sixth dorsal.

FIG. 127. Correction of the lumbar curve by raising the left buttock.

sist in spite of improved muscle tone; in fact are never recognized until such time as they force special attention because of the distress they çause.

Sacro-iliac Subluxation.—Since backache is one of the most prominent symptoms in cases of sacro-iliac subluxa-

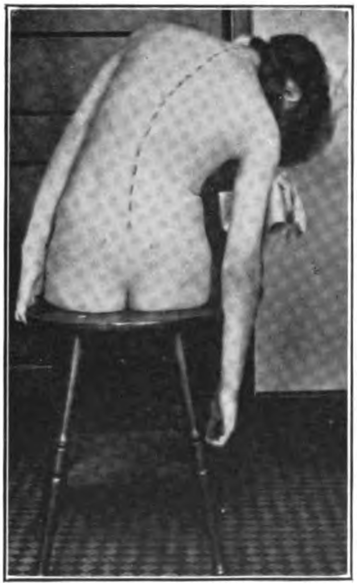


FIG. 128. The effect of rotation of the bodies of the vertebrae, in spinal curvature, on the location and extent of side bending.

FIG. 129. Same case bending to the left.

tion, no examination would be complete without taking the possibility of such a lesion under consideration.

Spinal Rotation.—Practically all static conditions of long standing are characterized by slight spinal rotation. This is the natural result of the body's effort to transmit its weight through its strongest side. This compensatory rotation can not be corrected without taking into consideration that condition for which the rotation is itself a correction.

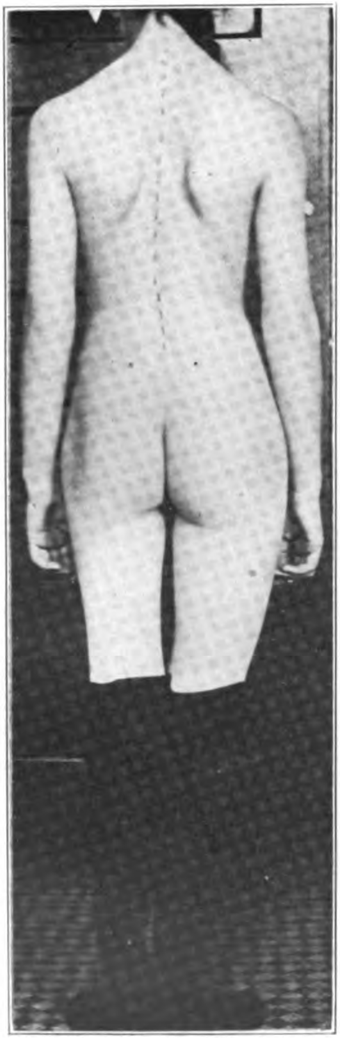


FIG. 130. This picture shows that the lumbar curve is primary and due to faulty development of the left lower extremity.

FIG. 131. Correction of the lateral lumbar curve by lengthening the left leg.

Spinal Curvature.—Curvature of the spinal column is not always characterized by local or general backache. As a general rule structural scolioses are not painful. This is probably because the shape of the bones has become adapted to the weight of the body in the new position. Pain is apt

FIG. 132. Great irregularity of the spinal column, in a case of tedious convalescence, after typhoid fever. Shows the effect of remaining almost constantly on the right side.

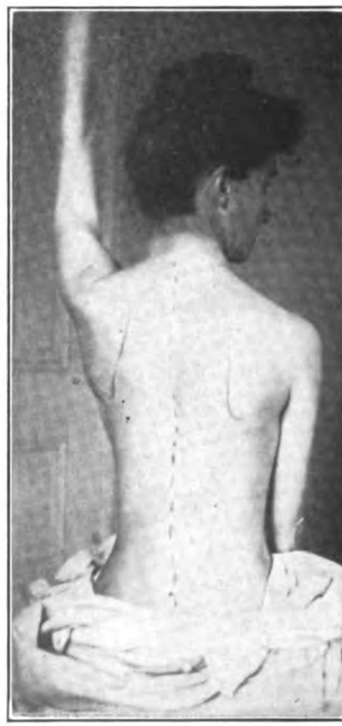


FIG. 133. Corrective effect of extension of left arm so as to influence the irregularity of the spinal column due to weakness.

to be associated with a functional curve, because such a curve puts muscles and ligaments on a stretch. As the bones and intervertebral discs gradually yield to the unequal pressure of a functional curve, rotation takes place, according to the laws which govern rotation in the dorsal and lumbar regions, and a compensatory condition results, which we recognize as a right dorsal left lumbar scoliosis, or the reverse.

Caries.—2. Actual disease of vertebrae may be the cause of backache. Such a condition is usually a localized

FIG. 134. Structural lateral curvature and kyphosis, great rigidity, no pain or discomfort.

caries due to tuberculosis. Caries is characterized by angular deformity, great sensitiveness to digital pressure and especially to vertical pressure; i. e., any addition to the weight of the body above the involved vertebrae. Localized backache associated with a prominent spinous process and sensitiveness to vertical pressure should be sufficient to cause any physician to suspicion the existence of caries.

Rigidity.—Even these conditions without apparent deformity should make one hesitate before using any leverage through that area. One of the characteristics of localized backache in disease of the structure of the spinal column is rigidity, i. e., the body protects itself by muscular tension sufficient to limit or prevent movement in the inflamed area. Whenever this protective phenomenon is observed it should be a warning against interference, until one is convinced that more is to be gained than lost by interfering with nature's protective mechanism.

Arthropathies.—Cases of paresis and tabes dorsalis are subject to arthropathies and hence heavy manipulation, of a leverage or thrusting type, should be avoided. There is danger that an arthropathy may exist, and as such conditions are not characterized by pain, the normal protective mechanism does not assert itself. Fig. 135 shows an angular deformity in a case of paresis. The deformity was caused by severe manipulation by one who had no knowledge of pathology or, in fact, any of the basic medical sciences. This woman had a comparatively straight spinal column which exhibited some stiffness and sensitiveness, eighth to twelfth dorsal. The woman was placed on her back, knees doubled under her chin, then rolled on to her shoulders and a heavy downward thrust given so as to strongly flex the lower dorsal. The sharp kyphosis was instantly produced, with resulting pressure on the spinal cord.

Spondylitis Deformans.—A general posterior curve with ankylosis, or diminished flexibility, thickened spinous processes, tenderness to digital pressure, localized pains, not markedly sensitive to vertical pressure, is recognized as spondylitis deformans. Other joints of the body are usually similarly affected.

Rachitis.—The changes due to malnutrition, rachitis, are frequently recognized. The fact that changes elsewhere

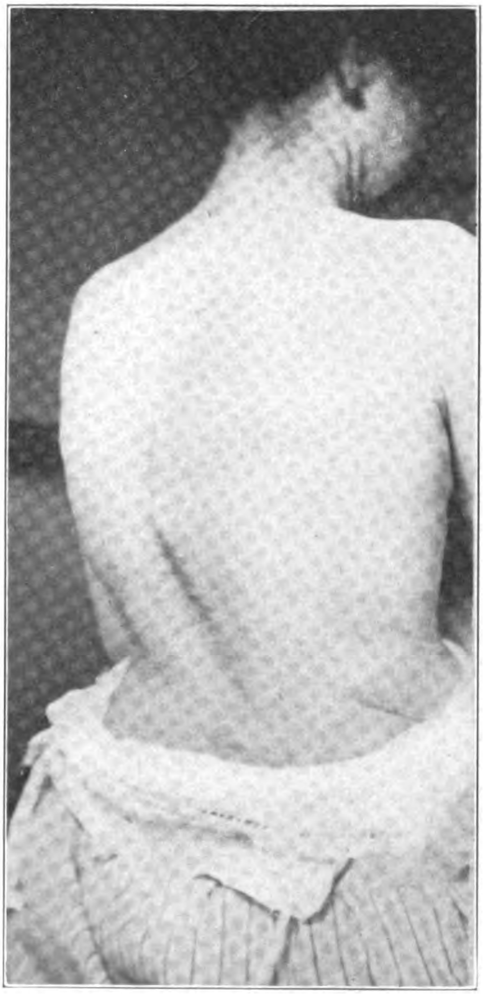


FIG. 135. An angular kyphosis produced in a case of paresis by severe flexion and compression, by an ignorant pretender.

are apt to more positively indicate the previous existence of rachitis makes diagnosis comparatively easy.

Malignant Growths.—When localized backache is complained of and no deformity is evident, thorough tests should be made to determine the effects of positions and movements. The protective contraction of the muscles should be carefully analyzed, so as to judge whether the pain is due to any inflammatory process involving the vertebrae, or any of their joints. Nearly all pains in the lumbar region are called "lumbago," but one must always be on guard lest a persistent lumbago-like pain be not given its true value. Pains of a sharp, lancinating character which persistently appear in a definite spinal area or along nerve trunks originating from that area, usually have a sinister significance. A definite diagnosis is practically impossible, but the persistence of the pains, in spite of all efforts to relieve with heat, positions of rest, or manipulations, is pretty good evidence that some malignant process is at work which involves these spinal tissues. If no fever exists, or other constitutional sign, it may be that the pain is due to involvement of the spinal column by a growth within the body. As example, a man, 44 years old, complained bitterly of sharp lancinating pains in the lumbar region and extending down branches of the lumbar and sacral plexuses. All efforts at relief were unavailing. There was no deformity of the spinal column, but the patient held himself rigid. Many attempts were made by many physicians to make a diagnosis. One of them used heavy manipulation of a leverage character. In order to test the effect of vertical pressure he used a concussing blow on the top of the head and then on the heels. This latter produced agonizing pain which was followed rapidly by paraplegia. The case ran a tedious course of many months. Autopsy showed cancer involving left kidney and the spinal area under it. The progress of the disease was exceedingly slow and hence his body was able to bring many compensatory mechanisms into action, which made it difficult for even the most skillful to recognize the true condition.

Typhoid Spine.—The so-called "typhoid spine" is another form of spinal trouble, without deformity, which may be a spondylitis but probably is a pure neurosis.

Lumbago. 3. Under this head we may collect a variety of conditions which are characterized by pain which is particularly aggravated by voluntary movement. It is ofttimes difficult to determine what the structural change is which gives rise to this pain. Each case will show peculiarities as to the exact location of the pain and the amount of possible voluntary movement. There may be involvment of muscle, ligament, fascia, or periosteum. The cause of the trouble may be **fatigue** as result of posture, **strain** from lifting, or may be due to a **toxemia.**

Posture.—Backache, due to posture, is commonly produced in any one who attempts to do work which compels bending of the back forward. Until such time as the individual develops adaptation to this position there will be sensitiveness at those points in the spinal column which endure the greatest strain. The strain thus produced may affect the extensor muscles of the back, or in case the posture is such as puts strain on ligaments, there will be hyperesthetic points directly on the vertebral spinous processes where the supraspinous ligaments attach. Backache due to strain is not characterized by fever. The recumbent position gives relief.

Toxemia.—Backache due to toxemia is nearly always of sudden appearance. The fact that the patient first becomes conscious of its existence when some movement is made such as quickly sitting up in bed, or bending forward to pick up something, or putting on clothing, always leads to the belief that the pain is due to strain. Nearly all such cases show a coated tongue, bad breath, constipation, headache, and general physical depression. The pain

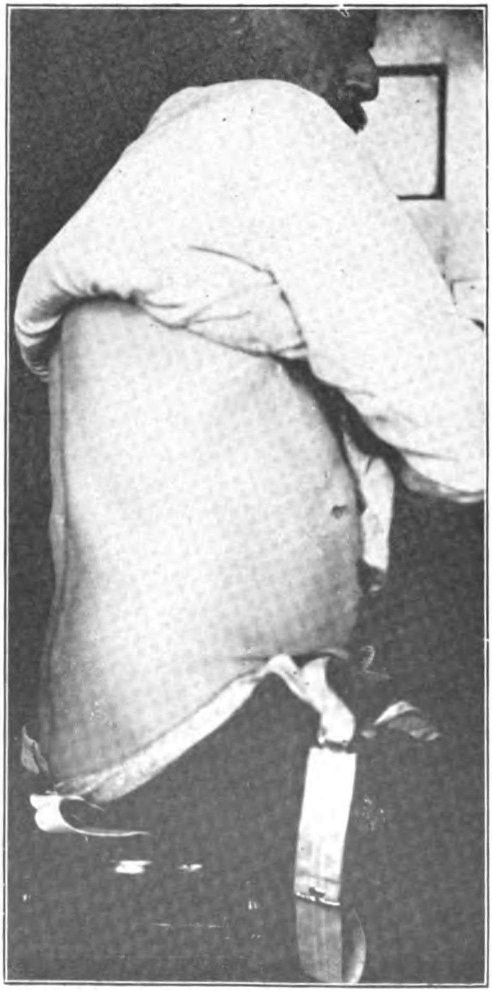


FIG. 136. A swelling under the sheath of the left erector spinae muscle, which was coincident with an attack of "lumbago," following a heavy strain.

is not necessarily located in the erector spinae muscles. It is frequently localized around the fifth lumbar spinous process, which is exceedingly sensitive to digital pressure. There may be some fever in the cases for twenty-four hours. Thorough catharsis is indicated and usually is followed by rapid decrease in pain. The pain in most of these cases is only present during voluntary movement. The physician can usually give quite extensive passive movement without causing severe pain.

Trauma.—A genuine trauma of the extensor muscles or ligaments of the back usually has enough of positive history to classify it with sprains of other joints. Rest, heat and gentle manipulation are indicated. In these cases the protective mechanism heretofore mentioned, that is, muscular tension to prevent movement, is very apparent. Relief from pain is usually quickly attained by a position of rest which makes no demand on the strained tissues. There may be localized swelling under the aponeurosis covering the erector spinae. Fig. 136 shows such a swelling caused by a severe lift. The patient was a lumber shover. He was assisting in handling a heavy timber when the greater portion of the weight came suddenly upon him. Another case, whose back had a swelling of similar character and history of repeated attacks of "lumbago," but no history of trauma, proved to be sarcoma involving both muscle and bone in this area.

"Crick in the Back."—The so-called "crick in the back" is characterized by a sudden onset and excruciating pain. It appears to be due to some sudden movement which ordinarily puts no strain upon any tissue. They are not limited to any particular area of the back, but are as apt to appear in the neck or interscapular area as in the lumbar area. All such attacks are rather severe during the first day but usually subside under heat and manipulation. These attacks seem to be associated with a constitutional state and hence tend to recur at certain seasons or under certain conditions of the atmosphere, especially cold, dry, electrical winds. Although these cases show some signs of indigestion they do not seem to be of the same character as those we have previously mentioned.

Involvement of the Spinal Cord. 4. Pain in the back may be due to some involvement of the spinal cord or its membranes. As a general rule there are enough other symptoms such as motor or sensory phenomena to direct one's attention to the real seat of disease. The pain in these cases is likely to be symmetrical or at least definitely located with respect to certain spinal nerve trunks. Furthermore, pain due to involvement of the cord, or its meninges, does not call forth the protective reflexes which are so evident when any structural tissue of the spinal column is involved. There is no necessity for rigidity to protect supporting tissues. (We are not including spinal meningitis in this group.) When the nerve roots are involved the pain is intense and definitely located. When the root ganglia are involved we have the well known condition called herpes zoster.

Infectious Fevers. 5. Many of the acute infectious fevers are characterized, in part, by severe backache. Influenza, tonsilitis, smallpox, typhoid, diphtheria and dengue all have severe backaches as an incident in their course. It is not known what produces the pain in these fevers.

Referred Visceral Pains. 6. Probably the great proportion of backaches are referred pains due to involvement of thoracic, abdominal or pelvic viscera. Attention has already been called to Head's law of referred pain, and to the existence of the receptor fields for sensory impressions for certain segments of the spinal cord. The intero-ceptive field is an area of low sensibility, so far as our conscious recognition of this field is concerned. Not all segments of the spinal cord receive sensory fibers from this field, hence visceral reflexes are found only in those portions of the back associated with those segments having

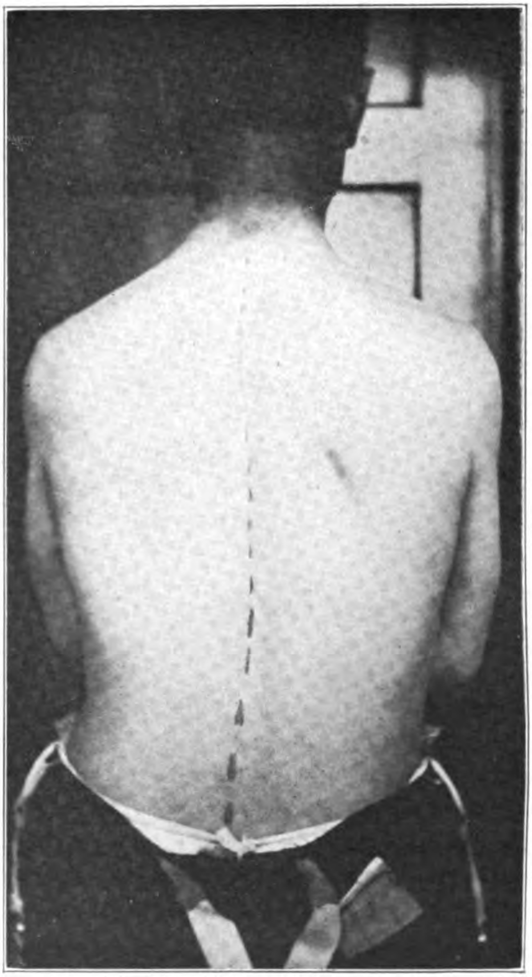


FIG. 137. An occupation curve with flattening in the upper dorsal. Telegrapher. Patient complained of pain and tenderness, second to fourth dorsal on the left side. Died sixty days after the photo was made, angina pectoris.

intero-ceptive sensory communication. Disturbances in hollow viscera such as the stomach and intestines are due to overloading the digestive apparatus. Fatigue and consequent failure of digestion leads to distention with gas, absorption of toxins, faulty elimination. Distention causes pressure on nerve endings in the walls of the viscera and thus initiates reflex backache. Exaggeration of physiological activity of the liver, or spleen, causes tension on the capsules of those organs and hence irritation of their sensory nerves with reflex back pains. The same is true of the kidney. Disturbances in the blood supply to any organ, such as occurs in arterio-sclerosis, or as result of aneurism, usually cause referred pains. The referred pains that are due to functional fatigue are usually of a somewhat different character from those due to inflammation in visceral organs. Acute inflammatory states in the viscera give rise in many instances, to cutaneous hypersensitiveness in their segmentally associated areas. These cutaneous areas are hypersensitive to a slight touch but not especially so to pressure. States of functional strain and fatigue, whether acute or chronic, are more apt to produce a reflex, in the spinal area, which is characterized by tenderness to pressure over the extensor muscles at some point between the spinous processes of the vertebrae and the angles of the ribs. Cutaneous and deep tissue hypersensibility may be associated in the same case. The deep hypersensibility is the more constant form discovered by palpation.

Inflammation of Serous Membranes.—Wherever the necessity for friction of one organ, or structure, on another is necessary, we find serous tissue in the form of a bursa, tendon, sheath, synovial membrane, tunica vaginalis testis, pleura, pericardium or peritoneum. Inflammation of a serous membrane is accompanied by muscular fixation of the structures which depend on that membrane for free movement. This is a protective action required to prevent friction of the inflamed surfaces. Inflammation of a pleural surface calls forth a protective contraction of all the muscles which are concerned in producing movements which require the co-operation of that pleural surface. If pleural effusion occurs there is still an increased muscular tension, although not so spasmodic as when no effusion exists.

Colicy Pain.—Gall stone colic, intestinal colic, renal colic and appendicitis all cause severe reflexes, deep muscular as well as cutaneous, in the areas innervated from the same segments of the cord. These reflexes are found in areas of greater extent than those properly associated with these visceral structures. The severity of these colicy pains undoubtedly excites an overflow of stimuli into segments above and below those which directly innervate these structures.

Summary.—For the purpose of bringing some of the various causes of reflex pain into orderly arrangement we may classify them as follows:

1. Due to functional strain of viscera, e. g., digestion of a very rich meal.
2. Due to distension of a hollow viscus, or stretching of the fibrous capsule of an organ.
3. Due to inflammation of the serous investment of a viscus.
4. Due to disturbance of circulation in visceral blood vessels caused by disturbed mental condition, or on account of a pathological change in the walls of the arteries, arteriosclerosis.
5. Due to excessive effort to overcome obstruction of the lumen of hollow organs as in spasms of the muscular coats of the intestines, common bile duct, ureter or fallopian tube.

Pluri-Segmental Control of Viscera.—It should be remembered that, as a general rule, the reflexes due to these causes are not definitely limited in extent, either as to skin areas, or groups of extensor spinal muscles. Just as no skin area, or single muscle, other than a rudimentary one of the fifth layer of the back, is completely innervated from a single segment of the cord, we find also that no viscus is wholly controlled by fibers from one segment.

Reflex Subluxations.—The continuous action of a reflex, such as that due to inflammation of a serous surface, or to long continued functional strain, or to continued circulatory disturbance, usually results in a change in the character of the back, i. e., a certain degree of static alteration takes place as a compensatory adaptation to varying degrees of muscular ankylosis. This muscular ankylosis is the expression of the visceral reflex. It produces changes in bony alignment which we recognize as subluxations when only three or four vertebrae are affected; or as curvatures, when greater numbers are involved.

Intensity of Reaction.—The extent and complexity, or intensity, of a reflex, or co-ordinated series of reflexes, is not a criterion by which to estimate the extent of pathological change in a viscus or viscera. Very serious pathological changes may be present in a viscus without producing intense or even determinable spinal reflexes. These changes may have progressed so slowly and involved such small areas that no intense protective reaction was called forth.

Location of Reflexes.—Based upon clinical and experimental observations, a considerable amount of data has been secured bearing upon the location of reflexes in connection with various visceral diseases. The data with respect to the location of cutaneous hyperaesthesia has been well mapped out, but until osteopaths began to plan their manipulative treatment according to the structural changes in spinal alignment, due to muscular hypertension, there was practically no attention paid to the phenomenon of reflex hypertension. The referred visceral pains and the hypertension of the spinal muscles are expressions of a disturbed segment or segments of the spinal cord.

Reflex Patterns.—Based on clinical and experimental data, it is possible to outline a series of reflex patterns which are characteristic of certain visceral involvments. The complexity of the patterns depends largely on how great an effort is required by the body to overcome the disease. Some diseases have a spinal reflex pattern apparently out of all proportion to the gravity of the illness. This is especially marked when autotoxemia is a characteristic of the illness. Under such circumstances muscular tension and tenderness extend far outside the limits of the normal segmental innervation.

CHAPTER XVI.

ADAPTATION AND COMPENSATION.

Examination of patients frequently reveals the results of accidents or disease which do not appear to have any present deleterious influence on their health. It is always necessary for the physician to estimate the relations which these changes have, in the past, borne to the general health, or may, at present, be liable to exert under known conditions of climate, diet and environment.

Definition.—In speaking of structural and functional changes, we use the words adaptation or compensation. Adaptation means, in biology, favorable organic modifications suiting a plant or animal to its environment. Compensation means, "to make up for," "to counterbalance," "that which makes good the lack or variation of something else." The examples of adaptation and compensation are very numerous and it is necessary for the physician to be able to recognize the cases in which the body has exercised, or may, with proper assistance, exercise this power to a great degree. It is sometimes said that disease is an effort of the body to accommodate itself to new conditions, that is, changes in the quantity and quality of stimuli occasioned by variations in climate, diet, environment or accident.

Osteopathy apparently originated from the fact that structure affects function. With this as a basis, all examinations are made from the structural standpoint and therefore, if we follow this method too literally, we are apt to overlook the fact that the cells of our bodies have the power of adapting themselves to very pronounced changes in all those things which are considered essential to perfect functioning. Function in these affected cells may not be perfect, measured by their former activity, and yet apparently answer all the demands made upon them by the conscious or sympathetic life of the individual. There may be other cells, somewhat similar in character, whose increased activity can compensate, that is, "make good the lack of" activity in the affected cells.

The Spinal Column.—The examination of the spine frequently reveals the irregularities in its structure. Disturbed function in some viscus or other group of tissues is sometimes attributed to this structural variation, even when no direct nerve influence over the affected tissues can be directly traced to the spinal area. Mere change in structure, cannot warrant us in considering it primary to a functional disturbance, which does not exist in a location whose control can be traced to it. The effort on our part to always connect structure with function, having the relations of cause and effect, sometimes leads to very far-fetched reasoning. It is necessary for us to decide, in a given case, whether or not the present condition of the individual is as good as it can be made. Our decision will manifest to the keen observer whether we have recognized the extent of possible adaptation and compensation.

Curvatures of the spine present many phases which must be considered before treatment is begun. The curvature of an old case of Pott's disease seldom affects sympathetic life to the extent that we would expect. The very gradual progress of this disease seems to give ample opportunity for the structures, in close relation to the diseased area, to accommodate themselves to the changed conditions. It is hardly conceivable that anyone would fail to recognize the accommodation manifested in these cases, and yet we have heard of those who advocated forcible straightening of the spine. The question to be decided is whether it is better to risk life by forcible

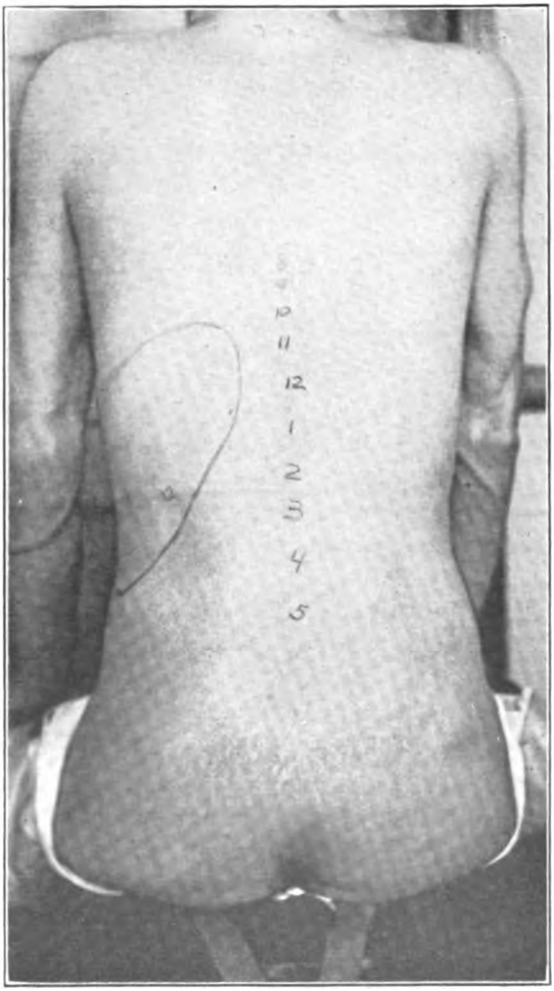


FIG. 138. Adaptation of the body to the state of its contents. Enlargement of the spleen which causes a bulging of the ribs and a coincident spinal lesion.

straightening of the spine or endure deformity with fair health. Deformity is always a wound in the self-esteem of the individual. Many would risk life time and again to be rid of it. It is this which gives the experimenting physician or surgeon ample opportunity to try his skill or his ignorance. It is all one to the patient, a chance to be rid of deformity.

Compensatory Curvature.—A lateral curvature of the spine usually has two parts, the primary and the compensatory curve. The compensatory curve is the effort to maintain the erect position, that is, keep the weight of the body properly balanced. The physician must determine which curve is primary and which is compensatory.

When the hip is dislocated, or any condition exists which shortens one leg, the spinal column is curved to compensate for this reduced length. It would be useless to treat a compensatory spinal curvature, without lengthening the leg by reducing a hip dislocation or putting an extension on the shoe. When the femur is dislocated, all the thigh and hip muscles accommodate themselves to a new position, then the spinal column curves because the pelvis tilts enough to compensate for the lack of length in the extremity. The longer the dislocation has existed the more perfect is the adaptation and compensation. To reduce the dislocation we must undo the work of adaptation, that is, lengthen the muscles and force the head of the femur into the acetabulum.

All individual spinal lesions must be judged carefully as to their relations to functional disturbance. The fact that spines develop unevenly, in many cases, makes it hard to define their exact condition. A lateral subluxation may exist to which the body has become accommodated. To reduce this subluxation might again subject the individual to disturbed function.

The Thorax.—Drooping of the ribs lessens the antero-posterior diameter, but increases the vertical diameter. The full round chest of large capacity is usually less flexible and active than the small chest. The question in each case is whether the thorax is doing the amount of work necessary for the body. The chest may show evidence of a period of malnutrition, during childhood, that is, "rickets." There may be evidences of the effects of occupation. In any case of deformed thorax

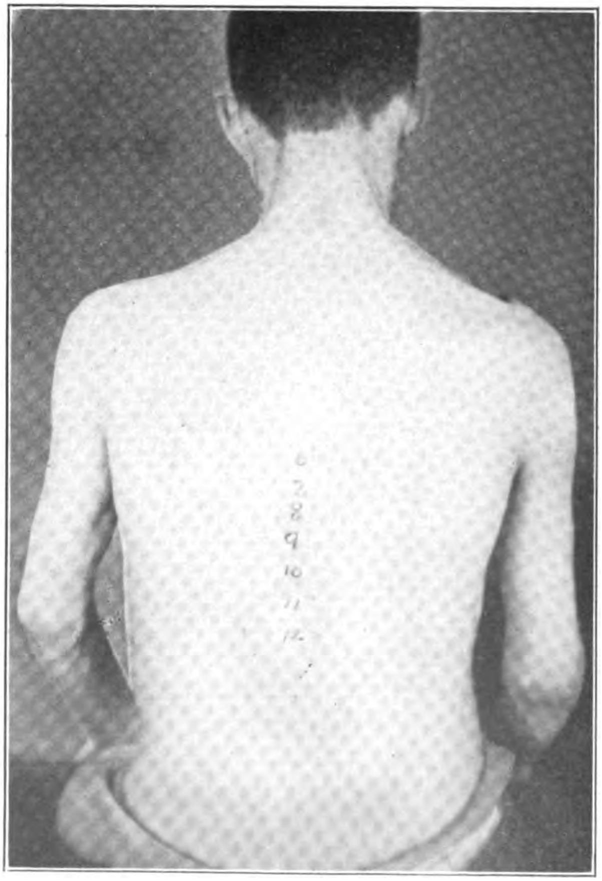


FIG. 139. Posterior view of a case of leukemia, showing spinal area involved in adaptation of the body wall to its contents.

the question uppermost in our minds should be: "What is its functional capacity?"

The Heart. — Compensation by the heart, for some mechanical defect in it, is the most interesting subject studied by the physician. As a result of contraction of the orifices of the heart, or faulty action of its valves, there

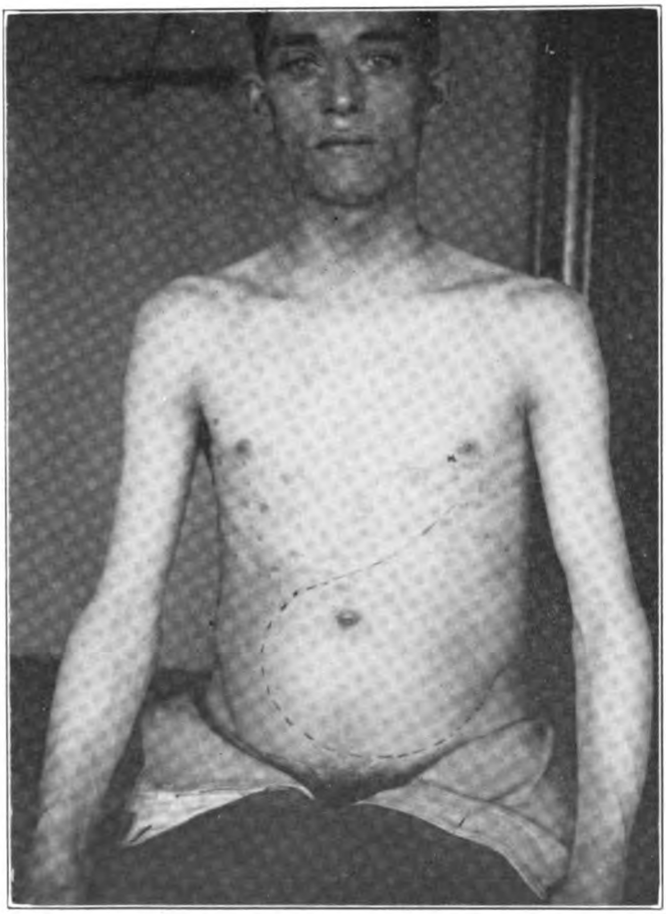


FIG. 140. Anterior view of case of leukemia, showing outline of the enlarged spleen.

is an increase in the size of one or more of its chambers. This increase is at the expense of the thickness of its walls, thus resulting in disproportion between the size of the cavity of the ventricle or auricle, and the amount of muscular tissue required to empty them of their contents. When the proportion between the cavity and its walls is so far restored that the heart is able to overcome the stasis of the blood in that portion of the circulatory apparatus behind the lesion, we say that compensation exists. The ability to recognize the status of a heart lesion is of great value to a physician.

Skin and Kidneys.—A spinal lesion might cause a disturbance in the functioning of the kidneys, decrease of activity, which in turn is compensated for by increased activity of the skin, which in time is compensated for by increased activity of the bowels. The diarrhoea in this case would be compensatory, and yet it is very difficult for the physician to note this fact. If therapeutic means were used to stop the diarrhoea, and the kidneys or skin did not immediately take up the work of elimination, the body would call upon the serous membranes and areolar tissue, to take care of the surplus liquid in the circulation. As a result there would be edema of the extremities, ascites, pleuritic effusion.

The compensating action which may take place between the kidneys, skin, mucous and serous membranes, is one which is more frequently recognized and made use of by physicians than any other example of the same power manifested in the body. The fact that the skin and kidneys respond to each other's needs, forms the basis for many therapeutic procedures. Mucous membranes become active when the skin fails. Perspiration reduces activity of the mucous membranes. Serous membranes cease their excessive activity when mucous membranes eliminate freely. The oedema of areolar tissue gives way to activity of mucous membranes. The physician must recognize which is the diseased tissue, and which is the compensating one. The failure of the kidney to excrete might not be the fault of its own structure, but result from the vis a tergo given the circulation by a diseased heart.

Power of Encysting.—In this western country, California, we have ample opportunity to witness the ability

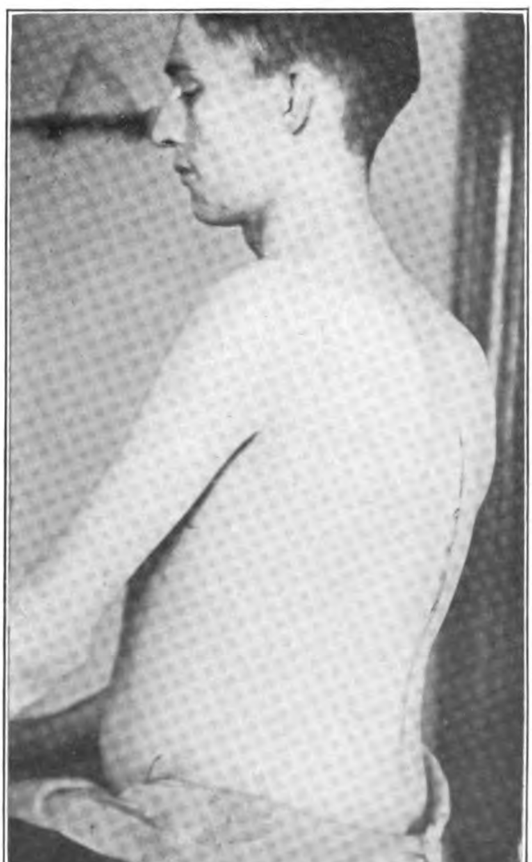


FIG. 141. Side view of case of leukemia, showing result of adaptation of the spinal column and ribs to the contents of the body.

FIG. 112. Plantar impression of almost complete letting down of the longitudinal arch.

of individuals to do hard, tedious work, after a considerable portion of the lung has been destroyed by disease. The healing which takes place under favorable climatic conditions, seems to leave the remainder of the lung in perfect functional condition. We have examined two cases, in which the whole right lung was destroyed, and the heart had been drawn into the right half of the thorax. Both of these individuals were able to compete with their more perfect fellows for a living, by doing hard manual labor. One of these patients had a discharging abscess in the axillary line, between the ninth and tenth ribs. This abscess had discharged continuously for four years. The patient did not complain of a single symptom of ill health. He earned his living as a miner. This shows how thoroughly the system may become accommodated to very marked changes in the condition of its tissues. This abscess was in the man, but apparently not affecting his functions. Probably the abscess was walled off from the active body tissues by a protective membrane.

The history of the lodgment of bullets in various portions of the body, demonstrates that what cannot be thrown off by ordinary means, may become encysted, and thus not interfere with the activity of the tissues.

The Extremities.—Adaptation and compensation can be noted very quickly in many cases of injury of the extremities. A fixed scapulo-humeral articulation is partially compensated for by increased mobility of the scapula on the thorax. When the anterior tibal group of muscles is paralyzed, the patient compensates for inability to raise the toe, by flexing the thigh. When the hip joint is fixed in the extended position, the lumbar portion of the spinal column becomes very flexible.

Law.—All living things strive to preserve themselves. This means they do the best they can under all conditions. In order to do this they must adapt themselves to changes in the character of their environment and compensate for

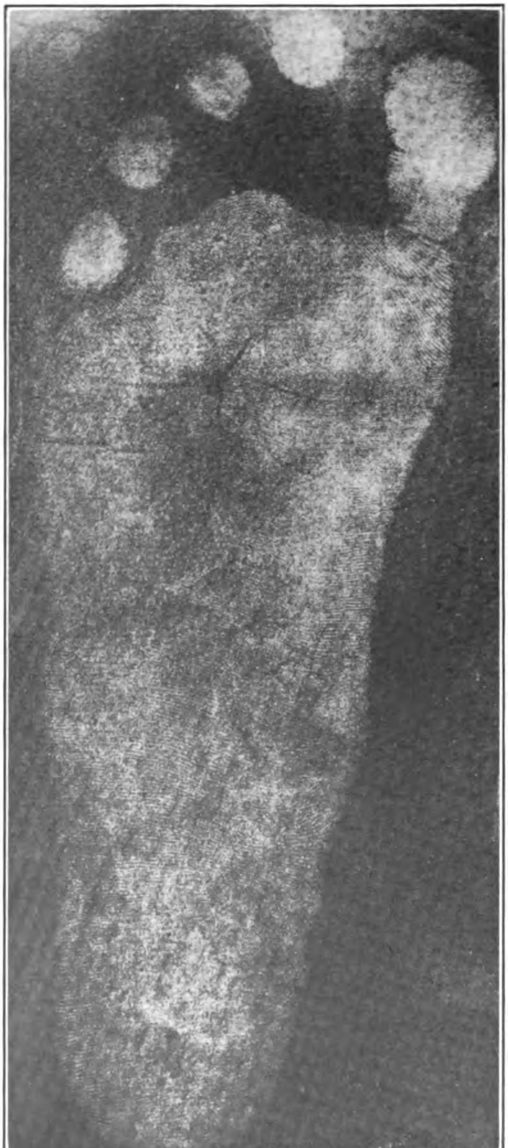


FIG. 143. Plantar impression of case of absolute flat foot. The longitudinal arch is completely broken down.

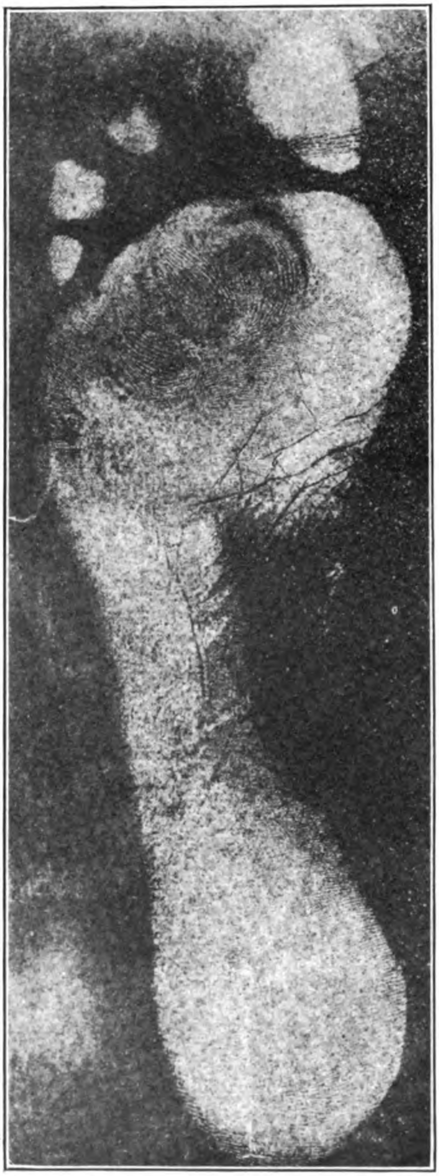


FIG. 144. Plantar impression of loss of transverse arch, and consequent increase of pressure on the head of the second, third and fourth metatarsal bones, as evidenced by the callous.

injuries to, or losses of their own structure. Adaptation to external conditions calls for the operation of compensating or balancing devices within the organism, therefore the logical study of this subject would naturally group the phenomena under three heads. First, the study of structure, with a view to determining the existence of balancing devices in the arrangement of bones, ligaments, muscles, blood vessels, viscera and nerves. These compensatory mechanisms must be considered in every effort at adaptation. This first division deals with internal structural conditions, and their functions, i. e., anatomy and physiology. Second, the study of conditions under which living structures are existing. This division deals with all those things which constitute environment, such as food, temperature, atmospheric pressure; relation to other living things, such as insects, protozoa and bacteria; animal and vegetable poisons. Third, a logical outgrowth of the first and second divisions, i. e., a study of the artificial conditions used by physicians to influence the natural conditions of the first and second divisions.

Since man's position is upright, it appears that all parts of his body are constructed with the end in view of making that position easy to maintain. A bewildering series of compensating devices serve to balance the body in the upright position. Any deviation of any part, as the result of accident or necessity, is immediately met by an opposing counterbalancing effort of its natural compensatory opposing structure. If this compensatory effort is not present, there is loss of balance between reciprocating parts, resulting in strain and discomfort. As a general proposition the foregoing is recognized by all, but to actually recognize the failure of compensation, the presence of strain, imbalance, requires knowledge of the structure of reciprocating parts.

The feet present some interesting mechanisms for responding to the needs of the body in balancing in the upright position. Every change in shoe last calls for a compensatory change in the relation of tarsal, metatarsal and phalangeal joints, with the consequent changes in muscular tension, to meet the demands of maintaining the equilibrium of the body. The bursae which lie under the skin areas, which are subject to pressure, vary considerably. Their compensatory character is well illustrated in the different forms of club-foot. A bursa is usually located in such deformities wherever needed to protect the bony points from friction. Figs. 89, 142, 143 and 144 show plantar impressions of feet with varying degrees of weakness in the longitudinal or transverse arches. Two of these cases had been treated for backache and innominate lesions, without success. The reason for the failure is well illustrated by these plantar impressions.

The adaptive and compensative changes, which are so readily observed in the human foot, present very many phenomena which should be patent to all students of medicine. The fact remains that physicians fail with astonishing frequency to take account of these phenomena, therefore we feel warranted in giving attention to this subject.

The case which is here described and illustrated was sent to me by Dr. Geo. F. Martin, of Tucson, Ariz. Mr. C., age about 28, interested in mining enterprises, applied for relief from pain in the right foot and leg. Examination revealed a high, swollen instep, and measurement of the length of the foot showed it to be one-half inch shorter than the left. The ankle did not appear to be involved. The top of the instep felt bony, instead of pulpy, as might be expected from the appearance. Palpation of the inner side of the longitudinal arch showed that some decided change had taken place in the astragalo-scaphoid articulation. Just posterior to the scaphoid tubercle, instead of feeling the astragalus, a depression was noted and this depression was continuous with a sort of groove which passed across the instep, from internal to external maleollus. Fig. 145. When the patient stood on the foot

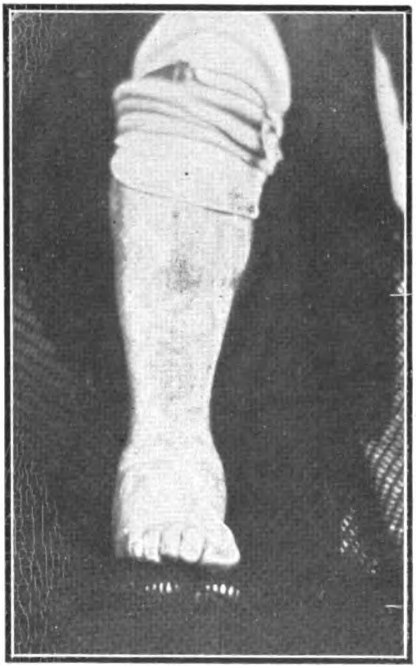


FIG. 145. Anterior view of old fracture of the scaphoid.

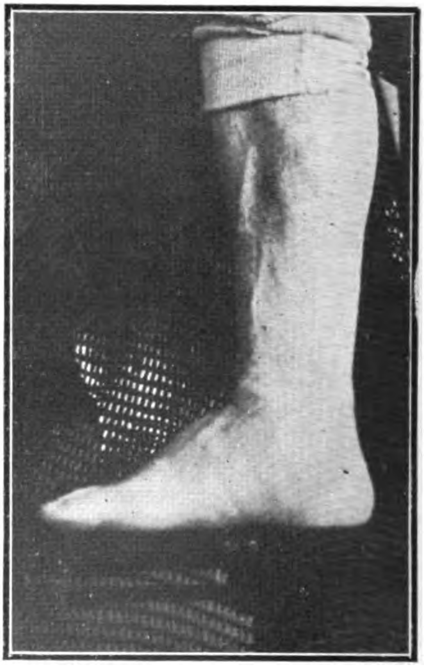


FIG. 146. Side view of old fracture of the scaphoid.

this groove was decidedly apparent. Fig. 146. Palpation, while the weight was on the arch, seemed to indicate that the tibia and fibula held a relation to the astragalas similar to that which is normal when the foot is extended on the leg, i. e., the posterior portion of the superior surface of the astragalus was bearing the weight. The shortening of the foot, height of the instep, inability to palpate perfect continuity of the internal side of the longitudinal arch and existence of groove just in front of the ankle joint, together with slight swelling but no edema, dilated veins and dull pain in the arch and leg, but no loss of function, (i. e., mobility existed in all tarsal and metatarsal articulations) were indicative of some decided structural changes. The principal point noted about the

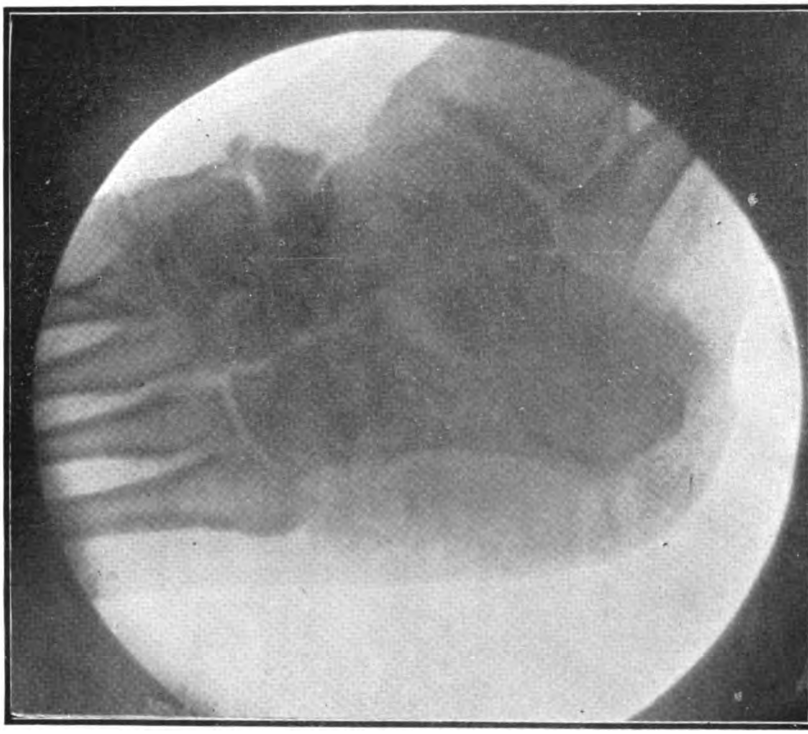


FIG. 147. Radiograph of an old fracture of the scaphoid and consequent displacement of the astragalus.

movements was that inversion and eversion of the foot took place with the foot in the normal relation to the leg, as though it was extended, thus demonstrating that the astragalus was in fact in a position of extension, even though the foot appeared not to be so.

The condition of this foot is exceedingly interesting, when the history is considered. Mr. C. says his foot was injured by a large rock, which a fellow workman accidentally dropped. This accident took place four years ago, while he was working in a mine. The foot swelled slightly, i. e., to about its present size and was painful, but did not incapacitate him for work. Claims he never lost a day on its account, and it was not examined by a physician. The swelling gradually subsided and the foot gave him no inconvenience for three years, except in the matter of fitting a shoe. Recently swelling and pain have developed.

FIG. 148. Radiograph of an old fracture of the scaphoid, showing compensatory rotation of the foot on to its outer margin, to avoid transmitting the body weight through the longitudinal arch.

My first suggestion, based on the insufficiency of the arch, was the use of an instep supporter, but this proved a failure, as it caused his foot to turn on the outer border. The support prevented the inner side of the arch from lengthening when weight was put on it, and the astragalus could not have free movement, hence the foot inclined toward the outer side, and strained the ankle.

Several skiagraphs were made which were very satisfactory in aiding diagnosis. The first one was made to show the relation of the tarsal bones on their superior-external aspect. Fig. 147. This shows the head of the astragalus downward, out of relation to the scaphoid. Fig. 148 shows a view directly from above the dorsum of the arch, and demonstrates clearly the dislocation of the head of the astragalus. The inner side of the longitudinal arch is not complete, and what there is of it—sca-

FIG. 149. Radiograph of an old fracture of the scaphoid, showing relation of the head of the astragalus to the fractured scaphoid.

phoid, internal cuneiform and first metatarsal—is badly distorted. The relations of the metatarsals, as shown in this illustration, indicate the tendency to throw the weight on the outer edge of the foot. The side view, shown in Fig. 149 demonstrates again the dislocation of the head of the astragalus downward to a position under the scaphoid. The scaphoid shows an irregular outline,

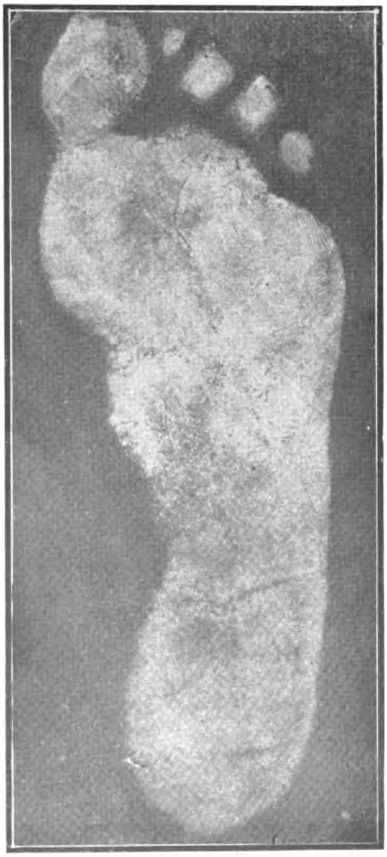


FIG. 150. Plantar impression showing effect of old fracture of scaphoid and consequent downward movement of the head of the astragalus.

as though having been fractured and repaired, leaving irregular masses of callous.

An impression of the plantar surface of the foot was taken. Fig. 150. This shows the great increase in contact surface, especially under the head of the astragalus. Another interesting thing demonstrated by this impression is the change that has taken place in the second metatarsal, and second toe. Both have been elevated so that they no longer bear much direct weight. The third and fourth metatarsals are bearing the direct application of the weight of the body.

In order to more clearly analyze this case, we will consider some general fundamental ideas concerning the structure and function of the foot. The foot acts, primarily, as a passive support of the body weight; secondarily, as an active lever to move this weight, as in running. In order to perform these functions, it must have strength, elasticity and adaptability, thus permitting it to assume various attitudes necessary to protect it from injury. Since the primary function of the foot is to act as a support, the integrity of the ligaments is essential. When the foot is passive under weight, the arches settle slightly. The arch as a whole is elastic, but the ligaments are not. The elasticity of the arch is the result of the movement of the bones into a position where the ligaments receive the weight. Muscles, ligaments and the plantar fascia all serve to support the foot, but when passively bearing the weight of the body, the ligaments bear the strain. Loss of elasticity in the foot causes increased pressure on points of contact on the sole of the foot, also on the toes. The skin thickens over these bony contact points in an effort to compensate for loss of elasticity, thus corns and callouses are evidences, in many cases, of compensation and should indicate the necessity for a careful examination of the structure of the foot.

In the attitude of rest the astragalus rotates slightly inward and downward on the os calcis, thus making the head of the astragalus somewhat prominent on the inner side of the foot. This movement is checked by ligaments, and this position of fixation removes all strain from the muscles. In the case we are studying, the calcaneoscaphoid ligament was torn, hence the rotation of the astragalus is limited only by compressing the soft tissues of the sole against the floor, as is evidenced by the impression along the inner border of the foot in Fig. 150. The position of the head of the astragalus under the scaphoid raises the inner border of the foot and throws the weight on the outer border, a natural compensatory position. From the foregoing we judge that this foot is a poor passive support. Although it has done good service for nearly four years, it has never been called upon, until within the present year, to act for long periods of time as a passive support. Heretofore this foot has adapted itself to uneven surfaces, producing constant variation of pressure. Now that contact with smooth hard pavement gives no opportunity for shifting of weight and alternating contraction of muscles, it fails as a supporting mechanism. Steady pressure of the head of the astragalus on the soft tissues of the plantar surface interferes with circulation, causes edema and pain.

The secondary function of the foot is as a lever, in actively raising and propelling the body. We divide these functions into primary and secondary, because a foot that might serve as a good passive support, might possess none of the active elements required in running. A wooden foot would serve as a support, but not as an active lever. The heads of the metatarsal bones act as a fulcrum, the calf muscles furnish the power, the weight rests on the astragalus. When the foot is used normally, the line of weight passes downward through the center of the knee and ankle joints, hence forward along the line of the second toe. The fact that the inner side of the foot is longer than the outer, causes the strain resulting from lifting the weight of the body over the fulcrum, to be carried toward the outer side of the foot. This gives an appearance of turning the foot inward—"pigeon-toe." The toe does not turn in, but points directly ahead. This is the normal action when walking. In standing, the feet point outward, so as to give a greater base of support. In walking properly the feet should move parallel to each other, so that the strain falls through the center of the foot.

The movements accomplished by the case we are studying were quite normal, thus demonstrating that all the muscles were active, and that there was very little ankylosis in any of the joints. It is interesting to note that the astragalus has no muscles attached to it, hence its change of position is purely accommodative. All the other bones of the tarsus have muscles attached to them, hence they respond to muscular contraction, and take positions to which the astragalus accommodates itself when weight is put upon it.

An interesting problem is presented in this case, which is associated with fractures in general. We have been taught that fixation is the basic principle in the treatment of fractures, and this is so firmly believed by the public, that any other treatment, which might be used by a physician, resulting in deformity or some loss of function, would subject the physician to probable loss, in a mal-practice suit. This foot never had the benefits of rest, adjustment of the bony structure, or fixation. It passed through the successive repair stages, subject to at least a moderate degree of functional demands. How much better it might have been under ordinary routine treatment, is conjectural. The point we are interested in at this time, is the adaptation, which has resulted in a fairly useful foot as an active lever under conditions of rough ground, but has failed when the primary function of passive support on a hard level surface is required.

CHAPTER XVII.

INHIBITION.

Acceleration—Inhibition.—We have noted in a former chapter that the attributes of nervous tissue are irritability, conductivity and trophicity. We may add to these acceleration and inhibition. We do not use the terms stimulation and inhibition as denoting opposite conditions, because stimulation applies to the initiation of an impulse. This impulse may be acceleratory or inhibitory in character. We may stimulate a nerve whose chief function is inhibition. An impulse, whether accleratory or inhibitory in character, is the result of stimulation.

All bodily functions require stimulation, in the sense we have used the term, i. e., something must initiate an impulse which is designed to excite activity. After this activity is started, it must be governed. It is the means of governing these activities, we are interested in studying.

Muscular Contraction.—Muscle may be stimulated to contraction. This contraction may be increased or decreased, thus showing that after initiatory impulse starts on its way to the point of conversion into work done by the muscle, it is accelerated, increased, or inhibited, restrained by certain influences which we cannot easily analyze. The contraction and relaxation phenomena of muscle are equally important. Vaso-constriction and vaso-dilation are examples of these phenomena.

Secretion.—The activity of secretory tissues is regulated by some arrangement similar to that controlling muscular action. After a cell becomes active, it is still under the control of a governing center, which accelerates or inhibits, according to the necessities of the case.

Acceleration and Inhibition as Attributes of Nerve Tissue.—Cells are full of potential energy, which needs a stimulus to start its conversion into kinetic energy. We may ask ourselves the question; Why isn't all of the potential energy converted into kinetic at one time, or in response to a single stimulus? If the explosive material in a magazine is ignited, it all explodes—there is complete conversion of potential into kinetic energy. There is no restraining or accelerating in this case. The element, nitrogen, whose liberation in this case causes such dire results, is the same element in the cells whose liberation is noted as "work" done by muscle or gland. Why isn't all the nitrogen in the cells liberated by a single stimulus, as in the magazine? We can think of no explanation except that impulses passing over nerves are qualified by other impulses passing over other nerves, the two stimuli of opposite character thus modifying each other, or in some cases, adding their forces when of like character.

Inhibition as an attribute of the nervous system, does not seem to be exercised in short reflex arcs, neither does it appear to be exercised by centers in the spinal cord. It may be that a certain amount of inhibitory influence is exerted in these subsidiary centers, but thus far investigations demonstrate this attribute to be possessed by the brain cells.

Inhibition a Normal Attribute of the Central Nervous System.—Inhibition is a normal restraining influence possessed by the central nervous system. When the osteopathic physician speaks of inhibition, he means a therapeutic procedure which exercises a restraining influence over some function, this restraining influence being independent of that inhibition which is an attribute of the central nervous system.

Anything which decreases the number or strength of sensory impulses reaching a reflex center, is inhibitory in character. The medical profession has made use of a large number of agents for this purpose, opium, for example.

History.—Inhibition is a word found in literature bearing on the phenomena of the nervous system. It is well for us to investigate the history of this word, and the phenomenon which it indicates. The phenomenon which occasioned the use of this word was first observed by the brothers Weber (1845) and many investigators have since confirmed it. They noted that excitation of fibers of the pneumogastric nerve occasioned slowing or stoppage of the contractions of the heart. This new phenomenon must have a designative term, hence the word "stoppage" was used, meaning the arrest of activity of an organ, by arousing activity in a nerve supplying it. The word "inhibition" was proposed later by Brown-Sequard and has remained in use, to the exclusion of the earlier terms.

After observing the phenomenon of nerve arrest in the heart, other phenomena of a somewhat similar character were grouped under the same head. Thus we find the term inhibition confused with such phenomena as the paralysis of motor nerves by curare, loss of sensation following the inhalation of chloroform, shock and fatigue. We can thus realize the great confusion of meanings attached to this term. Later investigators realized the essential differences in these phenomena, and drew attention to the fact that paralysis, shock and fatigue were not comparable to the phenomenon of arrest of cardiac contraction following stimulation of the pneumogastric. Morot says, "In order to prevent this confusion, it is necessary to return to the experimental datum which lies at the foundation of the conception of inhibition. This appellation will be given to every phenomenon reproducing the characters and the essential conditions of stoppage of the heart by the stimulation of the vagus nerves."

Arrest of Activity.—Paralysis, shock, fatigue and inhibition all signify arrest of activity, but are not synonymous, as may be noted by examining into the pathology of the conditions thus described. Paralysis ordinarily means arrest of activity, due to a destructive process involving nerve elements.

Shock.—Shock is a phenomenon more closely allied to inhibition than the others. It signifies arrest of activity of the whole nervous system, due to excessive stimulation of a part, as, for example, the making of a wound. The stimulation produced by the wound reacts on the central nervous system, and produces arrest of activity. This phenomenon fulfills the definition of inhibition, as it is given in physiology: "An activity which prevents the manifestation of other activities."

Fatigue.—Fatigue is the arrest of activity due to over stimulation, and therefore involves the idea of destruction in a less degree than is signified by paralysis.

Location of Inhibition.—In the consideration of reflexes, we presuppose the existence of a mechanism consisting of two nerve elements, motor and sensory. The stimulation of the latter is transmitted to the former, and is manifested by work done by the terminal tissue which received it. This simple mechanism presupposes the approximation of the motor and sensory elements at some central point. To explain inhibition, we must add a third element to this reflex arc, interposing it at the point of contact of the motor and sensory elements. Since the point of terminal contact of motor and sensory elements is in the gray matter, wherever it occurs, this inhibitory phenomenon evidently resides in the same location.

Muscular Activity.—It is axiomatic that muscular activity is the evidence of the nervous elements which control it. Likewise, it has been considered that non-activity of muscle implied quiescence of the nervous elements. The phenomenon of inhibition would seem to imply a form of activity of nervous elements just as important as that which calls forth contraction. Muscular repose is the result of nerve activity. This is the important point, in the practical consideration of inhibition.

Three Characteristics of the Nervous System.—The nervous system during its developing period, shows three special characteristics, i. e., it either appropriates or produces energy—it is undetermined how the energy is secured—transmits energy, and lastly retains the discharge of energy. The last characteristic is inhibition.

Development of Inhibition.—When watching the movements of a young babe, we are amused by the incoordinate activity of its extremities. At this stage in its development, inhibition is not an accomplished function of its nervous system. The bladder and bowels act reflexly. If inhibition develops normally, the child soon controls defecation and micturition; if not, a case of enuresis exists, until such time as the inhibitory function is developed in the central nervous system.

Neurotic Diathesis, Chorea.—The well recognized fact that many children are easily precipitated into the convulsive state, is an evidence of the poorly developed condition of this third attribute of nervous tissues. The so-called neurotic diathesis seems to mean little more than faulty development of inhibition. Inhibition may develop in a fairly normal manner, but on account of nutritional conditions, environment or accident, be in part impaired. An example of this is exhibited by the well known uncontrolled movements in chorea. Impairment of the inhibitory function of the central nervous system would seem to be sufficient cause for chorea.

Paralysis Agitans.—To carry our theory into later life we may take paralysis agitans as an example of the impairment of the inhibitory function of the central nervous system. This functional neuronic disease presents no lesion of the nervous tissue, which has been detected up to the present time. It may be that future study of nerve tissue will discover a delicate mechanism, whose purpose is inhibition.

Developing Inhibition by Training.—The functional activity of nerve tissue is augmented by use, just as muscular power is enhanced by proper training. Knowing this fact is evidenced everywhere in the field of educational endeavor, we feel that inhibition, as an important function of the nervous system (in fact, we may call it a protective function) should be recognized and cultivated early in life. The well-trained child is the one possessing a well balanced nervous system. Such a child does not have spasms, because appetite and desire have been trained, and these virtues of self control manifest themselves in nerve power and control. Thus do we find the consideration of a purely scientific aspect of the development of the nervous system leads us into thoughts concerning moral development of the units of human society. Through such studies as this, the physician becomes an important factor in the development of a proper and healthful social life.

Inhibitory Effect of Pressure.—Now, to return to another view of our subject, we call your attention to a few of the recognized phenomena constantly presented to us, by our efforts to alleviate disease conditions. We know by many experiences that by pressure on the surface of the body, over the course of a nerve bundle, a restraining influence is often exercised over the function of the tissue receiving the terminals of that nerve bundle. Even more interesting is the observed fact that a restraining influence is often exerted on tissues remote from the point of pressure, which do not receive any of the terminals of the nerve which is pressed upon, but receive terminals of other nerves from the same segment of the central nervous system. We may even go farther and say that it is not an unobserved phenomenon to have functional activity restrained in very remote tissues, which do not seem ordinarily to be immediately connected with the segment of nerve tissue directly affected. This diffusion of restraining influences, following external pressure, would seem to point to the probability that the pressure acts as a stimulus to an inhibitory mechanism in the central nervous system. If this were not so, we could not expect any reflex restraining effects, such as we are constantly seeking. As examples of pressure effects, let us call attention to pressure of the suboccipital nerves in cases of headache. These nerves are in position to be compressed against bone. The effect of compression seems to be manifested peripherally by a decrease in pain. Pain in the abdominal viscera can frequently be lessened, to a very appreciable extent, by external pressure made over the proper associated spinal area. In this we have a good example of the reflex effect of pressure, which seems to uphold the idea that pressure is really stimulation of a function residing in the central nervous tissues. Pressure over the sacral nerves in a woman passing through the menopause, and troubled by irregular heart action, has been known to be almost immediately followed by regular heart rhythm. Since the cardiac irregularity was a reflex, occasioned by disturbance of the sacral plexus, there must have been a re-adjustment of nervous activity, due to some form of stimulation. It seems very probable that a movement, which we name inhibition, may in reality be a form of stimulation which calls forth a function of the central nervous system, the resultant action of the central nervous system being merely evidence of the fact that re-adjustment takes place as a self preservative activity, i. e., a manifestation toward the normal.

Dosage.—We are likely to be misled into the fatuous belief that if we give just enough stimulation, or inhibition, in a given case, i. e., if our dosage is just right, we will get perfect results. This is the old stumbling block of homeopathy and allopathy. Devotees of these systems beguile themselves with the idea that specificity of dosage is the needful thing. If we observe closely, we are very cognizant of the fact that we can not exactly estimate the quantity of nerve force resident in the patient we are treating. This being so, there is no possibility of exact dosage, hence stimulation and inhibition, as therapeutic measures, other than simply palliative procedures, are of little avail. We are continually impressed with one of the fundamental ideas in osteopathic practice, that the only measurable guiding quantity in giving an osteopathic treatment is the palpable tissue change, the lesion. Any case not presenting a palpable lesion, can only be treated on general principles underlying natural therapeutics, i. e., the tonic effect of change, re-adjustment. These changes range all the way from slight variations in diet, habits, surroundings and thoughts, up to genuine shock. Inhibition as a form of movement has a place in our practice, but it is well for us to have a realizing sense of its limitations.

Impairment of Function.—Inhibition, as a function of the central nervous system, must necessarily impress us with a host of new ideas in connection with the manifestation of lack of restraint of functional activity in various tissues. Enuresis in the babe is normal, but we look with suspicion on its presence in the four year old; there is retardation of development. Chorea is an evidence of impairment of this function, after it has apparently been normally developed. Paralysis agitans is an evidence of impairment of this function late in life.

Physiological Activity Is the Result of Stimulation.—All the functions of our body are initiated by stimuli. It must not be inferred from this statement that the author is satisfied that life consists of nothing but reflexes. So far as we can note the phenomena of muscle and gland, we are compelled to recognize the fact that most of them are reflexes. Work done by muscle and gland is initiated principally by sensory stimuli. Excessive sensory stimuli excite increased work in muscle and gland, sometimes to the point of exhaustion. To decrease the amount of work, we must decrease the number of stimuli. The stimuli originate at the periphery of sensory nerves. Sensory nerves are most numerous in the skin, mucous membrane and muscle. Inhibitory influences must be applied to one or more of these structures. Skin is the surface tissue, richly supplied by sensory nerves, and under it are muscles, also well supplied by sensory nerves.

Hilton's Law.—Hilton, by showing that the skin, muscles and synovial membrane of a joint, or the skin, muscles of the abdomen and contents covered by peritoneum, are innervated from the same segment of the cord, laid a foundation for the rational use of inhibition, in osteopathic practice.

Inhibition—Therapeutic.—Inhibition, as a terapeutic procedure, consists in a steady digital pressure made over some nerve trunk, or over an area which is closely connected with a spinal segment from which nerves pass to an internal viscus, which we desire to affect.

In order to explain the necessity for this movement and its beneficial effects, we must note the phenomena of vaso-motion.

How Vaso-motor Centers Act.—Vaso-motor centers act according to the sum of the stimuli reaching them from skin, muscle, glands, etc. If the sensory nerves of one lateral half of the body are stimulated, as by pricking with needles, the temperature of that half of the body will be higher than the other, thus demonstrating that excessive stimulation of sensory nerves ends in vaso-dilation, i. e., loss of tone of the muscular coat of the blood vessels. Since excessive, i. e., over-stimulation of sensory nerves in this experiment causes inhibition of vascular tone and hyperaemia results, we argue that any procedure, which lessens the excessive amount of stimulation passing to a vaso-motor center, will favor the return of the vascular tone. Therefore, since it is easily demonstrated that digital pressure lessens pain and sensitiveness in the area pressed upon, we know that the registering power of these peripheral nerves is decreased, and there results a better vascular tone in that area.

Over-stimulation Equals Inhibition.—If over-stimulation results in inhibition of vascular tone, as the above experiment seems to demonstrate, then it appears rational to decrease the stimulation to a point where vascular tone is not disturbed. Digital pressure does decrease the irritability; therefore we may express ourselves as follows: Inhibition of sensory nerves, in skin and muscle, which are over-stimulated, will favor the return of vascular tone in all areas which are supplied with nerves from the same segment of the cord.

Over-stimulation of sensory nerves causes vascular dilatation. Inhibition lessens the irritability of sensory nerves and hence decreases the number of stimuli reaching the vaso-motor centers, thus allowing a return of vascular tone.

The Guide for the Use of Inhibition.—Knowing the complete distribution of any nerve trunk, we may judge the condition of the internal structures, supplied by one of its branches, by the physiological activity of surface tissues, supplied by others of its branches. In this way we are guided as to our use of inhibition.

Pathological Changes Which Accompany Over-stimulation.—If an individual eats a hearty meal, and before it is digested eats another, and continues the process, the stimulation of the sensory nerves in the mucosa of his digestive viscera results in a physiological hyperaemia which, under the ceaseless stimulation of the presence of food, finally becomes chronic. The liver becomes hyperaemic, and its sensory nerves are stimulated by the increased amount of blood present in the capillaries. These sensory nerves do not register their impressions on the sensorium of the brain, but do excite that area of the spinal cord with which they are connected by means of the rami-communicantes.

This area of the spinal cord lies between the sixth and tenth dorsal spines. From this area, nerves pass to the deep muscles of the back. These muscles are excited to undue contraction, and their sensory nerves are thereby made sensitive. The capillary circulation in these muscles is poor, thereby increasing the muscular sensitiveness. This muscular sensitiveness, or rather increased stimulation of the sensory endings in the muscles, sends a new set of impulses to the same area of the spinal cord, sixth to the tenth dorsal, and the cord reflexes them back to the sympathetic system. Thus a figure 8 is formed with the union of the circles representing the spinal cord. With impulses entering the cord from both loops, sympathetic and cerebro-spinal, the cord itself becomes hyperaemic. The constant interchange of reflexes which were originated by excessive demands on the physiological activity of the tissues involved, either ends in a spasmodic effort of nature to rid itself of the intolerable condition, by means of a "bilious spell," or the hyperaemia causes excessive secretion of mucous, hypertrophy of connective tissue, and atrophy of parenchymatous tissue. The bilious spell is nature's safety valve.

Rational Treatment.—After such a condition as we have described is well established, dieting merely lessens the reflexes in the sympathetic portion of our figure 8. The reflexes in the cerebro-spinal portion are still active, because the deep muscles of the back have become chronically contracted, and continue to over-stimulate the sensory nerves. These cerebro-spinal reflexes still help to maintain the hyperaemia of the spinal cord, which continues to disturb the rhythm of the sympathetic. Manifestly, the treatment must consider both portions of the figure 8. Dietetics will lessen to some extent the hyperactivity of the sympathetic loop. Digital pressure, inhibition, will relax the spinal muscles, and lessen the hyperactivity of the cerebro-spinal loop. The two lines of treatment will decrease the number of stimuli entering the segment of the spinal cord, sixth to tenth dorsal, hence there will cease to go out from that segment a series of impulses which have tended to pervert the secretion in the digestive viscera.

The contraction of the spinal muscles may have subluxated a vertebra which then becomes a source of irritation. In such a case, a movement to replace the vertebra in its true relation acts in the nature of inhibition, i. e., it ceases to cause excessive stimuli to enter the spinal cord.

Digital pressure on contracted dorsal muscles causes sensitiveness, i. e., consciousness of the fact that the nerves in that region are abnormally irritable. The sensitive area along the spine will be in direct central connection with an internal viscus which is equally if not more sensitive.

Hyperaesthesia of Sensory Areas—Diagnosis.—The hyperaesthesia of sensory areas along the spine is of practical value for diagnostic and therapeutic purposes when we know their nerve connections. By inhibiting a hypersensitive spinal area, we set up a change in an area of low sensibility, i. e., a visceral area. The inhibitory pressure does not merely deceive consciousness by lessening the power of its informing nerves, which alone have power to stir up those reflexes which will tend to assist the diseased part to return to normal.

Results of Inhibition.—We know that inhibition lessens pain in the area of conscious sensation. The result of daily practice teaches us this.

Inhibition of painful areas does more than lessen pain; it aborts those impulses which are the result of pain, and sends a counter impulse into the center which, in a measure, negatives the original impulse. If this were not so, we could not stop vomiting, intestinal peristalsis or uterine colic. We know that inhibition of a sensory area of the spine not only stops pain in that area, but also pain, if there is any, in the viscus which is in central connection with it. Therefore, if we affect the tonus of both skeletal and involuntary muscles, sensation in the cerebro-spinal and sympathetic systems, we certainly affect the caliber of blood vessels and the activity of secretory and excretory glands.

It is not too much to say that inhibition does not deceive consciousness by lessening the power of registering nerves, but does stop a storm of reflexes which have no reparative tendency, and that it does affect the area of low sensibility, as is evidenced by a change in the condition of its musculature, blood supply and secretory activity.

There are many osteopaths who contend that the keynote of all manipulative work, according to osteopathic principles, is the discovery and removal of a "lesion," osseous in character. With this idea carried to extreme, the author has no sympathy. In connection with this idea the student is referred to the chapter on Subluxation, page 283.

The Phrase "Remove Lesions."—The phrase "Remove Lesions" is a good one, and yet it is inexact in many cases. It is an elastic phrase, and capable of many and varied interpretations. Each year of active practice adds to the osteopathic idea of what lesions are. Our literature contains many references to lesions which are not mentioned in Dr. Still's writings, and yet Dr. Still's basic work has made the later conception possible. Osseous lesions have always been paramount in our work and thought, but muscular lesions now hold an equal place, and bid fair to lead, when we see more clearly into the subject.

The Human Body Is a Vital Mechanism.—We say that "when the anatomical is absolutely correct, the physiological potentiates." This conception is based on the statement that the human body is a machine. The human body is vastly more than a machine. It is a vital mechanism, and the fact that it is vital, renders it susceptible to other influences besides mechanical, such as falls, twists, strains, etc. We may truthfully say that when the physiological is over-active, the anatomical alignment is disarranged. The principles of osteopathy, as they were first promulgated, declared that a structural defect is at the bottom of every physiological defect. Structure always affects function. A sufficient number of cases were found to give a foundation of fact to this statement. Hasty reasoning tried to make this an all-embracing principle, applicable to every case of disease. Other schools of medicine have made similar mistakes. The allopathic school promulgated the "law of contraries." The homeopathic school holds aloft the "law of similars." Neither of these are laws. A law is absolute, no exceptions are tolerated. If there are any exceptions to a so-called law, it ceases to be a law.

Osteopathic Meaning of Inhibition.—By the term inhibition, we do not attempt to convey any other meaning than that of pressure, applied at some particular point on the surface of the body, for the purpose of lessening the hyperactivity, or hyperaesthesia, of the immediate, or some distant part of the body. The inhibition itself does in some cases remove what we may choose to call a lesion, in other cases it may make the removal of a lesion possible, but in the majority of cases, its effect is purely on the nerves, thereby acting on both the motor and sensory portions of the reflex arc, lessening muscular contraction and pain.

The Scientific Use of Inhibition.—It has been proven many times that the osteopath is capable of checking excessive functional activity in viscera by the simple means of inhibition. Some would quibble as to the cause of this activity. The original stimulus may have disappeared, but the reflexes which it initiated may be perpetuating the condition. Many cases have been treated in which no definite cause or osseous lesion could be discovered. Some of these cases came under the heading Indiscretions; others under purely mental conditions. These cases were treated by inhibition, based on a knowledge of the anatomy and physiology of the parts involved. The treatment was successful. We are sure that such successes are just as gratifying, just as scientific, as are those in which the finding and reducing of a subluxation brings the glow of triumph to the eye of patient and physician alike.

Inhibition as a Local Anaesthetic.—Inhibition is a local anaesthetic, and as such, is being used universally in the osteopathic profession today. True, it is not a treatment which will secure results in a minute. We can not inhibit for five minutes at the eighth dorsal spine, in a case of malarial fever, and expect to check the chill. The chill can sometimes be controlled as long as the inhibition is maintained. The influence thus gained over the muscular contractions seems to increase the patient's resistance. The onset of the next chill usually shows a decrease in the intensity of muscular contraction, and the duration is shortened. No one would say that we remove a physical lesion by this treatment, or the cause of the chill. Muscular contraction of the deep dorsal muscles comes on with the chill, but does not cause it. Surely inhibition in this case works a nervous change of a pronounced character.

An example of the good results of inhibition is afforded by one of the author's cases. Woman, fifty years of age, suffered from diarrhoea, two years' duration. Five to seven bowel movements daily. No formed feces. Usually the stools were typhoid in character. Uterine fibroid removed prior to development of diarrhoea. History of continuous drug treatment. Osteopathic examination did not reveal any osseous lesion. There seemed to be nothing to lay the blame upon, except the once existent fibroid, or the result of the operation. Since no definite lesion existed, the treatment was planned as a test of inhibition without any other method. At the end of three months the patient had but one movement daily, and the feces were well formed. Pressure, and gentle stretching of the muscles extending over the area between the eighth dorsal and fifth lumbar spines, constituted the methods used. From fifteen to twenty minutes was the duration of the treatment, three times per week for two months, and twice per week thereafter.

In cholelithiasis the intense pain can be modified by inhibition at ninth and tenth dorsal spines, right side. Inhibition at this point also lessens the contraction of the abdominal muscles, and thus makes direct manipulative treatment possible. The same is true in cases of appendicitis. We could not give direct manipulative treatment in such cases, if it were not for the power of inhibition to lessen pain in the affected area, and the consequent muscular contraction. How much more influence is exerted over the nerves of the appendix and surrounding region, it is hard to say. It may be that the inhibition arouses other forces of a stimulatory character to be brought into action to empty the appendix. Direct manipulation in these cases is frequently out of the question.

Inhibition to Remove Lesions.—Inhibition is a large and necessary part of many treatments given for the purpose of removing a definite lesion, for if inhibition were not first used, the true lesion could not be touched. This is the case in intestinal obstructions. The intestinal irritation causes such bowel contractions, cramps, and contraction of the abdominal muscles, that the physician's fingers cannot palpate the disturbed area. Inhibition over the spinal area from which the nerves to the disturbed area pass out, will cause relaxation of the muscles.

In a case of pleurisy which came under the author's care, an opportunity was afforded to test inhibition unhampered by any other method. The patient could not bear to have the right arm moved; respiration was exceedingly shallow, and the physical strength was very low. Hot fomentations had been used, but to lift the arm caused excruciating pain in the side. It was a case of dry pleurisy. Steady inhibition was given for fifteen minutes, between the transverse processes on the right side, in the area between the third and the seventh dorsal vertebrae. After this length of time the patient could raise the right arm above the head and take much better inspiration. As a result of this treatment given twice per day, the patient made a good recovery, though all the metabolic processes were carried on in a very unsatisfactory way.

Inhibition as a Preparatory Treatment.—There is still another time when inhibition is of incalculable value: In making examination of the vagina or rectum, especially the former. Several times, in the author's practice, examination of the vagina seemed impossible, without great distress to the patient. The irritability of the mucous membrane of the vagina caused intense spasmodic contraction of the sphincter, but steady inhibition over the third and fourth sacral foramina for about five minutes, caused complete relaxation, and the examination could then be made without any trouble. Cases have been reported to the author by many osteopaths, describing the good results of inhibition in gynecological cases. These cases have ranged from simple nervous vaginismus to curettement. Since the sacral nerves are so near the surface, and are not interrupted in their course to the pelvic viscera, they afford excellent opportunity for the good effects of inhibition to be demonstrated.

CHAPTER XVIII.

SOUNDS PRODUCED IN JOINTS BY MANIPULATION.

Normal Sounds.—It is not uncommon to hear peculiar sounds accompanying the normal movement of joints. These sounds are indicated by popular terms, such as "cracking," "snapping" and "popping." They are so common that every one has heard them, either in their own bodies, or those of friends. Pulling the fingers is the best known method. It is commonly supposed that such a method, if persisted in, will enlarge the joints. It is doubtful whether there is any proof of this. Doubtless the fear of it originated as an effort to frighten some one in whom the phenomenon was easily produced. Loose jointed people are able to produce sounds in many joints by carrying normal movements to the limit. Scarcely any movable joint, in which the ligaments and muscles are normally relaxed, is free from the possibility of producing sound, when the opposing muscles are contracted unevenly, i. e., either the flexors or extensors predominating. The joint surfaces will slip upon each other suddenly, thus producing the sound. After it has been once made, it is rarely repeated without there has been an interval of rest, during which the muscles change their tension. The cracking in the tempero-maxillary articulation can be repeated until the structures ache, because it is occasioned by the sliding of the interarticular cartilage on to the eminentia articularis. The wrist and shoulder are capable of producing frequent sounds, on account of their free movement, and the many directions in which the force is applied.

Abnormal Sounds.—A large number of sounds which originate in joints are abnormal; i. e., the joints are not normal, or else these particular sounds would not be produced. Some of these sounds are familiar to all physicians. They result from forced motion, actively or passively made, in a joint having limited movement as a result of injury; or intracapsular deposits, due to disease. Another class of sounds is produced by forced movement, passive, in joints having lost some of the normal relations of their surfaces.

Pathology of Joints Producing Abnormal Sounds.—It may be well to recount systematically the conditions in which passive movement of joints produces sounds. In this way we can note the difference between the characters of sounds usually recognized by physicians, and those especially peculiar to manipulative treatment of subluxations.

Synovial Adhesions.—The breaking of adhesions between articular surfaces produces a sound comparable to that occasioned by the breaking of a green stick, in which the fibers break individually as the force becomes greater and greater. Synovial adhesions are due to many causes, the simplest of which are slight injury and non-use of a joint. An injury sufficient to cause slight efforts at repair, when accompanied by rest, will result in a few adhesions. Voluntary movement of the joint is arrested by these adhesions. Such conditions frequently follow a sprain, or the splinting of a joint just above or below a fracture. The joint may be quite well, but by keeping it perfectly fixed during the repair of the fracture, the periarticular structures lose their elasticity, and a few adhesions may form within.

Non-use of a Slightly Sprained Joint.—Sometimes a timid person may be so fearful of moving a slightly sprained joint that adhesions form, and control of the joint is lost. I was recently called to examine a foot, which was very painful and useless. Seven months previously the ankle was sprained. The foot had not been used since that injury. I found the foot stiff, cold and resting on a pillow. Examination revealed slight motion which seemed to be limited by elastic bands. There was no inflammation in the foot. Sudden force, applied first in direction of flexion, then extension, caused a series of cracking sounds, which indicated the rupturing of adhesions. The range of motion instantly increased. If these adhesions had been broken six months before, much of the muscular atrophy of the leg and thigh would have been avoided.

A patient with broken femur, having been kept in bed twelve weeks, was unable to move the knee, on account of adhesions formed during period of non-action due to splinting. Forcible flexion of the knee a little each day gradually broke the adhesions, until movement was nearly normal.

These are the cases with which all physicians are familiar. The sounds produced are not repeated at any time following the first forcible movements. Such adhesions as these, are due to rest, not without some slight injury, involving the joint structures. I do not believe that non-use alone is capable of causing adhesions.

Rheumatic Joints.—Rheumatic joints sometimes manifest conditions similar to sprain. Adhesions form during the period of inflammation and persist after its subsidence. Rupturing these by sudden force frequently restores normal movement.

All the foregoing conditions are the result of some degree of inflammation. Forced movement breaks the adhesion, which makes a sound as it breaks. There is no repetition of the sound in succeeding movements.

Semilunar Cartilages of the Knee.—The semilunar cartilages of the knee joint may become displaced and cause great pain, with loss of motion. A case recently under treatment gave history of frequent accidents of this kind, while riding a bicycle. When extending the leg to push the pedal down, the force was exerted with the knee somewhat everted. Excruciating pain came on suddenly, and the leg could not be extended. Examination revealed a very sensitive spot at the outer and anterior surface of the joint. The semilunar cartilage slipped forward and blocked the extension of the joint. By taking the leg between my knees and making thumb pressure on the painful prominent spot, then gently flexing and slightly rotating the tibia on the condyles of the femur, followed by quick extension, a distinct sound was elicited, and the action of the joint was restored. The sound indicated replacement of the cartilage.

"Bone Setting."—It has been supposed that much of the work of osteopaths consisted in breaking adhesions, which were simple enough, but happened not to have been strictly attended to by the surgeons. There is much chance to misinterpret the work of the osteopaths in reducing subluxations. Medical men of established schools of medicine have failed to closely analyze the structural condition of joints before and after manipulation, hence they have jumped to the conclusion that all of our work was of that kind called "bone setting" for want of a better descriptive term. This appellation, "bone setting," is a popular one, first used in England to describe the work of individuals, usually uneducated, who treated patients by manipulation of joints, which they said were out. Quick forceful movements in the direction of normal joint actions usually resulted in a "popping" sound. When this occurred the "bone setter" considered his work accomplished.

Historical Reference.—Aside from adhesions the conditions which we find limiting the movements of joints are subluxations. Wharton P. Hood, M.D., M.R.C.S., furnished the Lancet a description of what was commonly called "bone setting." His articles were published in that journal March and April, 1871. The articles were published in book form the same year, entitled "On Bone Setting (So Called) and Its Relation to the Treatment of Joints Crippled by Injury, Rheumatism, Inflammation, Etc." Dr. Hood made close observations of the work of a "bone setter"—Mr. Hutton. This gentleman sought to teach Dr. Hood his art, as a matter of gratitude for professional attention given him by Dr. Peter Hood. In the pages of this book I find a clear, concise exposition of the bone setter's art, together with a record of the observations of the author, who has the advantage of excellent training in the medical arts. There is no doubt in my mind as to the similarity existing between the conditions which were recognized by so-called "bone setters" and those who have formed the basis for the successful advancement of osteopathy. The difference lies principally in the educational qualifications. Dr. Hood notes that the manipulations were made without any knowledge of anatomy and physiology, but were nevertheless astonishingly successful, and he calls attention to the fact that much greater success, with less probability of injury, ought to result from these manipulations, when the true pathology of the joint is understood; i. e., when the operator is in fact a trained surgeon, thoroughly versed in the details of anatomy. Dr. Hood evidently did not understand the conditions which we recognize as subluxations of the ribs and vertebrae, although he came very near to it, as you will observe hereafter. His attention was principally fixed on the conditions following greater or lesser degrees of joint inflammation, resulting in intra-articular adhesions or extra-articular contractions. In the case of adhesions, breaking them causes a sound which can not be repeated, but subluxations may occur repeatedly in the same joint, each reduction causing a sound.

Tarsal and Carpal Subluxations.—In Dr. Hood's chapter on pathology, I find the following: "Subluxations of tarsal and carpal bones must occur, I think, in a considerable number of instances. I mean by subluxations, some disturbance of the proper relations of a bone without absolute displacement, and I believe that such disturbance may be produced either by the traction of a band of adhesion about the joints, or by a twist or other direct violence." Grant the possibility of subluxation in the arthrodial joints of the carpus and tarsus, it is not improbable to conceive of them in any other joint. As a pure example of "bone setting," one of my recent cases is apropos. A lady stepped on some small hard object, the point of contact being just under the instep. Sharp pain, localized on top of the instep, began at once, and was not relieved by heat or other antiphlogistic measures. Forty-eight hours after the onset of pain, I was called to examine the foot. Found some swelling over the instep, but palpation localized the pain in the articulation between the scaphoid and internal cuneiform. Any attempt at local movement of this joint caused sharp pain. The patient could not stand on the foot, on account of the pain, which was increased thereby. Extension of the foot, with firm pressure on the upper side of the articulation, caused a very loud sound, the prominence of the scaphoid was not so apparent, and the patient could put her weight on the foot immediately. This was a case of tarsal subluxation. If the same degree of displacement had existed in a vertebral articulation, the effect on circulation in the nerve centers of the cord might have caused very widespread symptoms.

The subluxations treated by "bone setters" have usually been those which occasioned pain in the joint. The osteopath does not depend upon pain as a symptom of subluxation, but makes palpation the true guide.

Enarthrodial and Arthrodial Joints.—When the head of the femur is forced out of the ascetabulum, there is more or less tearing of ligaments, with consequent inflammation. Replacement of the head is not accomplished without a distinct sound. The sound is considered as audible evidence of successful operation. The same is true of the shoulder joint. The great range of movement in these joints necessarily requires lax ligaments, therefore great separation of the joint surfaces is possible. The arthrodial joints, in all parts of the body, are constructed on a different principle. The range of movement is not great in them, and their ligaments are comparatively short. The form of the body surfaces of the arthrodial joints does not limit motion, as in the case of enarthrodial joints.

Replacement of the head of the femur or humerus requires it to move over a ridge of bone or cartilage, and when it sinks suddenly into its proper place, a sound is heard. Probably the sound which accompanies the reduction of a subluxation arthrodial joint, can be explained by the sudden readjustment of joint surfaces, even though there is no ridge of bone or cartilage to glide over. It is hardly probable that a subluxated joint has its surfaces smoothly, though in a limited area, opposed to each other. Forcing a greater area of contact corrects the unevenly opposed surfaces.

Slow vs. Quick Reduction of a Subluxation.—A subluxation may be reduced slowly, and in such an instance no sound is heard. Quick, sharp force is required to overcome the periarticular tension which will result in sudden replacement with sound.

Bone Setters' phrases.—The use of the statement by some osteopaths that a "joint is out" or a "bone is out" is merely the direct appropriation of the "bone setter's" pet phrase. The use of the phrase "There, it's in," or some similar one, when the sound of the reduction is heard, is also an appropriation from the same source. These phrases are unscientific, and should not be used by any one who pretends to understand the true pathology of the condition he is treating. In the case of sound due to the breaking of adhesions, we could not truly say a "bone is out," nor in the case of subluxation is it right to describe it thus. If it is adhesion, call it so, and if a subluxation, describe it carefully. In this way definite knowledge of joint conditions will be gathered.

Differences of Opinion.—There is some difference of opinion between osteopaths as to whether a subluxation must give forth a sound when properly reduced. Discussions of the subject thus far have not settled it. It seems that the statement made previously in this chapter, that slow reduction of a subluxation by relaxing movements will not cause a sound, but forceful and sudden relaxation will do so, about covers the facts. We know that subluxations are reduced by both methods, with satisfactory results.

Elsewhere we have called attention to the treatment of subluxations. For comparative purposes, and that the student may know what was understood concerning the manipulative treatment of the spinal column previous to the advent of osteopathy, we quote a portion of Dr. Hood's chapter on "Affections of the Spine."

"Affections of the Spine," Dr. Hood.—"I fear it must be admitted that the great importance of the spinal cord, and the gravity of its diseases, have rather tended to make professional men overlook the osseous and ligamentous case by which it is enclosed, and which is liable to all the maladies that befall bones and ligaments elsewhere. The quack, on the other hand, who probably never heard of the spinal cord, recognizes the presence of structures with which he is familiar, and deals with them as he does in other situations. The result is much the same as in the hip joint. The quack every now and then cures conditions which the authorized practitioner had regarded with a sort of reverence because they were "spinal"; and he every now and then kills a patient because this reverence did not exist for his protection. If the profession generally would so study the diseases of the spinal cord as to rescue them from specialists, the first step would be taken towards rescuing the disease of the vertebral column from quacks.

"Crick in the Back."—"However, the matter may be explained, it is quite certain that many people now resort to bone setters, complaining of a "crick" or pain or weakness in the back, usually consequent upon some injury or undue exertion, and that these applicants are cured by movements of flexion and extension, coupled with pressure upon any painful spot.

Manipulation of the Neck.—"In a few cases, Mr. Hutton was consulted on account of stiffness about the neck or cervical vertebrae, and he then was accustomed to straighten them. * * * His left forearm would be placed under the lowered chin of the patient, with the hand coming round to the base of the occipital bone. The right thumb would then be placed on any painful spot on the cervical spine, and the chin suddenly elevated as much as seemed to be required. As far as my observation extends, the instances of this kind were not bona fide examples of adhe-

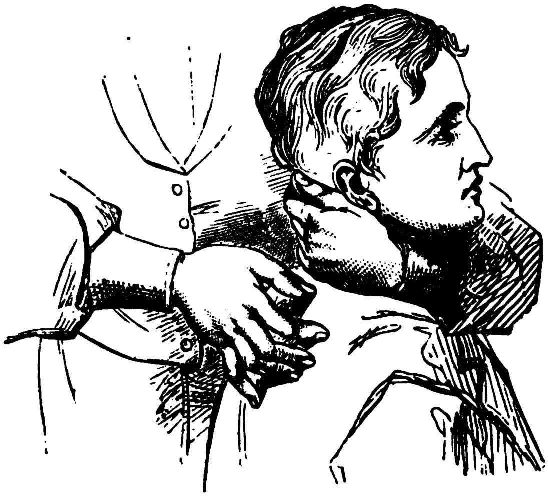


FIG. 151. Illustration from "On Bone Setting" by Wharton P. Hood, 1871.

sions, but generally such as might be attributed to slight muscular rigidity, or even to some form of imaginary malady. The benefit gained was probably rather due to the pain of the operation and the effect produced by it upon the mind of the patient than to any actual change in the physical condition concerned.

Manipulation of the Back.—"For the lower regions of the spine he had two methods of treatment differing in detail but not in principle. In the first, when the painful spot was found the patient was made to get out of bed and to stand facing its side, with the front of the legs or perhaps the knees—according to the height of the patient and the bedstead—pressed against it. She was then told to bend forward until the bed was touched by the elbows. His left arm was then placed across the chest, and the thumb of the right hand upon the painful spot. Firm pressure was then made with the thumb, and as soon as he felt that he had settled himself into such a position that he could obtain the full power of the left arm, the patient was told to assume the erect posture with as much rapidity and vigor as she could command. This movement was facilitated and expedited by the throwing up of his left arm and the opposing force of the right thumb. As a rule there seemed to be two painful spots, answering to the upper and lower border of the affected vertebrae, so that the manoeuvre would require to be repeated.

"In the second method the patient was seated in a chair placed a short distance from the wall, so that the feet could be firmly pressed against it. She was told to bend forward and place her arms between her legs, with the elbows resting against the inner side of the knee; to sit firmly on the chair, and at a given signal to throw herself upright. The operator passed his left arm under the chest, placed his right thumb on the painful spot, and, in order to obtain firm and resisting pressure, rested his elbow against the back of the chair. The signal being given, the operator, keeping his fist clenched so as to support his thumbs and the elbow being held firm in its position, when the patient throws herself upright, resists the approach of her back to the chair and bends her head and shoulders as far backwards as possible, the position of the feet preventing any forward movement.

Treatment of Upper Dorsal.—"These two methods are used for cases in which pain is present in the dorsal vertebrae below the eighth, or in any of the lumbar. The treatment used for the upper dorsal and lower cervical vertebrae was to place the operator's knee against the painful spot and, with the hands placed upon the shoulders, to draw the upper part of the body as far back as possible.

"In cases when pain was complained of in the dorsal and lumbar region and the backward movements did not afford the required relief, the patient was made to bend sideways, and a similar process was gone through as in the other manipulations.

Comment.—"As a commentary on all this, there is manifestly little to say, except that the size of the vertebral column is such as to admit of considerable diminution without injury to the cord, and that the bones and ligaments of the column as already observed are liable to the same results of injury and to the same diseases that befall bones and ligaments elsewhere.

Differential Diagnosis.—"The surgeon who is consulted about a case of spinal malady should first of all make sure that he is not frightened by a bugbear, and should then proceed to determine by scientific methods of examination whether or not he is in the presence of disease of the nervous centers, or of caries, abscess or other destructive change in the vertebral column. On such points as these no man who possesses a thermometer, a microscope and a test tube has any excuse for remaining long in doubt; and if he is able to exclude the possibility of such conditions, he may then regard the spine simply as a portion of the skeleton and may deal with it accordingly. Here, as elsewhere, injury and rest, or rest and counter irritation, may produce adhesions that painfully limit movement and that may at once be broken by resolute flexion and extension. Here, as elsewhere, partial displacement may occur and may be rectified by pressure and motion. In the lower cervical, the dorsal and the lumbar portions of the spine the change of position of any single vertebra can only be slight—enough to produce pain and stiffness, but not enough to produce visible deformity. In the highest region, however, partial dislocations are sometimes more manifest. The following case is quoted from the hospital report of the Medical Times and Gazette of August 5th, 1865: 'John S——, aged 21, laborer, of St. Mary's Cray, was admitted on May 26th, 1865, under Mr. Hilton. States that he has been ailing for the last three months; loss of appetite and general debility; has, however, followed employment. On Sunday, May 14, he was stooping down to black his boots as they were on his feet, when suddenly he "felt a snap" in the upper and back part of his neck; he felt as if someone had struck him there. About a quarter of an hour after he became insensible and continued so about half an hour; then he felt a stiffness and numbness at the sides and back of his head and the back of his neck, with a fullness in the throat and difficulty of swallowing. At first he had no loss of power over his limbs, only slight pain down his right arm; some days after admission, however, he had partial loss of power in the right arm, which shortly recovered itself. On admission he carries his head fixed, and has pain on slightest attempt to rotate, flex or extend the head; his jaw is partially fixed, and he cannot open his mouth wide enough to admit of a finger being passed to the back of the pharynx; his voice is thick and guttural; deglutition not attended by any great uneasiness. Complains of all symptoms before enumerated. Externally, over the spine of the second cervical vertebra, there is a tumor hard and resisting, but tender on pressure; this is evidently formed by the undue prominence of the spine of the axis itself; the tenderness is not general, but circumscribed; the parts all around are numb. He was put on his back on a hard bed, his head was slightly elevated and a small sand bag was placed beneath the projecting spine, and the whole head maintained in a fixed position by larger sand bags. He was ordered pulv. Dov. gr. V; hydr. c. creta; gr. iij., bis die. This was continued for about ten days, when his gums became affected slightly, and it was then omitted. Marked improvement has taken place in his general appearance and more particularly in his special symptoms. He continued until July 3, gradually and steadily improving. He then had acute rheumatic inflammation of the right knee and elbow joint, followed in a day or two by a similar state in the left knee joint. There was no evidence of a pyaemic state. The joints were blistered; he has been treated with pot. nitr. and lemon juice and is now fast recovering. The tenderness and all the symptoms have disappeared, the projection still remaining, and he expresses himself much relieved by the continued rest in bed.'

Size of the Vertebral Canal.—"Mr. Hilton, in remarking on this case, observed that it had been demonstrated that the area of the vertebral canal might be diminished by one-third, provided that the diminution was slowly effected, without giving rise to any alarming or indeed marked symptoms of compression of the cord.

Conservative vs. Radical Treatment.—"Now, there can be no doubt that most surgeons would agree that Mr. Hilton exercised a sound discretion in simply placing this man in conditions favorable to recovery, or in keeping him at rest until the axis was fixed in its new position and the spinal cord accustomed to the change in its relations. There can be little doubt that Mr. Hutton would have made thumb pressure on the prominent spine while he sharply raised the head. The probability is that he would by this manoeuvre have cured his patient; the possibility is that he might have killed him. This sort of 'make a spoon or spoil a horn' practice we may contentedly leave to quacks, and without risking reputation in doubtful cases. I think we may find a considerable number which are not doubtful, in which skilled observation may exclude all elements of danger, and in which the rectification of displacement or the rupture of adhesions will be certainly followed by the most favorable results. For the discovery of these cases no settled rules can be laid down, since they can only be known by negations—by the absence of the symptoms that would give warning of danger. The diagnosis must be made in each instance for itself, and in each must depend upon the sagacity and skill of the practitioner."

CHAPTER XIX.

POSITIONS FOR EXAMINATION.

Observation.—The method of examination should be somewhat affected by one's getting a sense of the individuality of the patient. There are many things which one should be trained to observe quickly, such as the pose and movement of the patient, nutrition, character of the skin, etc. All of these things give a sense of direction to the examination, i. e., odd poses, compensatory movements, or cachexias lead one to try to determine the causes of these very apparent abnormalities. Minor phases of these things may escape our cursory glance, but it is unwise to commence any examination without first determining the probable region or regions especially requiring examination. This does not mean being particularly guided by the patient's own statement, but rather seeking to exercise one's powers of observation and deduction.

We wish it distinctly understood that we are striving here to explain a special form of examination which is only a part of general diagnostic work. An examination which comprehends merely the use of palpation would give a limited understanding of a patient's ailment, but since this book is concerned with elucidating groups of phenomena which can quite clearly be recognized by palpation, we will not use time or space to describe other coordinate methods which are ably taught in other texts.

In order to be systematic in the examination of patients, it is well to adopt the use of a certain routine of positions which will best show the details of osseous structure.

Testing Alignment and Flexibility.—The first position, as illustrated in Fig. 152, flexes the spinal column and makes the spinous processes prominent. This position is valuable in examining even very fleshy people. Approximation or separation of the spines can be noted, also

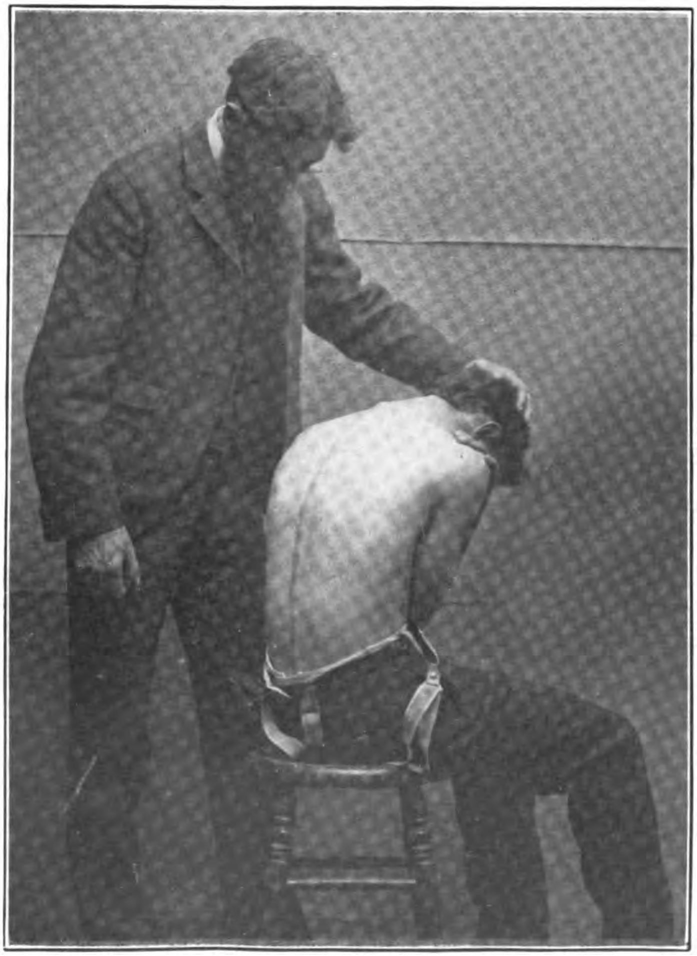


FIG. 152. Flexion of the spine in the vertical position to make the spinous processes prominent.

lateral deviation. If the amount of flesh over the spines, as in fat people, precludes the use of the sense of sight, you can ascertain the relation by the sense of touch.

Sense of Touch.—We wish to emphasize the necessity of the student's acquiring the habit of depending on the sense of touch, rather than of sight. In all osteopathic examinations, the sense of touch should be used to obtain those data concerning structure which form the basis of all diagnosis. Remember that you can not see bone, muscles and glands, but you can feel them.

Inspection.—While the patient is sitting erect, ascertain the flexibility of the spinal column. Note the position of the scapulae, whether near or far from the spinal column, whether unevenly placed. Note the development of the trapezius, latissimus dorsi, and erector spinae, i. e., observe their surface markings. If the patient does not voluntarily relax while in the erect position, ask him to assume his normal posture. This will illustrate the points of greatest spinal stress and show how the spinal column acts in its normal weight carrying capacity.

Palpation of the Ribs.—Fig. 153 illustrates a method of bringing the ribs prominently into view, or in case of fleshy persons, making it easy to palpate them. By pulling the arm up and across the chest, the latissimus dorsi is stretched which brings the four lower ribs into a good position for examination. The movement of the scapula away from the vertebrae makes it easier for the examiner to feel the angles of the fourth and fifth ribs. It is not well to depend on this position for evidence of rib subluxations, because the tension of the latissimus dorsi brings at least the four lower ribs into proper alignment. The spacing of these ribs will then be equal.

The chief value of this position is to give the examiner better opportunity to palpate the angles of the ribs above the ninth and to note the changed relations which

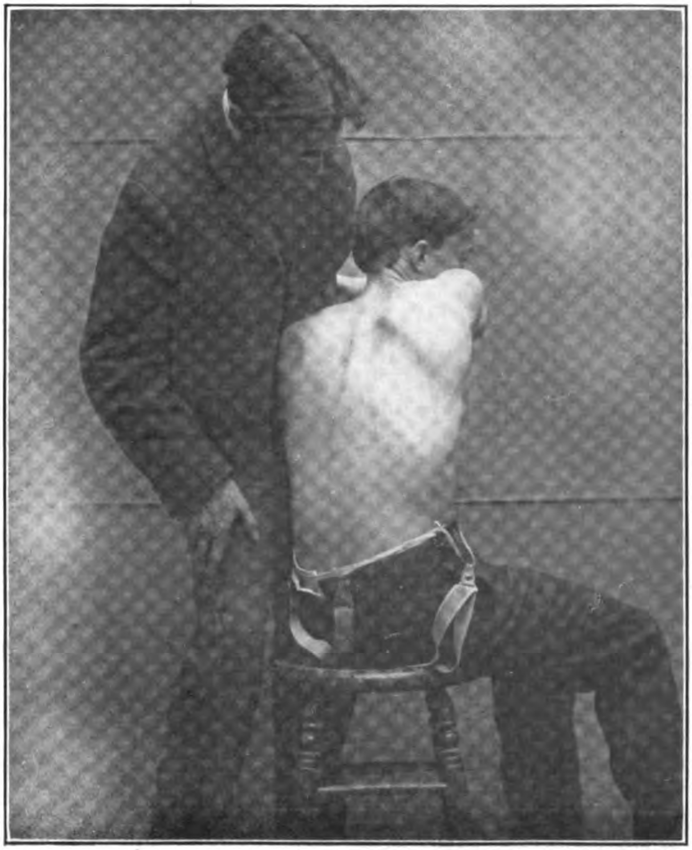


FIG. 153. Position to accentuate the prominence of the ribs.

may take place at the anterior end of the ninth, tenth, eleventh and twelfth ribs.

Palpation of the Spine.—After gathering as much information as possible by observing the form of the back, position of the scapulae and contour of the muscles, examine the spine by means of your sense of touch. To do this, have the patient sit erect, being careful not to exaggerate the normal posture, i. e., bend the spine far forward or backward in the lumbar region. A marked ten-

FIG. 154. Palpation of the spine in the vertical position.

dency to either position is indicative of weak muscles. Use the index and middle finger of either hand to carefully note the relations of the individual vertebrae, as in Fig. 154. Begin at the first dorsal and work downward to the sacrum. Lateral subluxations are easily noted with the patient in this position. Gentle digital pressure may be made at the prominent side of any subluxated vertebra to determine the degree of sensitiveness. This information is best secured when the patient is reclining, because the muscles are relaxed. While the patient is sitting there is usually too much contraction of both intrinsic and extrinsic muscles of the back to allow much examination, outside of mere study of alignment and normal or abnormal curves.

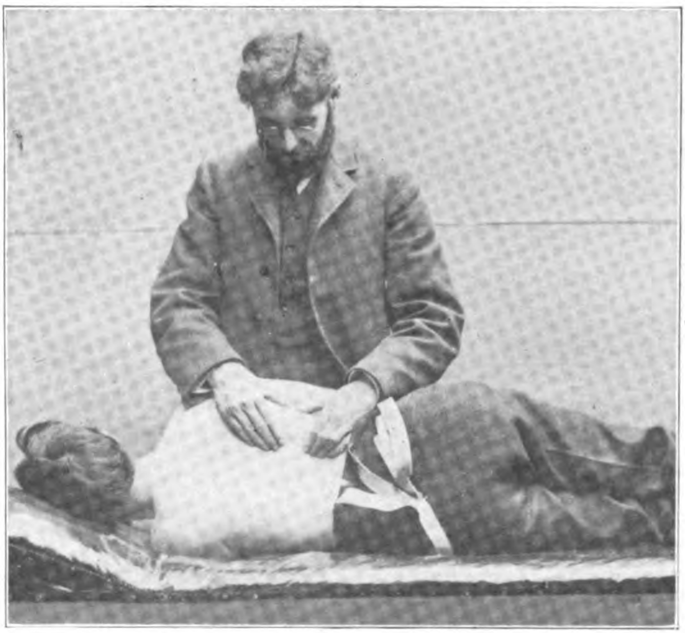


FIG. 155. Palpation of the dorsal muscles, horizontal position.

Now have the patient recline on the right or left side, which is most convenient, as in Fig. 155. Examine the condition of the spinal muscles by using the ball of the fingers of one or both hands. Be careful not to use the ends of the fingers. Commence your examination at the first dorsal by noting the amount of sensitiveness directly on or between the spinous processes all the way to the coccyx. To elicit this sensitiveness use a moderate pressure, equal to about six pounds. With this much pressure the patient

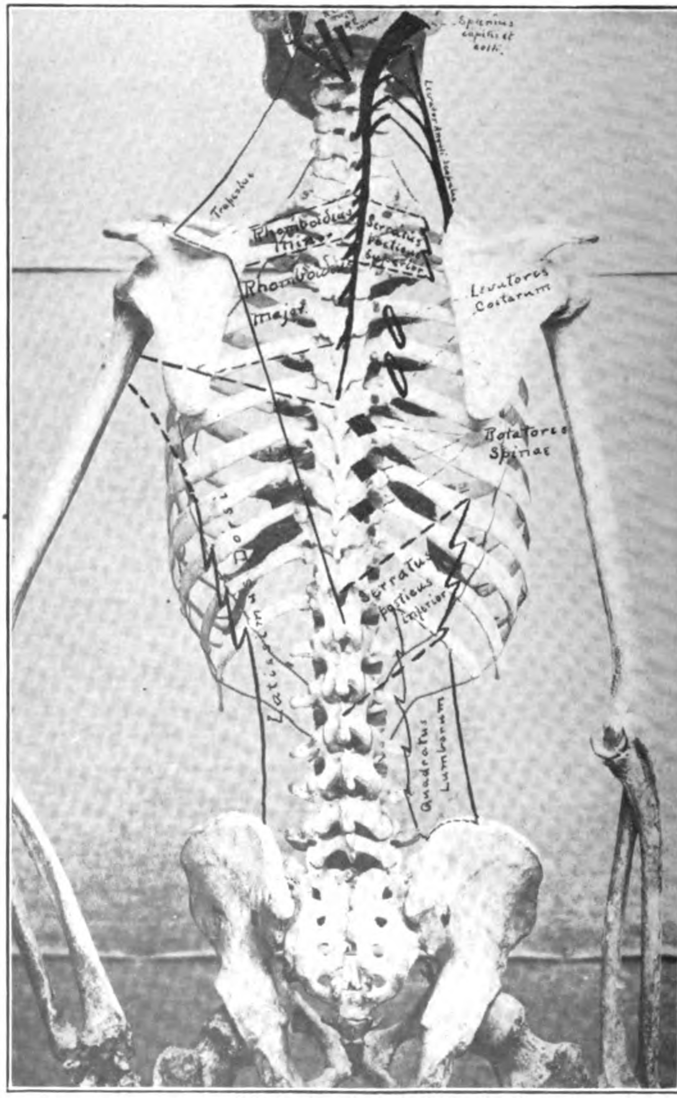


FIG. 156. Diagram of dorsal muscles, first, second, third and fifth layers.

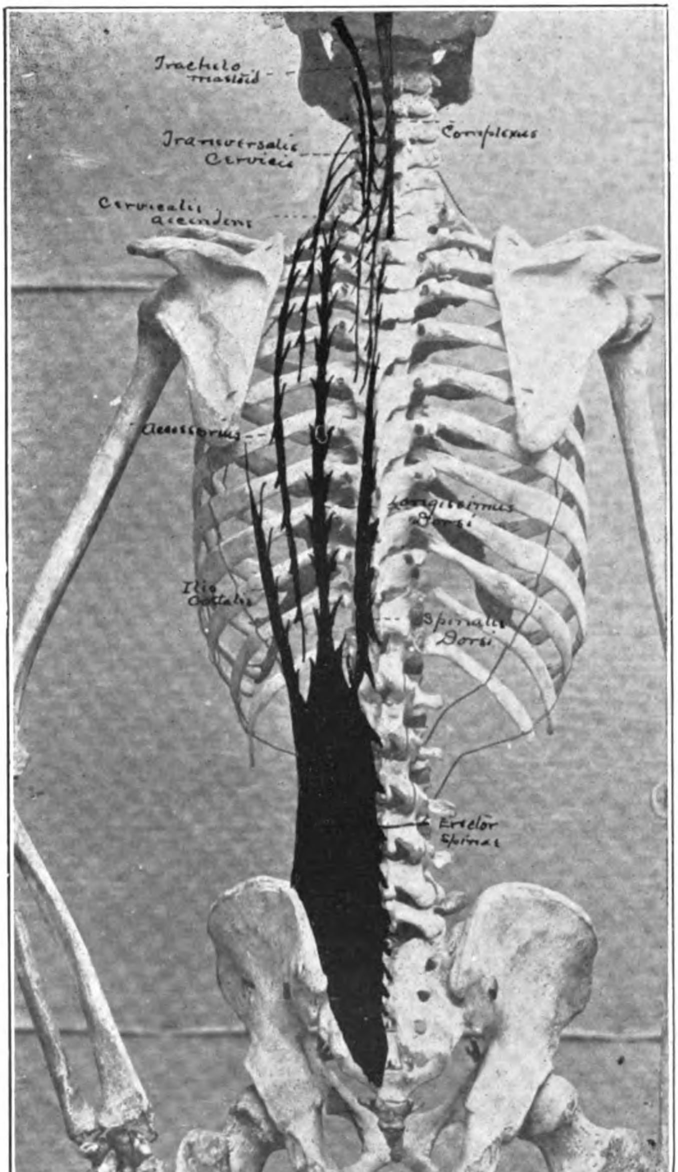


FIG. 157. Diagram of dorsal muscles—fourth layer. Adapted from a diagram in Cunningham's Anatomy.

will be able to distinguish easily between the sense of mere pressure and a painful or hyper-sensitive feeling.

Begin once more at the first dorsal and examine along the sides of the spines and about three inches from them. This space brings the internal and middle groups of intrinsic muscles under your fingers.

Extrinsic and Intrinsic Muscles of the Back.—In speaking of extrinsic and intrinsic muscles of the back, we desire you to bear in mind the different groups as they are noted in Gray's Anatomy. Gray divides them into five layers. The first three layers are extrinsic, i. e., arise from vertebrae and insert into the humerus, scapulae, or ribs. They depend upon the intrinsic muscles of the fourth and fifth layers to fix the spine so that operating from the spinal column as a fixed point, they can move the upper extremities and ribs.

While palpating a back which is moderately well muscled, you will be able to feel through the upper three layers and distinguish the condition of the muscles of the fourth layer. It is important that the student should learn to feel through the soft tissues to harder ones below. Skill in detecting varying degrees of density and hardness is an absolutely essential qualification of the diagnostician.

A careful dissection of the fourth layer will disclose the fact that there are three parallel groups of muscles. The first is the spinalis dorsi which lies on the side of the spines. The second group lies more on the transverse processes. The longissimus dorsi and its continuations make up this group. The sacro-lumbalis and continuations make up the third group which lies on the angles of the ribs. Careful palpation will distinguish these divisions.

The Diagnostic Value of Hyperaesthesia.—Different points, along the line of the first group, which are hypersensitive, may be evidence of direct strain of a single vertebral articulation, or the result of a visceral reflex, or even in sympathy with a rib subluxation which affects sensory nerves reaching the same segment of the cord from which its nerves arise. Hyperaesthesia directly upon the spines is usually found in connection with depression or elevation of the spines, not lateral subluxation.

Hyperaesthesia at points in the second group of muscles, i. e., the longissimus dorsi and continuations over the transverse processes, may result from vertebral or costal subluxation, or muscular contraction caused by visceral reflex.

When this excessive sensitiveness is found at the angles of the ribs, in the short muscular divisions of the sacro-lumbalis and continuations, it nearly always signifies an irritation from a costal subluxation.

The examination of the ribs should be made while the patient is in this reclining position. The fingers should follow the angles of the ribs, noting the spacing, special prominence or depression of an angle, then noting the compensatory changes at the chondro-costal articulations. In this way the relation of the ribs to each other can be determined.

When pain exists at any one of the points named, or the digital pressure arouses a painful reflex, all of the sensory points along the course of the spinal nerve should be tested in order to determine the extent of the nerve irritation. Take for example, the point on the spinal column between the fifth and sixth dorsal. After examining these two spines and finding them well placed, our digital pressure at the sides might cause a painful reflex, i. e., the patient might complain of our pressure. Then we test the point over the transverse processes and angles of the ribs, and even the junction of the ribs and costal cartilages. If hyperaesthesia is present at all points in the distribution of the fifth spinal nerve, we understand that the original irritation may be slight, but long continued, or strong and of short duration. If no osseous displacement is discoverable, which has a relationship with a hypersensitive nerve, we must look for evidence of disturbed functioning by the viscus most nearly related. The original irritation might have been an excessive demand on the ability of the viscus, as in the case of the stomach being overloaded.

In any case, the discovery of what appears to be an osseous lesion, leads us to test the condition of its related nerves. If they do not show undue excitability, the lesion is doubtful as a causative factor. A careful examination of vertebral spinous processes may show many deviations from symmetrical development, and the diagnostician should guard against the false evidence of these distorted spines. If a spine has been distorted by unequal development, there should be no sensitiveness around it except as the result of a visceral reflex. In case of such visceral reflex, the examiner can not help being misled as to the value of the apparent osseous malformation. His fingers can not inform him that what he considers an osseous lesion is in reality bad development. The only way he can escape from making a mistake is by continuing his examination without holding a positive idea that he has found the cause. The history and development of the case may arouse strong doubts as to the value of his discovered spinal lesion.

Your attention is called to this possible mistake in valuation of a lesion, so that you may not become wedded to the idea that, when you have found what appears to be a misplacement, you are free to end your examination and pronounce a competent judgment.

Test Muscular Tension.—While the patient is on his side, examine carefully the amount of tension in these three groups constituting the fourth layer. After considerable education of the sense of touch, it will be possible for you to determine that the points under your fingers are probably too sensitive. When these muscles feel hard and unyielding, they are usually sore to pressure. The contractured condition of the muscle has affected the sensory nerve filaments in two ways: First, by direct pressure between the contracted muscle bundles; second, by retention of metabolic waste products which result in chemical poisoning.

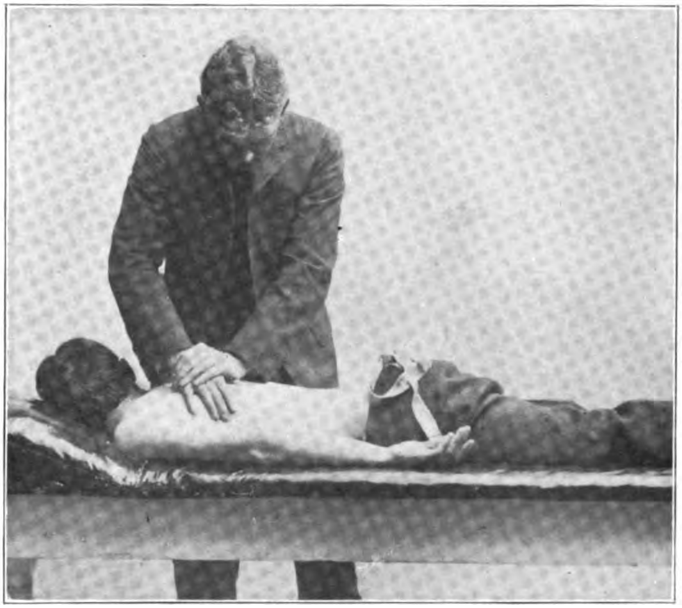


FIG. 158. Testing the pliability of the interscapular portion of the spinal column.

Thoracic Flexibility.—Fig. 158 illustrates a method of ascertaining the elasticity of the dorsal spine and thorax. This procedure assists in estimating the general condition of the body. If the thorax is fixed, inelastic, respiration can not be carried on properly. Oxygenation of the blood will be imperfect. If desired we may palpate the spinous processes and the musculature while the patient is in this prone position.

Examination of the Abdomen. — Fig. 159 shows the proper position of the patient for examination of the abdomen. The knees being drawn up allows relaxation of abdominal muscles. Where the abdomen is very sensitive to the touch, either because of pain or ticklishness, use the whole hand until the patient becomes somewhat accustomed to the touch. Sometimes it is necessary for the physician

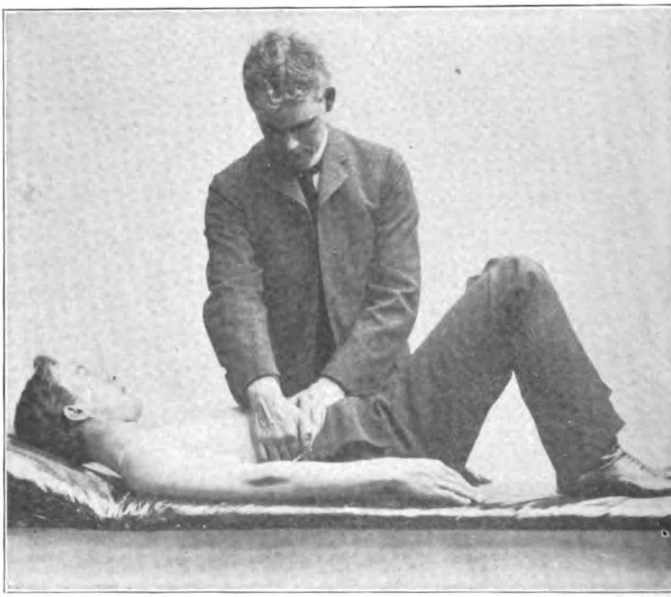


FIG. 159. Palpation of the abdomen.

to lift the feet from the table and flex the knees quite close to the abdomen. A steady, even pressure of the hand on the abdomen will soon become non-irritating to the patient, and deeper palpation can be made.

If the examination is a general one, commence your work, with the patient in this position, by palpating the thorax. Note form and flexibility, especially the flexibility of the five lower ribs. The free movement of these ribs is essential to many functions, chiefly respiration, but it also affords a sort of rhythmical massage to the liver and stomach.

Such observations of form and flexibility are very general, but they lead invariably to some clue of especial value in the search for effects and their causes.

Elevation or Depression of Ribs.—Note the spacing of the ribs to determine whether any rib is elevated or depressed. Palpate the chondro-costal articulations for misplacements, especially note the articulations of the tenth ribs, they are frequently broken loose and form additional floating ribs. They are usually depressed slightly under the ninth.

After palpation of the chest, use percussion, then auscultation, according to the methods outlined in the best text-

FIG. 160. Position for examination of the prostate gland.

books on diagnosis. By the use of all these physical methods it is possible to arrive at a very definite conclusion of the state of the thoracic viscera.

The abdomen should be palpated, then percussed. These two methods should make evident any organic change in the abdominal viscera.

Examination of the Rectum and Prostate Gland.—Fig. 160 illustrates a position for examining the rectum and postate gland. Fig. 161 is the well-known Simm's position which may be used for the same purpose as the preceding.

Other positions used by the osteopath for examination and treatment are the well-known gynecological positions, genu-pectoral and Trendelenburg.

Examination of the Neck.—For easy examination of the neck, the patient should be recumbent, as in Fig. 159. The muscles of the neck must have all tension removed so that the examiner's fingers can feel the processes of the cervical vertebrae.

A flat table instead of the model shown in the illustration is better. A hard small pillow may be used to support the head.

FIG. 161. Simms' position.

Since the spinous processes in the cervical region are short and bifid, and oftentimes developed unevenly and are covered with several layers of muscles and ligaments, it is not satisfactory to use them as landmarks for relations of cervical vertebrae.

The tubercles on the transverse processes are easily palpated, hence these serve as guides in the detection of slight misplacements of cervical vertebrae.

The transverse processes of the atlas are usually large and sufficiently prominent to enable the examiner to ascertain accurately its position. When the atlas is in its true position, its transverse processes will be found about midway between the mastoid processes of the temporal bones and the angles of the jaw. This relationship may appear untrue when the mastoid processes are quite large or small, or the angles of the jaw are more or less obtuse. It is necessary to study the relative development and positions in every case, on both sides, in order to discover whether a subluxation exists. The fact that nearly all subluxations of the atlas are twists instead of direct forward or backward displacements, makes it comparatively easy to detect the inequalities and understand the faulty position. Sensitiveness will be found in the tissues on the side whose transverse process is posterior. In case there is marked sensitiveness on both sides, that is, on the posterior surfaces of both transverse processes, the atlas is probably drawn slightly posterior on both sides by the severe contraction of its attached muscles.

The third cervical vertebra seems to be easily subluxated. It is usually twisted, not sufficiently to lock its articular processes, but just enough to make the dorsal surface of its inferior articular process easily palpable through the muscles which lie over it. This prominent point will be sensitive because the muscles over it are always tense.

Sometimes the sixth cervical vertebra is twisted. When this condition exists, there is marked disturbance of circulation in the head. The patient is usually wakeful and excitable on account of the congested condition of the cerebral blood vessels, caused by the pressure on the vertebral veins.

Note the tone of all the cervical muscles, the flexibility of the neck, the temperature of the skin on different parts of the neck. Palpate the chains of lymphatic glands, the thyroid and the submaxillary salivary glands.

After a thorough palpation of the neck, look carefully for any evidences of disturbed circulation in the head as may be evidenced by the appearance of the skin, mucous membrane of the mouth, the tonsils, conjunctiva or the wearing of glasses. Your knowledge of optics should enable you to judge the general condition of the eyes by inspection of the glasses worn.

Such an examination of the head and neck as herein outlined should give the examiner a good understanding of the structural and functional condition existing at the time of examination, and even guide him to what other parts of the body may need special attention.

The History of Lesions.—All facts as to structure and function, determined by your examination are historical, that is, they have dates and circumstances which give them much or little value. The experienced diagnostician delights in filling in the life history of the patient to fit the structural and functional changes. Herein lies the opportunity for the physician to bring to his aid all his resource of experience and education in judging how these lesions have been brought about and how they are now influencing other tissues.

The Extremities.—While the patient is in the recumbent dorsal position, Fig. 159, the lower extremities can be examined. Note the comparative length of the legs, but be careful to eliminate all possibility of mistake by observing whether the patient is lying evenly on the back, ilia same height, and muscles of both legs equally relaxed. A measurement from the anterior superior iliac spine to the internal malleolus determines the length of the leg.

Palpate the great trochanter. Note its relation to Nelaton's line. These general directions for examination will determine the weak, disordered or diseased part of the body which requires your further careful examination.

Subjective Symptoms.—You will observe that thus far nothing whatever has been said about asking the patient concerning his or her subjective symptoms. It is a general principle underlying osteopathic diagnosis that objective symptoms are the only true facts upon which the diagnostician dares base his judgment and final verdict. The nearest approach to a subjective symptom thus far mentioned is hyperaesthesia. This may frequently be judged by the feeling of the muscle when pressed upon by the fingers. The muscular reaction to the painful sensory impressions occasioned by the pressure can be felt. Usually we depend upon the patient to indicate or corroborate our sense of touch.

In actual practice this process is not carried out in its entirety. Time is a factor in the physician's life as well as in the life of the business man. He cannot afford to go about his work in this detective-like manner. It requires too much time. We hear a great deal of objection to the physician's question to his patient: "What is your trouble?" But the answer to it enables him to get quickly to work on the seat of disease or at least leads him quickly to it. The physician who is a good questioner saves much time. He does not accept the subjective symptoms, merely goes to work to prove or disprove their verity by the standards of physical diagnosis.

CHAPTER XX.

MANIPULATION.

There has been a very rapid evolutionary development of manipulation as a therapeutic method. It has been found to be a wonderfully adaptable means of alleviating human suffering. Undoubtedly the principles underlying any method of manipulation contribute something to all other so-called systems of movement cures. Manipulation is hand practice in the surgical sense. It is applicable in a tremendously wide range of disorders, for example the treatment of fractures, sprains, breaking adhesions, reducing dislocations, assisting venous circulation, stimulating peristalsis, reducing congestions, quieting reflexes, stimulating nerve centers, and many other things of a helpful character.

The form of manipulation most generally understood is massage. This term is used by some to mean any method of manual manipulation. Massage is a method of manipulation which has been extensively practiced and written about, hence there is no excuse for the prevailing slovenly use of the term to cover all forms of hand manipulation. The characteristic movements of massage are friction and kneading. They have proven wonderfully satisfactory as adjuvants in overcoming venous stasis and toning the neuro-muscular mechanism of the body. No one who is at all conversant with the phenomena of natural recovery fails to recognize the great assistance which even the crudest use of massage furnishes.

The next step of a scientific character in the development of manipulative methods was Swedish movements. These introduced leverage and voluntary resistance as new factors in increasing the tone of the neuro-muscular apparatus. A very limited field was accorded to massage and Swedish movements. Both these methods were practically never used except as prescribed by a physician. Practically no diagnostic ability or initiative is credited to those who apply the methods. Surgery was "Formerly that branch of medicine concerned with manual operations under the direction of the physician." If the evolution of surgery can be used as a criterion for judging the future of manual manipulation, there can be no doubt as to the commanding position that will be attained.

Osteopathy has introduced a new factor in manipulative therapeutics, i. e., the adjustment of joint luxations and subluxations. It is interesting to note that the art of manipulation applicable to this corrective work was developed independently of massage and Swedish movements. Osteopathic movements could not have evolved naturally from massage and Swedish movements, because osteopathic technique is the direct result of the theory, sturdily asserted and defended by Dr. A. T. Still, that "structure governs function." His recognition and treatment of joint lesions, "subluxations", led to the development of a system of movements primarily surgical in character. No matter how much any osteopathic physician may take issue with him in matters of theory, the fact exists that not one of them believes that he has ever been approached in skill in the art of corrective manipulation.

Present day osteopathic physicians are beneficiaries of all the successes credited to massage, Swedish movements, Dr. A. T. Still's original work, special operations devised by orthopaedists all over the world, and the brilliant work of Professor Lucas Championiere in the treatment of fractures by "gluco-kinesis" and mobilisation. We are beneficiaries of all these because Dr. Still believed in fundamental medical education and the establshment of a school of medicine and surgery primarily devoted to the scientific development of manipulative therapeutics. Since at the time of his most active work in practice and teaching, the abuse of drugs and surgery was at its height, it is no wonder that he desired to establish a system of practice which would not be burdened by inheritance of the foibles and failures of drug-therapy.

As a result of the success of osteopathic theory and practice, there has been the inevitable plagiarizing of its literature and methods by those who find it profitable to impose on an ignorant public. This plagiarizing has been done under several names, but especially under that of chiropractic. The history of this attempt to appropriate the principles and methods of osteopathy, without requiring any creditable educational work to make them safe means of treating ailing human beings, is a sad travesty on the standards of medical education in this country. Under our present laws new schools of medicine may be started as short cuts to avoid the moderately severe requirements of established schools. So long as this is possible, there will continue to appear "new schools" exploiting some phase of established methods under new names.

Methods of Procedure.—Osteopathic physicians frequently differ as to methods of procedure, but they all work according to the same principle. For instance, a subluxation of a vertebra might be discovered by two osteopaths. The first one might undertake to reduce the subluxation without any preliminary work on the muscles, believing that it is best to go right to the seat of trouble and remove it. His treatment would be severe because much strength would be required to overcome the resistance of the muscles governing the articulation. The second one might spend considerable time on the preliminary work of relaxing the muscles of the articulation, increasing flexibility, reducing sensitiveness, etc., before attempting any specific reduction of the lesion. The ultimate result of both methods would be alike. The question of which method is best lies wholly with the individual osteopath. Some like to put forth a severe effort for a short time, others a moderate effort for a longer time. Outside of the special choice of the osteopath, lies the business one of satisfying the patient. Severe work at the outset frightens some patients, furthermore, it actually bruises some of them. The ultimate result of the treatment may be excellent, but the patient does not quickly forget the methods used. There is a parallel between the immediate after-results of a severe osteopathic treatment and surgical shock. This shock should be avoided as much as possible.

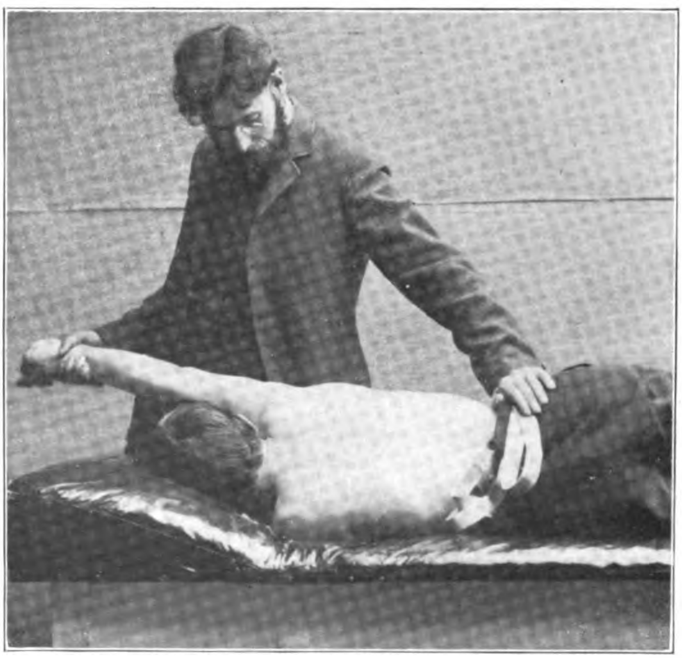


FIG. 162. Relaxation of the latissimus dorsi.

The movements hereafter pictured and described are all made with reference to structure rather than function. Few references are made concerning their applicability to special diseases. We do not care what the name of the disease is. The groups of symptoms which make up the pictures described in symptomatology have very little significance to the osteopath. His movements are not made with reference to a named disease, but to a faulty structural condition. The structural condition may be the basis for the physiological. Function does affect structure. We are not to lose sight of this fact. Function may be perverted by bad habits, hence our therapeutics must comprehend the hygienic and dietetic side of life as well as structural.

Every movement herein outlined secures a definite effect on a muscle, or is used to affect the relation of bony parts.

The movements made to affect the muscles of the back and spinal column are based upon the attachment of the muscles and the leverage they exert on the spinal column.

Relaxation of the Latissimus Dorsi.—The arrangement of the back muscles has been noted in the chapter on Positions for Examination. In order to relax these muscles in their natural relations, i. e., from superficial to deep groups, we begin with such a movement as will separate the extremities of the most superficial muscles to their fullest extent. Fig. 162 illustrates the method of relaxing the latissimus dorsi. One hand extends the arm to its fullest extent, the other hand anchors the ilium. It will be noted that the lower dorsal and lumbar portions of the spinal column are lifted by the pull of this muscle, Also the four lower ribs are raised. The intrinsic effect of this stretching movement is to take most of the tension out of the muscle itself and increase the amount of metabolic change taking place within it. But that is not what is primarily intended. The intrinsic effects are mere

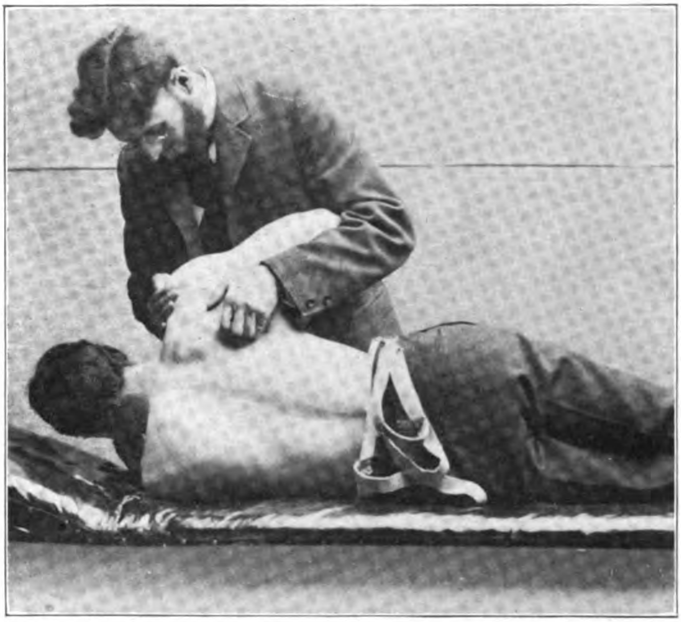


FIG. 163. Relaxation of the trapezius.

incidents in the physiological life of the muscle, and as such are found following all kinds of muscular movements. The extrinsic effects are what concern us most; the effect upon the vertebrae and ribs, the change in the form of the chest.

There are three uses for this movement. First, as preparatory to work upon muscles lying beneath it, i. e., purely relaxing. Second, in case of overlapping by any one of the four lower ribs. It is a common condition to find the twelfth rib under the eleventh, or tenth under eleventh. The pull of the latissimus dorsi is exerted on all alike, hence the individual ribs are brought into their proper relations. Relaxation usually allows a return of the faulty position, but if the ribs are held at their extremities by the operator for a few seconds after relaxation, the intercostal muscles and quadratus lumborum will

FIG. 164. Relaxation of the rhomboideus major and minor.

be filled with arterial blood which tones them. The patient should be directed to hang by the hands several times per day so as to get a good effect on the position of the lower ribs. Third, to affect lateral curvature of the spine in the lumbar or lower dorsal portion.

Relaxation of the Trapezius.—The trapezius is another of the superficial group of back muscles. Its fibers are so variously attached that several movements are required to relax all its divisions. Fig. 163 illustrates the method of grasping and holding the scapula while relaxing the trapezius. The scapula is rotated on the thorax as far as possible toward the head so as to stretch those fibers extending from the spine of the scapula to the sixth and twelfth dorsal spines; then away from the head to affect the cervical fibers, then away from the spinal column to relax the short fibers between the upper dorsal spines and scapula. There is a vast difference in the way the scapula can be moved about in different cases. Those having any tendency to asthmatic trouble will present a very fixed scapula. The more marked the asthmatic condition is, the more difficult it is to move the scapula. Pleurisy and lung troubles, especially when coughing is frequent, tend to hold the scapula fixed. Lifting the patient's body above the table by the scapula gives instant relief in many cases of pleuritic pain, intercostal neuralgia or angina pectoris. This result is explained by the removal of the pressure exerted by the scapula when it is held too close to the thorax by contracted muscles which are acting reflexly. A subluxated rib is usually responsible for the pains mentioned, but the muscles of the scapula are partially respiratory, hence act in connection with disturbances of normal rhythm of intercostal muscles. The pressure of the scapula helps to fix the whole chest in an unyielding condition. That which was at first purely helpful in character becomes in itself an added irritant. This movement or series of movements affects the tone of the muscle fibers, then the whole respiratory process.

Relaxation of the Rhomboids.—In the second group of back muscles we find the rhomboids, major and minor, accessory muscles of inspiration. Fig. 164 illustrates a method of stretching these muscles. The patient's elbow is placed against the physician's abdomen. Pressure against the elbow forces the scapula back, and makes its vertebral border prominent. The physician's fingers grasp this border securely, and then lift steadily upward. This movement is excellent for the purpose intended. That which has been written concerning the trapezius is applicable to the rhomboids. Outside of the intrinsic effects on the muscle and on respiration, a slight effect may be

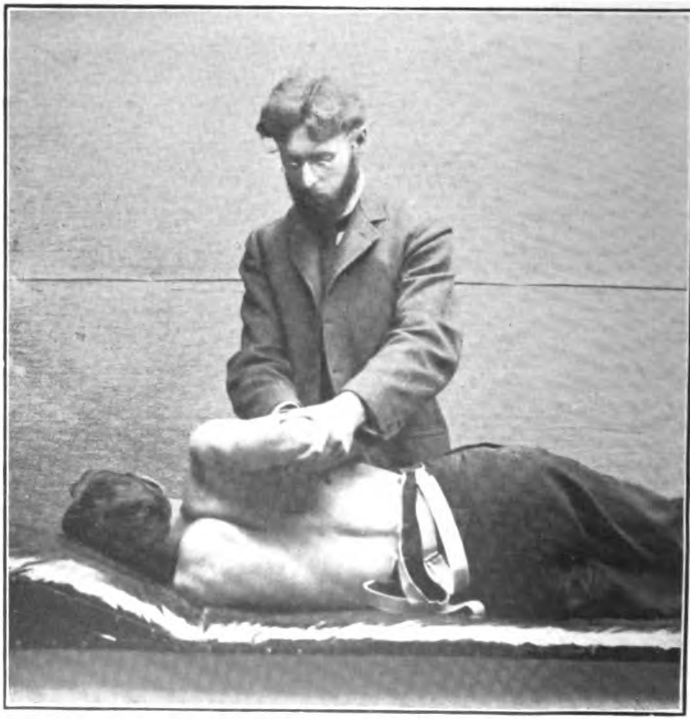


FIG. 165. Relaxation of the pectoralis major and serratus magnus.

exerted on a lateral curve in the interscapular region. It is generally used as preparatory to work on deeper structures.

The Pectoralis Major and Serratus Magnus.—Following these movements, where general thoracic and spinal relaxation are desired, the movement illustrated in Fig. 165 may be used. It affects the Pectoralis Major and Serratus Magnus. By pushing the patient's elbow as far back as possible, the scapula is approximated to the spinal column, hence the serratus magnus is put upon a tension which lifts the eight upper ribs. The pectoralis major also affects the upper ribs. The physician's hand on the angle of the ribs accentuates the expansion of the

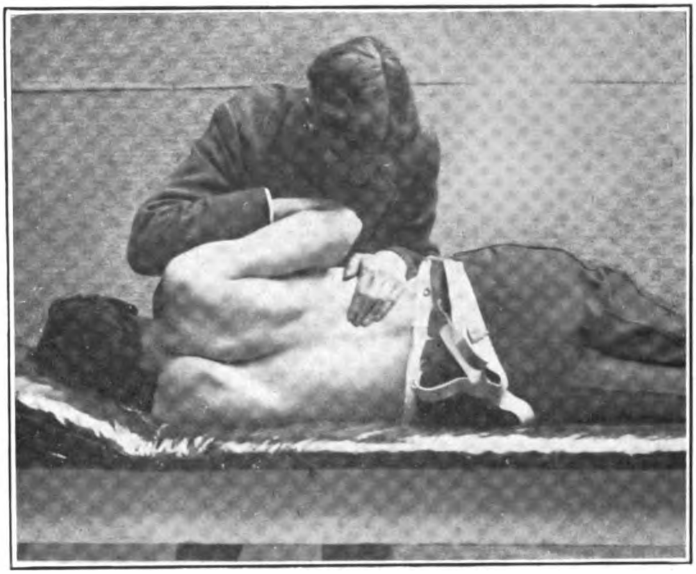


FIG. 166. Relaxation of the serratus magnus and some fibres of the fourth layer of dorsal muscles.

chest. This is a general movement, but one which has far-reaching effects upon respiration and circulation. It is adaptable to many specific structural defects of the ribs.

In Fig. 166 the physician again uses the humerus and scapula as means by which to affect the spinal column. The left hand exerts traction on the muscles above the spine, while the right hand and arm forces the patient's scapula toward the head and spine. The movement is made to enable the physician to relax the serratus magnus and some of the fibers of the fourth layer of the back. Slight torsion of the dorsal spinal column is also secured.

Quadratus Lumborum.—The relaxation of the quadratus lumborum is secured according to Fig. 167. In all displacements of the twelfth rib, it is necessary to secure a free circulation in the muscles attached to that rib. The fact that it is a floating rib makes its position dependent

FIG. 167. Relaxation of the quadratus lumborum.

on the tone of the muscles attached to it. It is frequently slipped under the eleventh. This movement separates them.

Fig. 168 is in some respects similar to the movement illustrated in Fig. 166, except that the scapula is forced downward, and the left hand is able to work through the relaxed superficial muscles. After the use of the movements already illustrated, it is astonishing how easily one can work upon the fourth layer or examine the condition of deep structures.

Erector Spinae.—The work upon the fourth layer should be done according to Fig. 155. The fingers are placed between the muscles and the spines of the verte-

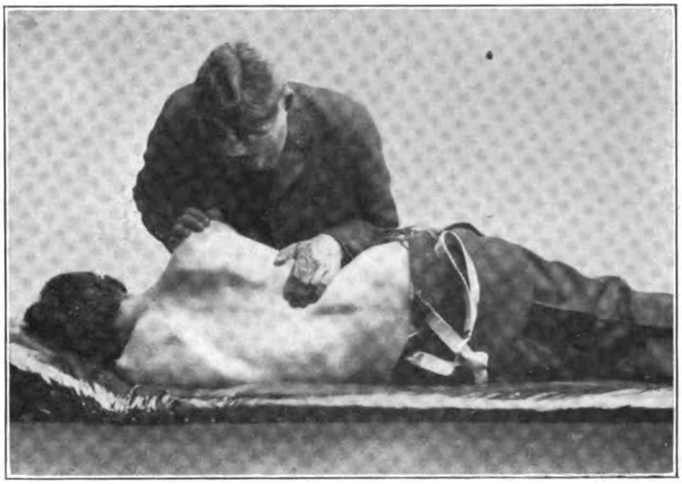


FIG. 168. Relaxation of the lower fibres of the trapezius.

brae and then drawn away from the spines in such a manner as to stretch the muscles. The fingers should never be allowed to slip over the muscles. Work steadily and deeply. Do not move the fingers over the skin. When you place your fingers, compel all soft tissues beneath them to move with them. In this way you secure relaxation of the erector spinae and continuations, take out soreness of the muscles, and prepare for specific work upon the ribs or vertebrae.

The erector spinae is rarely contracted throughout its whole length. Your work should be centered on that portion which your examination has demonstrated to be contracted, either as a result of visceral disturbance, osseous subluxation, strain or cutaneous reflex from cold.

Having now prepared our patient for specific manipulation, we will note the results to be obtained on the general contour of the spinal column.

Treatment of Simple Kyphosis.—Fig. 169 illustrates one of the simplest methods of springing a spine which is

FIG. 169. Springing a dorso-lumbar kyphosis.

FIG. 170. A method of springing a lumbar kyphosis.

FIG. 171. Springing an upper dorsal lordosis

kyphosed at the junction of the dorsal and lumbar. The physician's forearms are placed against the patient's shoulder and ilium while the fingers rest over the kyphosed portion of the spinal column. The hands draw forward while the forearms push away. Considerable force can be exerted in this way on slender patients.

Great force can be exerted on a posterior curve of the lower dorsal and lumbar portions by the movement shown in Fig. 170. This movement is also used for purposes other than corrective of structural defects. Since the leverage is so great, it is quite easy for the physician to carry it too far. The result is an active congestion of the lower portion of the spinal cord, followed by excessive activity of the nerve centers located there. In giving this movement to women, ascertain whether pregnancy exists. If so, do not under any consideration use it. The center for parturition might be excited by it, even though the movement made is slight.

There is practically no danger in this movement when intelligently used, except in the case of pregnancy. A slow, steady lift made while the physician is watching carefully the amount of resistance offered by the back will usually inhibit the excitement of the centers located in the lumbar enlargement of the spinal cord. The slowness and steadiness of the movement relaxes the muscles of the fifth layer and secures better drainage for blood in the spinal canal. No active congestion is brought on, hence a sedative effect is gained. Quick, intense execution of this movement has frequently a reverse effect, because the sharp strain put upon the muscles results in added contraction, active congestion and obstruction to good drainage of the spinal canal. These conditions result in functional activity of those organs governed by the nerve cells in the lumbar enlargement. Active congestion of a center results in increased function of the organ governed by that center.

As a general rule, this movement is contra-indicated for any purpose but that of correcting a structural defect. The reaction of many patients is an uncertain quantity, hence it is not wise to use this treatment for purely functional effects.

As a result of the ignorant use of this movement by those who are palming themselves off as osteopaths, the author knows of several cases where dangerous conditions were brought on.

Lordosis — Upper Dorsal. — An anterior curve, or straightened condition of the spine in the interscapular region, is rather difficult to treat on account of inability of the physician to use the extremities as levers. Fig. 171 illustrates a method of applying leverage by means of the cervical vertebrae. The position of the knee on the spinal

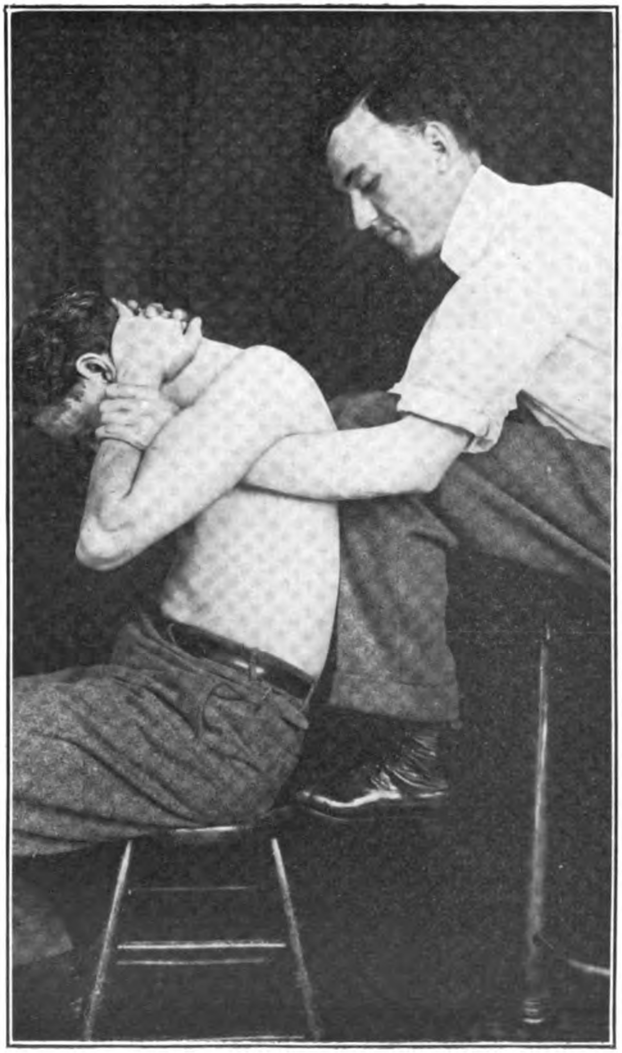


FIG. 172. Springing an upper dorsal lordosis. The leverage is so great in this movement that the operator must exercise great discretion in its use. As applied by a skillful operator it is exceedingly satisfactory.

column regulates the extent of the force of the movement. The knee is the weight to be lifted, the spinal column is a flexible lever. The physician's forearms are the fulcrum, while his hands apply the force to lift the weight (the knee) which bends the lever at the point governed by the position of the weight and fulcrum. The position of the physician's hands is important, because the cervical is not the portion of the spinal column we desire to bend. If the hands are allowed to rest close to the head, the force exerted is nearly all spent on the neck; the most flexible part of the spinal column is affected—a result not desired. Place the hands as nearly over the cervical and first dorsal spines as possible. Since the junction of the dorsal and lumbar segments is a very flexible point, the knee should be located higher.

Fig. 172 illustrates another method of producing flexion in the upper dorsal region. The leverage in this position is so great that the operator must exercise caution in its use. The operator should never aim to overcome the patient's resistance by exerting a greater force. The patient will usually relax under the influence of a tetering movement, i. e., short, gentle application of the leverage.

The Possible Variety of Movements Which Will Secure the Same Results.—All of the effects described may be secured by movements differing from those outlined. The author desires to illustrate the application of osteopathic principles. It is believed by him that the series of movements illustrated have the virtue of directly and forcibly affecting the part desired without using up too much of the physician's strength in their application. Where much work is done by a physician, it becomes a vital problem with him how to conserve his own strength. By the selection of those movements which give the greatest leverage, he saves himself.

The Head and Neck as a Lever.—If the anterior or straightened condition of the spine is very marked in the upper dorsal, it is possible for the physician to use the head and neck in securing his leverage. When the position of the spine is as described, the spinal muscles in that area will be very contracted. The vertebrae will be held tightly together, thus lessening the flexibility. Loss of flexibility of the spinal column results in poor circulation in the spinal cord with consequent perversion of the activity of the physiological nerve centers located there. Congestion, passive type, usually exists around these centers when drainage is interfered with by these contracted muscles.

Lordosis or Kyphosis May Affect a Function Similarly.—A change in the contour of the spine, either anterior or posterior, may result in the same disturbances in the peripheral distribution of the nerves from the distorted section. The anterior curve in the interscapular region usually causes the ribs to droop, which occasions a flat chest. The thoracic cavity is lessened, hence respira-

FIG. 173. Voluntary treatment of an upper dorsal lordosis.

tion is feeble. People with flat chests may develop wonderful breathing capacity by persistent exercise. The respiratory muscles lift the ribs. Exercise of these muscles will increase the antero-posterior diameter of the chest.

When directing a patient about the details of exercise to increase the breathing capacity, do not fail to impress the fact that a full round chest without flexibility is just as bad a condition as an abnormally flat chest. Flexibility is the keynote of health. Those exercises which merely increase the contracting power of muscles, without at the same time increasing their relaxing power are not healthful.

Examination shows that whether we have anterior or posterior conditions in the interscapular region, the spinal muscles are contracted. The patient's power to relax them is lost. The patient may feel tired and weak, but these muscles will not cease their contraction. The rigidity has passed beyond the patient's control.

The patient can do something toward restoring flexibility to an anteriorly curved or straight spinal column in the upper dorsal region. Fig. 173 illustrates the effect of flexing the neck forcibly by pulling down with the hands. These spines are greatly separated, and hence the muscles of the fourth and fifth layers are relaxed.

Fig. 174 illustrates how the physician can use the dorsal and cervical vertebrae as a flexible lever, and by shifting the position of the hand upon the spine apply the movement specifically to any particular vertebra. No movement which uses the arms as levers will affect the position of these vertebrae, because the first and second layers of muscles which are affected by arm movements do not control the intrinsic mobility of this portion of the spinal column. The fourth and fifth layers of back muscles are the groups which cause the mal-position of vertebrae in this region.

FIG. 174. Use of the head and neck as a flexible lever to affect the upper dorsal region.

Splenius Capitis et Colli.—The Splenius Capitis et Colli, a muscle of the third group, extends as low as the sixth dorsal spine. As its name indicates, it is a bandage muscle, and binds down the muscles under it. Its long attachment in the dorsal region gives it a considerable influence there, when its superior attachments to the head and neck are forced anteriorly by flexion of the neck. It is the influence of this muscle which makes the movements described so effective. These movements are for a general corrective effect on a section of the spinal column.

FIG. 175. A method of affecting kyphosis in the upper dorsal region.

They are not well adapted to treatment of an individual vertebra.

Kyphosis—Upper Dorsal.—A posterior curve in the upper dorsal region can be treated by the method illustrated in Fig. 175. The physician's right arm is placed above the patient's right shoulder and under the chest, so that the hand can be placed in the patient's left axilla. The patient's head should be turned away from the physician, so that the upward pressure of his arm will not interfere with the trachea. The physician's left hand may be moved from place to place along the spinal column. The farther the hands are separated, the more leverage is gained. Considerable force can be exerted in this movement without any danger to the patient, in fact, to be of any value it must be made forcefully. The primary use of this procedure is to reduce the excess of posterior curve.

That which has been written concerning the nerve centers in the interscapular region, when straightening or anterior curvature of the spine exists, applies equally to the posterior curvature.

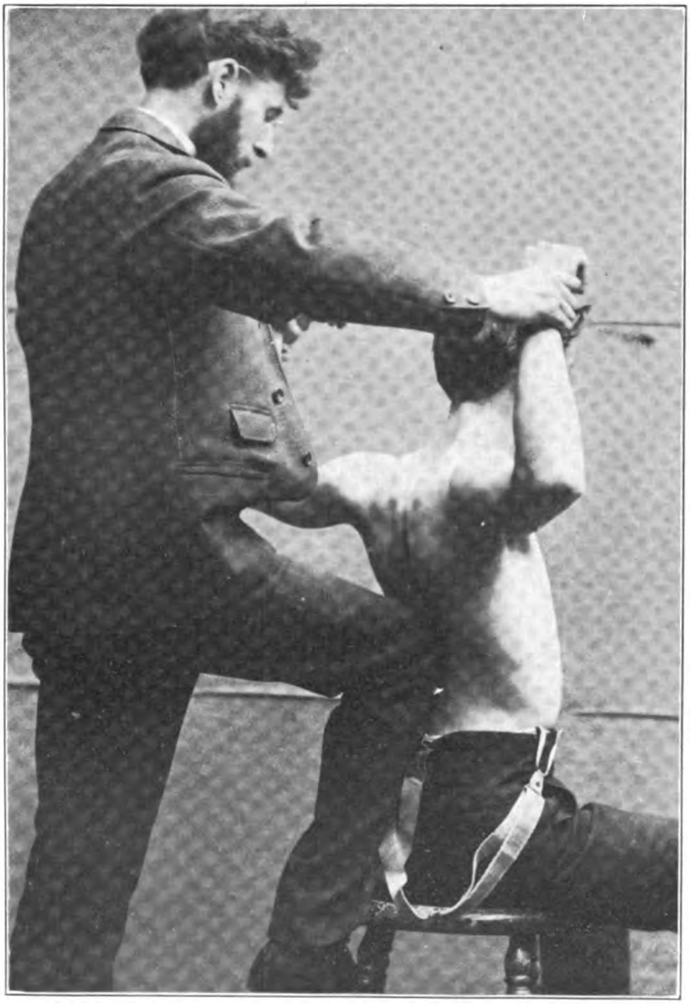


FIG. 176. A method of affecting kyphosis in the dorso-lumbar region.

Posterior curvature is accompanied by increased antero-posterior diameter of the chest, and loss of flexibility. This movement increases flexibility. It can easily be adapted to the treatment of the fifth or sixth ribs.

FIG. 177. A method of affecting kyphosis in the lower dorsal region.

Kyphosis—Dorso-lumbar.—When the kyphosis is at the junction of the dorsal and lumbar regions, it is easy to secure enormous leverage. The arms can be used as levers while the physician's knee rests against the kyphosis as in Fig. 176. If the patient's buttocks are held to the stool, the whole force of the leverage is spent on the back under the physician's knee. This movement should not be carried too far. It, like all other movements in which the physician has tremendous leverage, is liable to produce more than the desired effect. It stretches the thorax and abdomen very decidedly.

Contra-indications.—The author expects that all who use this and other high power movements, have examined their patients carefully before administering them. The presence in the abdomen of an aneurism, ovarian cyst, or

FIG. 178. A method of affecting kyphosis in the lumbar region.

gravid uterus, contra-indicate the use of any movement which compresses the abdominal contents, and also in the case of a gravid uterus any movement which is liable to cause active congestion of the lumbar enlargement of the spinal cord.

Other Movements.—Fig. 177 illustrates another method of exerting pressure on the prominent part of a kyphosis. The leverage is not so great as in the preceding method, but where the kyphosis is slight, it is the better movement.

Still another simple method of springing the lumbar portion of the spinal column is shown in Fig. 178. The patient's knees are held against the physician's abdomen, while the physician's hands make counter pressure over the apex of the kyphosis. The buttocks are forced backward by the pressure on the patient's knees. Some osteopaths object to this movement or any other which neces-

FIG. 179. A method of affecting either kyphosis or lordosis in the lumbar region.

sitates pressure of the patient's knees or elbows against the abdomen. There is an element of danger to the osteopath.

This position, Fig. 178, is used frequently where strong inhibitory pressure in the lumbar region is required. For example, in cases of diarrhoea or cramps. Any hyperactivity of structures governed by cells in the lumbar enlargement may be inhibited in this region.

When lordosis of the lumbar region exists, it is necessary to flex that region in order to counteract it. Fig. 179 illustrates an easy method of accomplishing this result.

This same movement with the physician's right hand under the spine can be made to do duty in correcting a posterior curve. When the hand is placed directly under the kyphosis, the back is lifted; then if the buttocks be forced to the table, the spine will be sprung in the direction desired.

Functional Kyphosis.—A large proportion of patients whose spinal columns exhibit a tendency to kyphosis, in the splanchnic area, suffer from either visceral reflexes or a hypotonic condition of the erector spinae muscles. There is scarcely a case of visceral ptosis that does not present a hypotonic condition of these extensor muscles. The functional kyphosis so frequently apparent in this region is tremendously benefited by rather forceful leverage movements which are accompanied by counter pressure at the apex of the kyphosis. If this counter pressure is applied suddenly, but not severely, it usually produces a sound in the arthrodial articulations of the spinal column under the point of counter pressure. This popping sound can be produced by a variety of methods, many of which are illustrated in this chapter. The patient practically always feels an increase of muscle tone after the popping sound is elicited. This is evidenced by a feeling of greater ability to hold the body erect. There is a genuine feeling of increased power, aside from any psychological effect

FIG. 180. A method of securing general dorsal rotation.

that may accompany the phenomenon. As a simple experiment, one may voluntarily extend one's fingers in opening the hand to its fullest extent, after having had it flexed for a considerable time. There is a feeling of limitation of the extensor movement which is done away with if we passively extend the fingers with the other hand. After this passive extension by manipulation we are able to voluntarily extend the fingers with greater power and to a greater extent than before. This equalizing of the forces of extension and flexion is probably what takes place, when we hear the sound, incidental to movements which produce sudden passive extension, in a joint which is in a state of imbalance on account of a static error, or visceral reflex.

Wherever we find the muscles which are prime movers of a joint in a state of imbalance, we are apt to produce a sound in the joint when we exaggerate the movement so as to suddenly stretch the dominant muscle or muscle group. This produces a readjustment of the joint surfaces. Since the spinal arthrodial joints are apt to be in a state permitting spinal flexion, due to static conditions, fatigue, or visceral ptosis, we are able more frequenlty to produce sounds in these joints than in most others, when sudden correction is made by counter pressure. This phenomenon of sound in a joint, incidental to a quick readjustment of its joint surfaces, when muscular tension controlling the joint is equalized, has led to the invention of many ingenious methods for producing it. Tables have been devised of various heights, having adjustable pads and separable sections so as to allow the patient to lie prone across openings in the surface of the table, thus greatly increasing the advantage of the operator in making sudden downward pressure on a selected point in the spinal column. No apparatus is necessary to enable one to do efficient adjusting work if the conditions necessary for the production of the popping sound are understood.

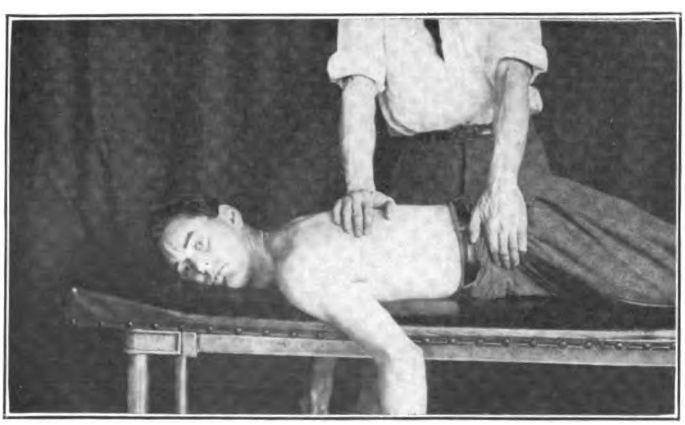


FIG. 181. To correct rotation in lower dorsal and lumbar region and secure free movement of the lower ribs.

The effort to produce such a sound in all so-called subluxations will surely result in strain of the peri-articular tissues. The operator must have a trained sense of tissue resistance and be governed accordingly. Leverage and counter pressure should never be used in the treatment of any joint which exhibits symptoms of inflammation. In case of inflammation in a joint, its position is probably self-protective and hence should not be roughly treated. The lack of ability to diagnose the true condition of a joint leads to frequent misuse of manipulative methods.

New Schools.—It is astonishing how varied a class of patients is benefited by rather heavy counter pressure movements. This fact has led to the rapid exploiting of so-called "new schools" which claim their methods are different from and far superior to osteopathic methods. It is an interesting fact, testified to by many patients who have been treated by many osteopathic physicians, that no two of their physicians operated alike. This is characteristic, in that the osteopathic colleges have not concentrated so much on a particular method as on teaching principles which are capable of many methods of application.

FIG. 182. Simplest form of movement to overcome a functional kyphosis in the dorsal region.

Various Applications of a Principle.—If a patient with a functional kyphosis, in the splanchnic area, lies prone on the floor or any other unyielding surface, as in Figs. 182 and 183, it often suffices to merely make sudden downward pressure on the apex of the kyphosed area with the palm of the hand. One, or several, popping sounds will be heard if the patient relaxes and the force of the sudden pressure is properly proportioned to the passive resistance of the spinal tissues. It may be necessary to concentrate the point of pressure, i. e., use a thumb or heel of the hand, reinforced with the opposite hand. The reason some operators use low tables is merely to allow them to use their own weight to the best advantage in using downward pressure. According to the extent of the "lesioned area," i. e., the kyphosis, and according to the voluntary power of relaxation characteristic of the patient, the operator can use a large or small contact area, i. e., the heel of the hand, hypothenar eminence, or the thumb. The amount of pressure must be proportioned to the passive resistance of the tissues. No effort should be made to

FIG. 183. To overcome a functional kyphosis in the upper dorsal we may use a towel as a sort of fulcrum while making sudden downward pressure over the transverse processes of the vertebrae with the thumbs. This movement usually causes a snapping sound in the articulations most affected by the thumb pressure.

overcome any active resistance on the part of the patient. The operator must contrive to use the pressure before the patient can bring his muscles into active contraction. Herein lies the necessity for the exercise of considerable discretion as to when the advantage of the patient's off guard moment should be taken.

The Use of a Fulcrum.—Advantage over a patient's natural spinal resistance is gained by using a fulcrum at some chosen point on the anterior surface of the body. A very simple use of this principle is illustrated by Fig. 184, wherein the operator's forearm serves the purpose of a fulcrum.

Figs. 185 and 186 illustrate the application of the same principle with the patient sitting. This is probably the easiest position for the operator to use counter pressure. His knees serve as a fulcrum. His hands, grasping the patient's elbows, have a secure hold, so that a sudden pull backward serves to force the weight of the upper portion of the patient's body over the fulcrum and thus fulfill the conditions of extension and counter pressure required for correction of the kyphosis. By varying the position of the

FIG. 184. To correct a functional kyphosis in the dorsal region. Operator using his right forearm as a fulcrum. Sudden downward pressure is made with the opposite hand, reinforced by the pressure of the operator's chest.

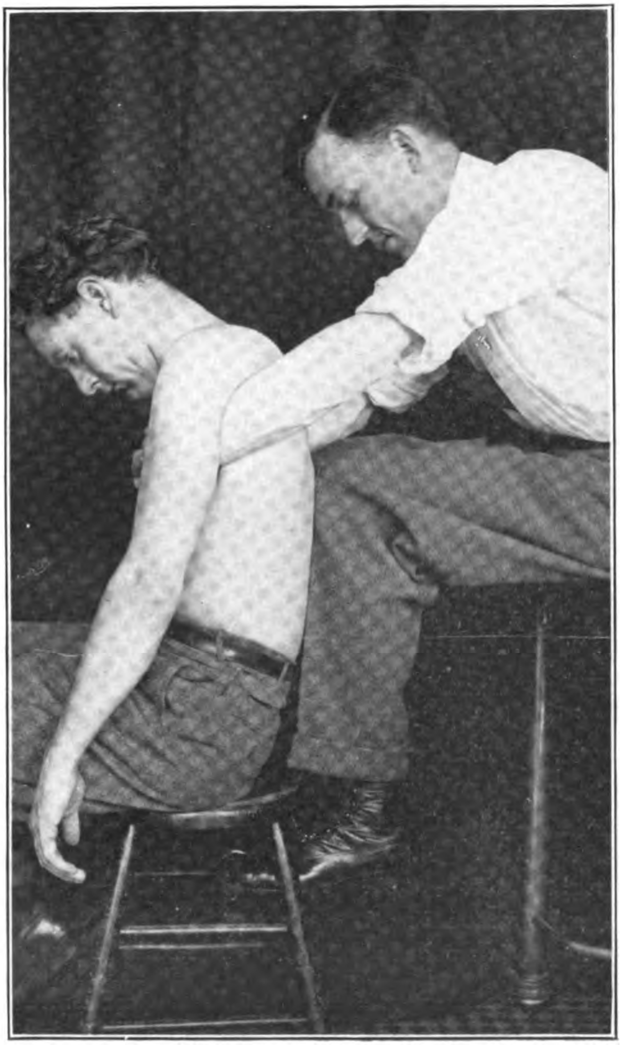


FIG. 185. To correct a functional kyphosis in the dorsal region. Patient must be relaxed. Operator makes a sudden but very moderate pull against his knees.

operator's knees and interlocking his fingers over the patient's chest, as in Fig. 185, the movement can be made very specific as to a single spinal segment.

A movement of great adaptability is illustrated by Fig. 187. The patient places his hands on opposite shoulders and then allows his weight to rest on the operator's forearm. In this manner the operator may use his left or right hand, according to convenience, as a fulcrum to be applied at any selected point in the dorsal or lumbar area. By lifting the patient's body against the fulcrum, either suddenly or gradually, the operator is able to concentrate corrective leverage and pressure at any desired point. Rotation of the spinal column can be secured by this movement and hence it serves as one of the most adaptable movements for all sorts of corrective work. The operator does not actually carry much of the patient's weight on his arm.

The first four dorsal vertebrae are rather difficult to manipulate. The position illustrated by Fig. 230 shows how the hypothenar eminence of the operator's left hand serves as a fulcrum, while the rest of the hand reinforces the neck, so that the head and neck thus reinforced can be used as a lever, which is forced backward by the right hand on the patient's chin. Fig. 189 shows how more powerful leverage may be applied, by one who has a keen sense of tissue resistance. Any movement, embodying great leverage, must be used with extreme caution.

Coordination of Corrective Movements.—The success of any of these movements depends entirely on the operator's ability to coordinate his movements so as to affect the special point in the spinal tissues requiring adjustment. Just as one's eyes coordinate to produce binocular vision, one's hands must work harmoniously to secure good results. The skillful operator causes practically no pain by his movements. They are timed and graduated to suit the needs of his case.

Fig. 191 illustrates a method of exerting leverage and pressure to correct a lateral subluxation in the upper

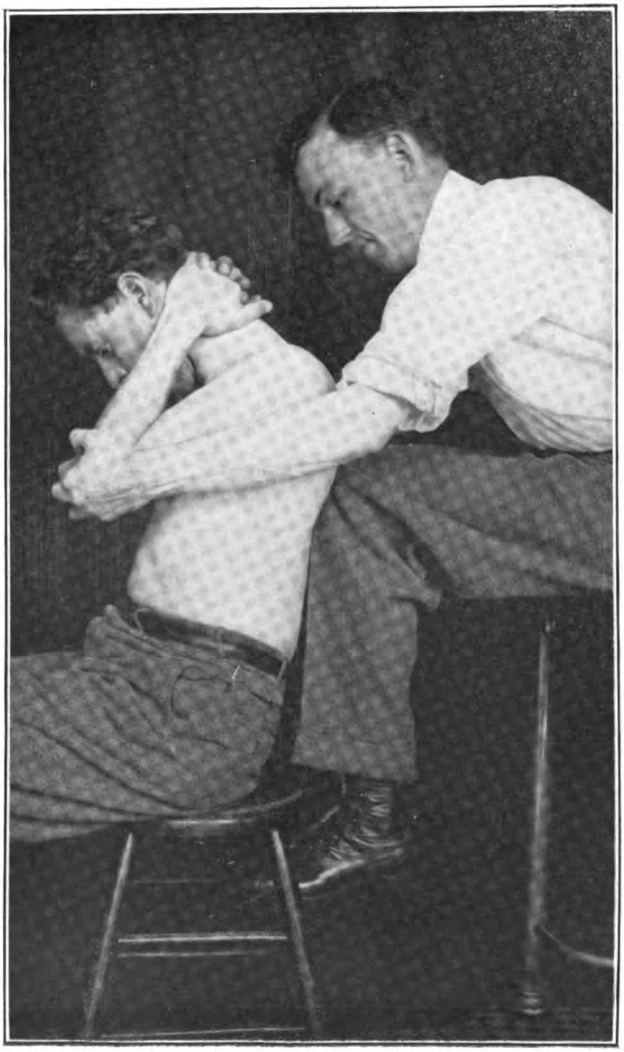


FIG. 186. To correct a functional kyphosis in the dorsal region. Practically the same movement as in preceding illustration. By transmitting the pull through the patient's arms, the patient's pectoral and serratus magnus muscles lift the anterior extremities of the ribs. This is an exceedingly efficient movement when executed by a skillful operator.

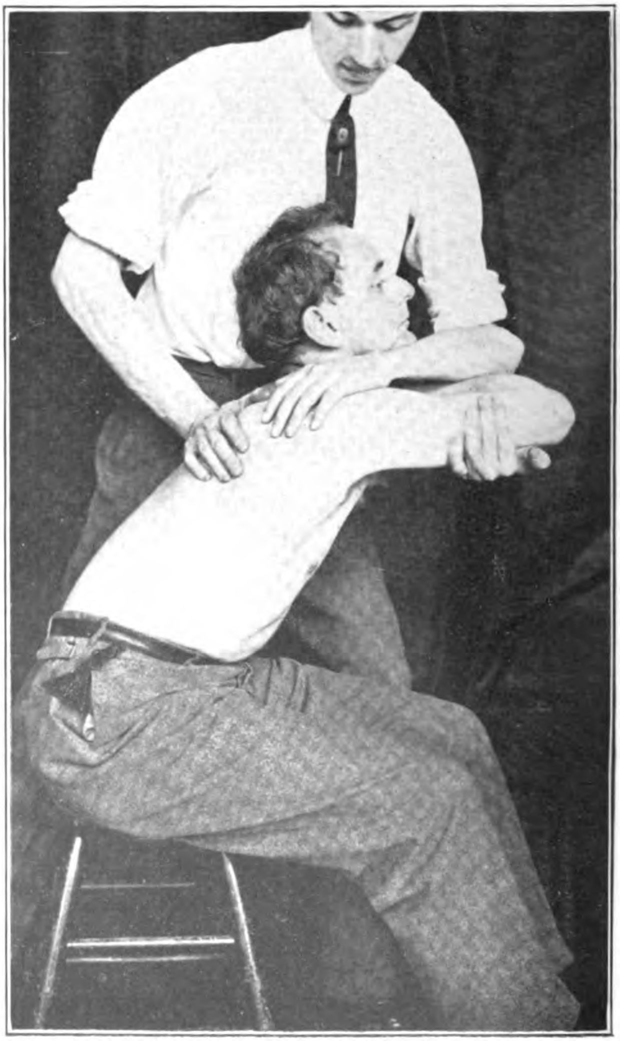


FIG. 187. An excellent movement by which to exert leverage and counter pressure in the dorsal and lumbar regions.

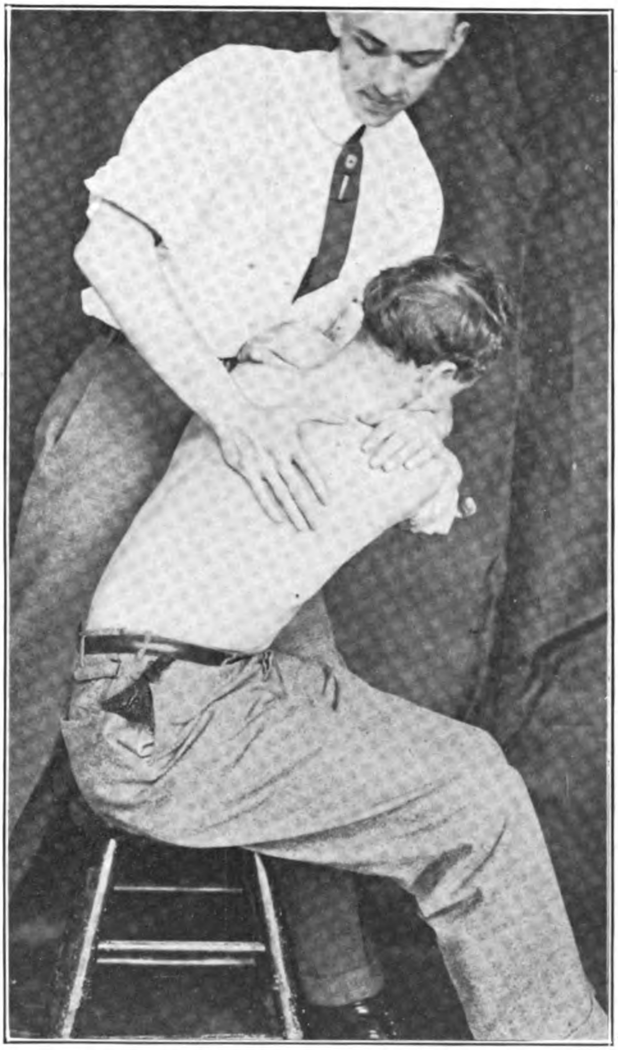


FIG. 188. An application of leverage and counter pressure to secure corrective rotation in the dorsal region. By concentrating the counter pressure the rotation can be accentuated in a single articulation.

FIG. 189. Using the head and neck as a lever while the hypothenar eminence of the right hand is used as a fulcrum in the upper dorsal region or by using the thumb and forefinger as the fulcrum the force of the movement may be exerted to correct a cervical lesion.

FIG. 190. A variation of the movement pictured in the preceding illustration.

dorsal. The operator's right hand serves to force the head and neck in a direction to bend the column over the thumb of the left hand, as a fulcrum. The patient's face is inclined toward the lesion side, so as to accentuate rotation, which is the actual corrective part of the movement.

Dorsal Rotation.—Fig. 181 is a simple method of securing flexibility in the lower dorsal portion of the back. Rotation is possible in the dorsal but not in the lumbar region, hence, by holding the shoulders down and lifting one hip, rotation is secured in the dorsal region. This movement forces the normal action between individual vertebrae of the lower dorsal region. If any particular articulation is at fault, it will not yield to such a general movement as this. The only gain made by it, in that case, is to prepare the surrounding tissues for more specific work.

Lateral Curvature.—This kind of deformity is frequently found and a large proportion of such cases are benefited by osteopathic manipulation. A weakened condition of the whole body predisposes to the formation of a lateral curve. Fig. 192 illustrates an uncompensated lateral curve, that is, the curvature is all in one direction. In such a case the muscles on the convex side are not doing their full duty. The patient is allowing the weight of the upper portion of the trunk to be held by the ligaments instead of the muscles. This simple curvature can be readily overcome by exercises which will develop the weak spinal muscles.

Fig. 134 illustrates a compensated curve, that is, a letter S curve. The primary curve is in the interscapular region and is compensated for by a curve in the opposite direction in the lumbar region.

Know How to Apply Principles. — The osteopath should know how to apply his principles so thoroughly that the position of his patient, whether lying, sitting or standing, will not confuse him. Some osteopaths desire to give their manipulations to the patient sitting, others like the reclining position better. On the whole, it seems best to select the position suited to the special work required.

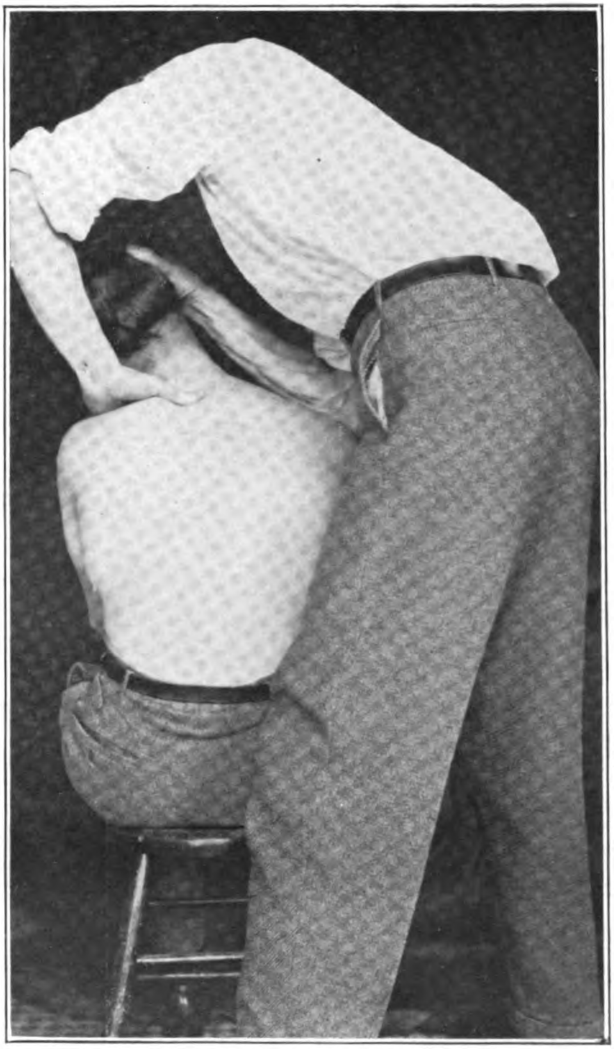


FIG. 191. Using the head and neck as a lever, reinforced by the operator's right hand and arm, while the operator's left thumb is used as a fulcrum to accentuate the force of an effort to correct a rotated upper dorsal vertebra, or a group lesion.

Do Not Copy Movements. — Do not copy anybody's movements. Learn the principles, then apply them in the manner most satisfactory to yourself and helpful to the patient. To understand the principles and apply them intelligently, one cannot know too much concerning all the subjects which are the basis of a broad medical education.

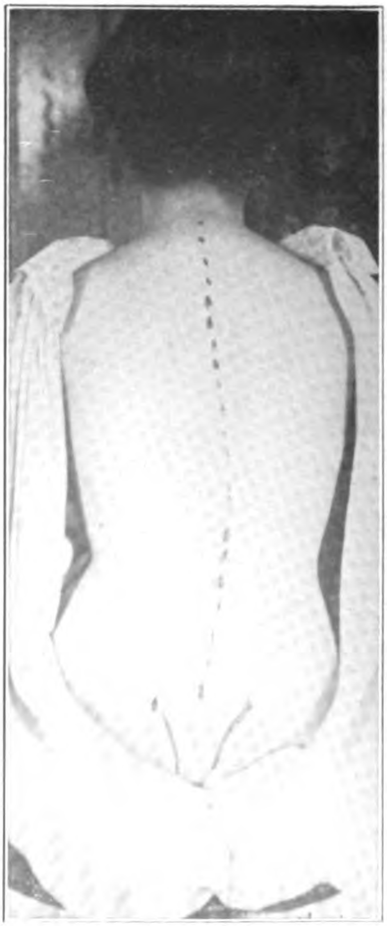


FIG. 192. A case of uncompensated lateral curvature, due to debility.

CHAPTER XXI.

REDUCTION OF SUBLUXATIONS.

Having noted a few movements which have a general beneficial effect on groups of structures, we will now examine a few of the movements which are applicable to specific subluxations.

In the chapter on Subluxation in the theoretical section of this volume, we called attention to the fact that "A subluxation is a slight abnormal relation between bony surfaces, maintained by uneven contraction in opposing groups of muscles which control the articulation. The causes of the contraction are violence, temperature changes and reflex irritation. A reduction is secured by equalizing vital activity." With this statement in mind, we will study first the lateral subluxations in the dorsal region.

Lateral Subluxation.—A lateral subluxation is possible only in those portions of the spinal column where the formation of the articular facets allow rotation. The cervical and dorsal are the regions in which this occurs. Lateral subluxation is most common in the articulations of the atlas, third cervical, and anywhere in the dorsal with the exception of the twelfth. The inferior articular facets of the twelfth are lumbar in character, hence allow only flexion, extension and circumduction.

It makes no difference what the cause of the lateral subluxation may be, the uneven contraction of muscles is the final result, hence all are treated in the same manner.

When the vertebral spine is discovered out of line with those above and below and tenderness noted on its prominent side, we are disposed to consider it a true lesion, an irritant to the nervous system. Whether it is the result of

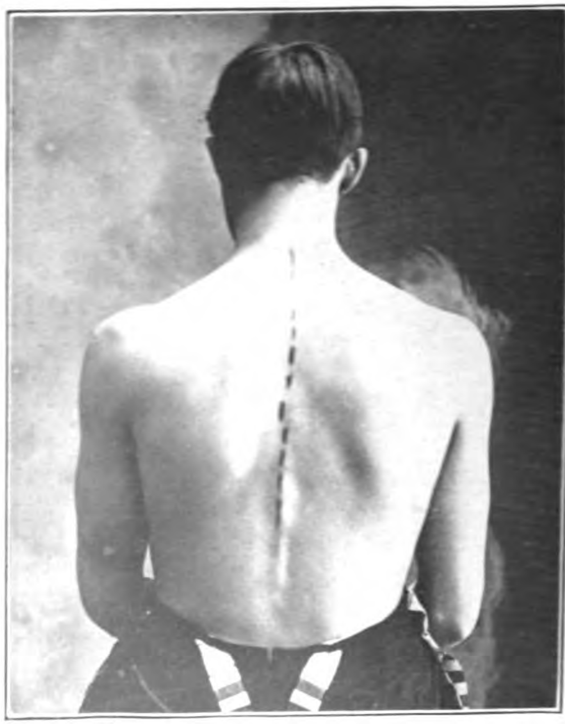


FIG. 193. Surface indication of a lateral subluxation.

accident, cold or reflexes does not need to be seriously considered. While it exists, it is a continual source of irritation to the nervous system, hence should be removed without delay. If it is the result of reflexes, its reduction will at least remove one disturbing factor from the case.

The prominent side of the spine is the one on which the muscles are contracted. The contracted muscles must be those which are holding the bone in its mal-position. In order to exert this influence, they must be attached in such a way as to move the bone in this direction when they act normally. Their present condition is one of hyperactivity. With this line of reasoning, any articulation can be examined, the pull of its muscles determined and move-

FIG. 194. "Exaggeration" of a lateral subluxation.

ments made in accordance with the normal action of these muscles.

In Fig. 193 we observe the subluxation to the left of a mid-dorsal vertebra. Intrinsic rotation of the dorsal spines is the result of the contraction of the rotatores spinae, one of the fifth group. In order for this vertebra to remain subluxated, i. e., more rotated than any of its fellows, the particular digitation of the rotatores spinae attached to it must remain contracted, after the other digitations have become relaxed. The work laid out for us is relaxation of this one digitation. The digitation which is acting is working from below, i. e., arises from the transverse process of the vertebra below the one which is subluxated.

The first movement consists in "exaggerating the lesion." The patient's body is flexed laterally away from the

FIG. 195. "Flexion" of a lateral subluxation.

prominent side of the lesion as in Fig. 194. This procedure stretches the contracted rotatores spinae and also separates the three vertebrae, i. e., the subluxated one and the superior and inferior ones, thus making it easier to push the subluxated vertebra into its true position.

The second movement is an anterior flexion to permit of greater freedom of movement between the articular processes. By forcing the body first into the position of lateral flexion, then anterior flexion, all the muscles of the fifth group which affect the subluxated vertebra are relaxed. During this anterior flexion, a "click" is sometimes heard which is evidence of relaxation sufficient to allow approximation of the subluxated surfaces. During all the time of

FIG. 196. Extension and counter pressure to reduce a lateral subluxation.

making these flexions, the physician's right thumb should make steady pressure against the prominent side of the spine, thus taking advantage of the relaxation gained by each flexion. The anterior flexion is illustrated in Fig. 195.

The final movement is lateral flexion toward the lesion while lifting the patient from the stool in such a way that the weight of the body below the lesion exerts its influence to separate the vertebrae. Fig. 196. Counter pressure with the thumb is made vigorously during this final movement.

The successful reduction of this subluxation may be accomplished without any "click" or other evidence of movement of the surfaces. The vertebra usually moves into its true position without any audible sign. The physician's fingers can determine the success or failure of the movement. If the subluxation was caused by accident or cold, its reduction is all that is needed, but if it is the result of reflex irritation, originating in a viscus, the physician must direct such a mode of living that rest may be secured for the stimulated viscus. Habits of life must be looked into.

Fig. 197 illustrates another method of reducing a slight lateral subluxation. The physician's left arm passes under the patient's left axilla, then the hand is placed firmly on the base of the neck posteriorly. This gives the physician great leverage. The physician's knee, right or left, is placed against the spinal column at a point four or five

FIG. 197. Leverage applied to a lateral subluxation in the mid-dorsal region.

inches below the subluxation. This compels the flexible spinal column to yield to the force applied at the neck, in such a way as to relax the deep muscles controlling the subluxation. Counter pressure applied to the prominent spine by the physician's right thumb completes the movement. By this movement about the same result is ob-

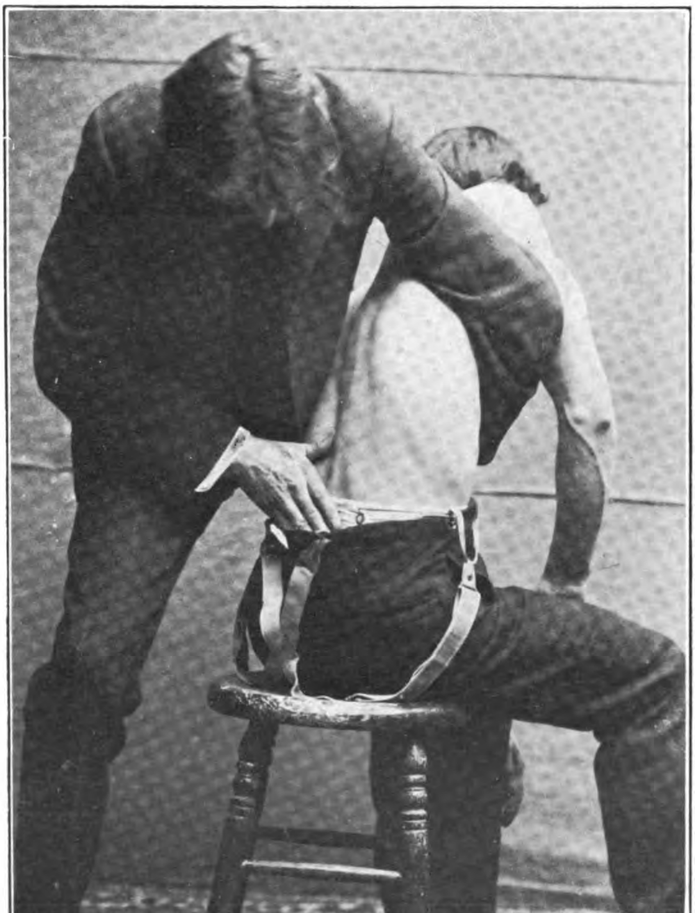


FIG. 198. Leverage applied to a lateral subluxation in the lower dorsal region.

tained as when counter extension is given by two men pulling at the head and feet of the patient, while a third one devotes his attention to forcing the vertebral spine into place. When the patient is short and heavily muscled, it is impossible to execute this movement satisfactorily.

Lateral Subluxation—Lower Dorsal.—A lateral lesion of the ninth, tenth or eleventh dorsal is more easily handled than those higher up, because the physician can grasp the patient in a much more satisfactory manner. Fig. 198 illustrates the method.

The series of movements is always the same as already described, that is, lateral flexion or "exaggeration," anterior flexion, then lateral flexion toward the lesion, as illustrated by the cut.

With this same position, other forms of subluxation in the lower dorsal and lumbar regions can be corrected.

A Depressed Spine.—Slight depression of a dorsal spine with sensitiveness over it, that is, between its apex and the spine below, indicates that the muscles in that situation are sufficiently contracted to draw the spine of the upper vertebra downward. The depressed spine indicates that the body of the vertebra is slightly tipped backward and downward. See chapter on Subluxations.

To reduce this lesion, a flexion of the spinal column as far as the vertebra below the lesion is made anteriorly. If the depressed spine is any one of the upper six dorsal, use the pull of the splenius capitis et colli, i. e., flex the head and neck as in Fig. 174. The physician's right hand is placed on the spine of the vertebra below the subluxation, thus allowing all the force of the movement to terminate in a pull on the muscles between this vertebra and the depressed spine. This same principle can be applied to all portions of the spinal column.

When individual spines are prominent and sensitiveness is found above the process instead of below, we have a condition the reverse of that just described. Its treatment is similar to that of the preceding, except that by changing the position of the right hand to rest upon the prominent spine, our leverage affects the contracted muscles above the spine.

Kyphosis—Pott's Disease.—Whenever a "knuckle" is found in the spine, inquire carefully as to the possibility of direct injury, predisposition to tuberculosis, etc. Pott's

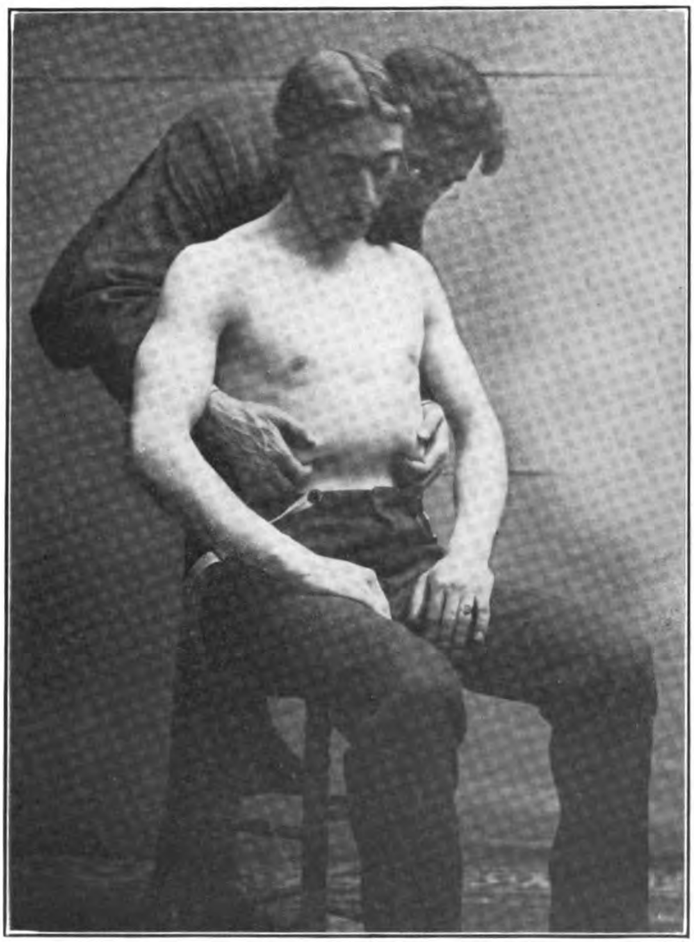


Fig. 199. Spreading the lower ribs and stretching the diaphragm.

disease of the spinal column may cause prominence of a single vertebral spine. As other vertebrae are affected, a kyphosis is developed.

Rib Subluxations.—Rib subluxations present many difficulties to the osteopath. The methods used in their reduction are as varied as can well be imagined. A few of the most useful and direct are given here.

In Fig. 199 the physician is applying a method of spreading the lower ribs. When the tenth rib sinks under the ninth and there is a general jamming of the four lower ribs together, the physician stands behind the patient who raises his hands above his head to spread the lower ribs by means of the latissimus dorsi. While the hands are elevated, the physician grasps the anterior extremities of the ribs and holds them up while the patient lowers his hands to his thighs. Such a movement as this will replace the ribs in their right relations, but a flexion of the patient's body will undo the work. Continual well directed treatment and voluntary exercise are needed to bring them to place and hold them there.

The four lower ribs can be separated and the antero-posterior diameter of the thorax increased by the method illustrated in Fig. 200.

The left hand lifts on the angles of the depressed ribs while the patient's arm is extended beyond his head, thus making use of the leverage gained through the attachment of the latissimus dorsi. This movement increases the right and left hypochondriacal spaces.

The position of an individual rib is affected by the contraction of the intercostal muscles above and below it. The spacing determines whether the rib is elevated or depressed. The width of an intercostal space will not be the same between the angles and anterior extremities. This is caused by the fact that the head of the rib is fixed so that it cannot move up or down. The movement which takes place between the head of the rib and the vertebra

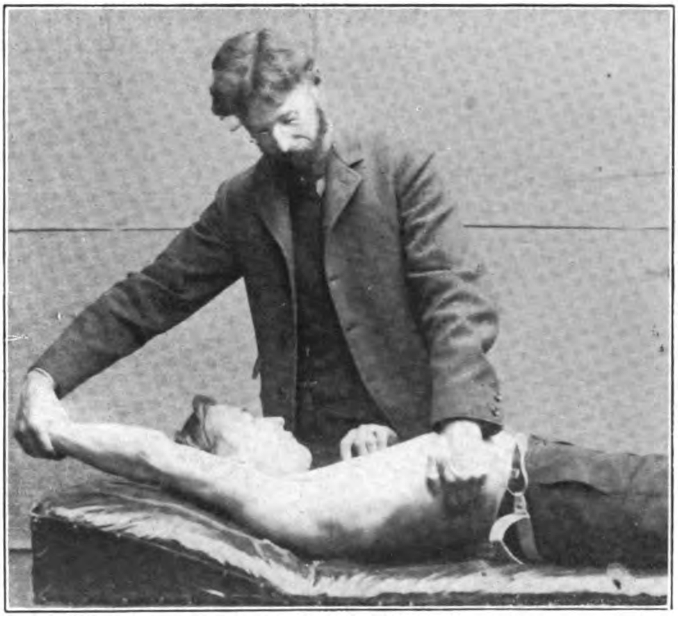


FIG. 200. Spreading the lower ribs by using the latissimus dorsi.

is a slight rotation. The costo-transverse articulation allows a slight gliding of the articular facet of the rib upon that of the transverse processes. As an example, take the fifth rib, when the space between it and the fourth rib is lessened by the contraction of the fourth intercostals. The lower margin of the rib becomes prominent because the rib is twisted when raised. The anterior extremity is depressed, making the fourth intercostal space wider anteriorly. Palpation of this rib in this condition will show a prominent angle with corresponding depression of the anterior extremity. When the rib is depressed at the angle, its anterior extremity will be prominent.

Palpation is the only method of discovering these subluxations. To reduce them, the same principle we applied to reduction of vertebral subluxations must be applied here, i. e., the relaxation of the contracted muscles.

The tendency in asthmatic and bronchitic patients is to cause elevation of the ribs, thus developing a barrel-shaped chest. When all the intercostal muscles act equally, the ribs are equally spaced, but in a case of bronchitis, some local portion of the bronchial tubing is especially

FIG. 201. First position to reduce a subluxated fifth rib.

irritated. From this area, irritant impulses reach the spinal center with which it is most closely associated. The intercostal muscles in direct relation with this center receive a greater number of impulses, hence, contract more vigorously. A strain or blow might cause the same result.

FIG. 202. Second position to reduce a subluxated fifth rib.

To bring this fifth rib down to its proper position, the physician may stand behind his patient, as is illustrated by Fig. 201. His left hand grasps the patient's right elbow and pushes it above the shoulder, thus causing the muscles to lift the ribs. This movement will pull on all the ribs of the right side; and tend to equalize the spacing. The physician places his left knee directly over the angle of the fifth rib, his right hand on the anterior extremities of the fifth, sixth and seventh ribs, the middle finger of this hand being applied against the lower margin of the fifth rib. The rib being now in right relation with its fellows, the critical period of the movement is when relaxation is allowed by lowering the arm. The knee above and over the angle, pressing forward and downward, while the middle finger of the right hand prevents depression of the anterior extremity. This leverage forces the rib to retain right relations with its fellow in relaxation of the chest. The termination of the movement is illustrated by Fig. 202.

A general depression of all the angles of the ribs causes their superior margins to be prominent. A flat chest is the result. This condition frequently follows pneumonia or some disease which causes the patient to lie on the back during a long period of weakness.

When a single depressed rib is found, it usually has been caused by a strain which has weakened the intercostal muscles in the space above it. Treat it while standing in front of the patient. Place the middle finger of the left hand under the angle. The patient's right elbow may rest against the physician's abdomen. Pressure made on the elbow forces the scapula back and brings into action the serratus magnus which lifts the ribs. Ask the patient to inspire and this will raise all the ribs. When relaxation comes with expiration, lift the angle of the rib forcefully, and it will regain its proper position. Fig. 203 illustrates this movement. Some osteopaths grasp the

FIG. 203. The position of the fingers below the angle of a depressed rib.

patient's right wrist and extend the arm first forward, then above the head, and back to the side, instead of placing the patient's elbow against the abdomen.

It will be noted that all these movements are based on the effects of muscular contraction and relaxation with resulting changes of the position of the structures to which they are attached.

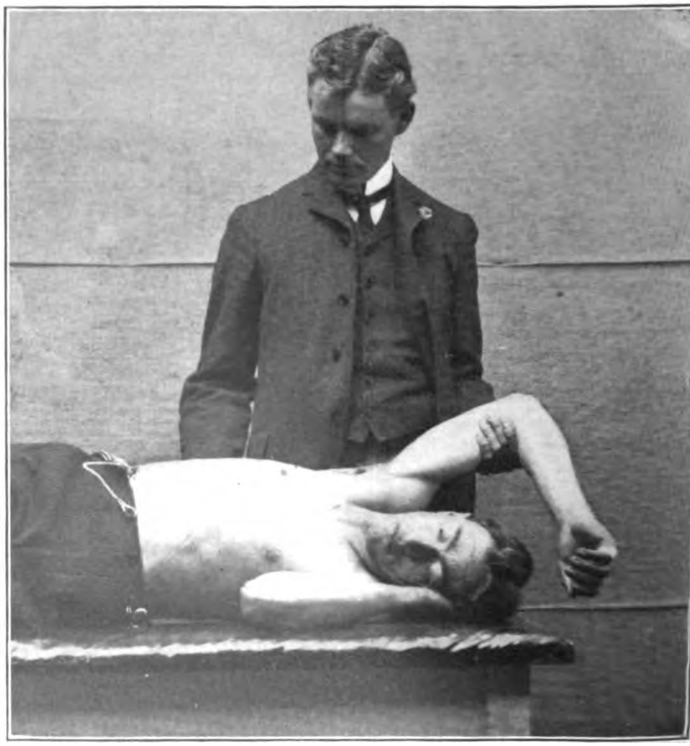


FIG. 204. First position in lifting a series of depressed lower ribs.

Figs. 204, 205 and 206 illustrate the method of raising and spreading the lower ribs. With the patient in this position, the physician can make extensive passive movements without much resistance. These movements are similar to that illustrated by Fig. 199.

When the ribs "droop" to a marked degree, there is a decided change in the shape of the diaphragm. The extent of the thoracic floor is lessened, and it may be that the structures passing through the diaphragm are detrimentally affected by it. The movement pictured in Fig. 199 is well calculated to spread the lower ribs and thereby increase respiratory capacity.

The first rib is so strongly held by the scalenus anticus that it practically never is depressed. It is, however, frequently elevated to such an extent that it infringes on structures around the first thoracic sympathetic ganglion, thus affecting heart action.

To depress the first rib to its proper position, it is necessary to take the extra contraction out of the scalenus

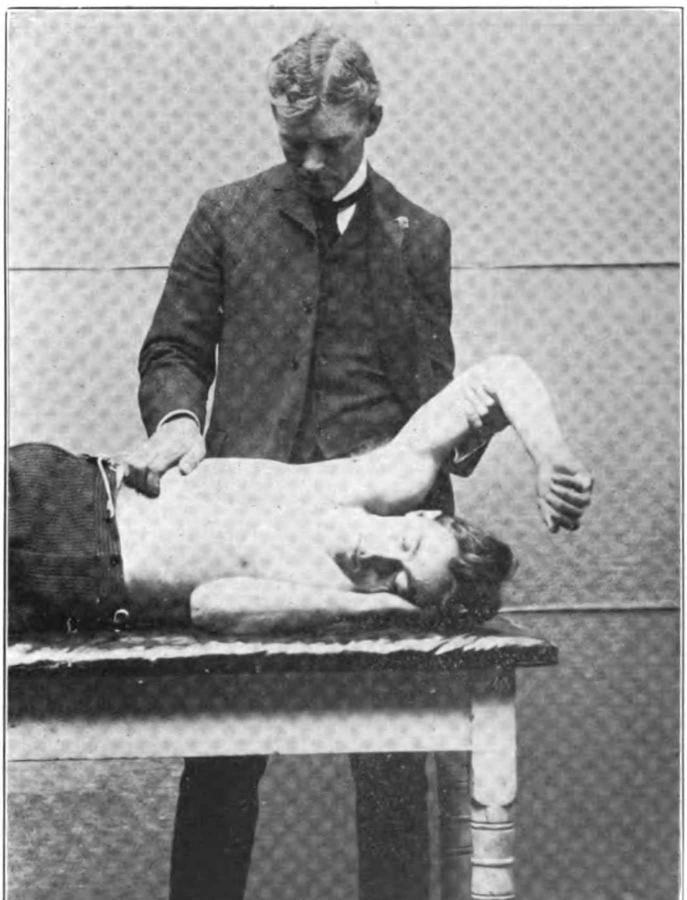


FIG. 205. Second position in lifting a series of depressed lower ribs.

anticus. This is done by making the first rib a fixed instead of a movable attachment. Fig. 218 illustrates the method of relaxing the scalenus anticus. The physician's thumb holds the first rib down while the muscle is stretched by forcing the patient's head directly to the opposite side. The scaleni muscles can be easily detected by placing one's fingers on the side of the neck near the base. They will be felt hardening during inspiration.

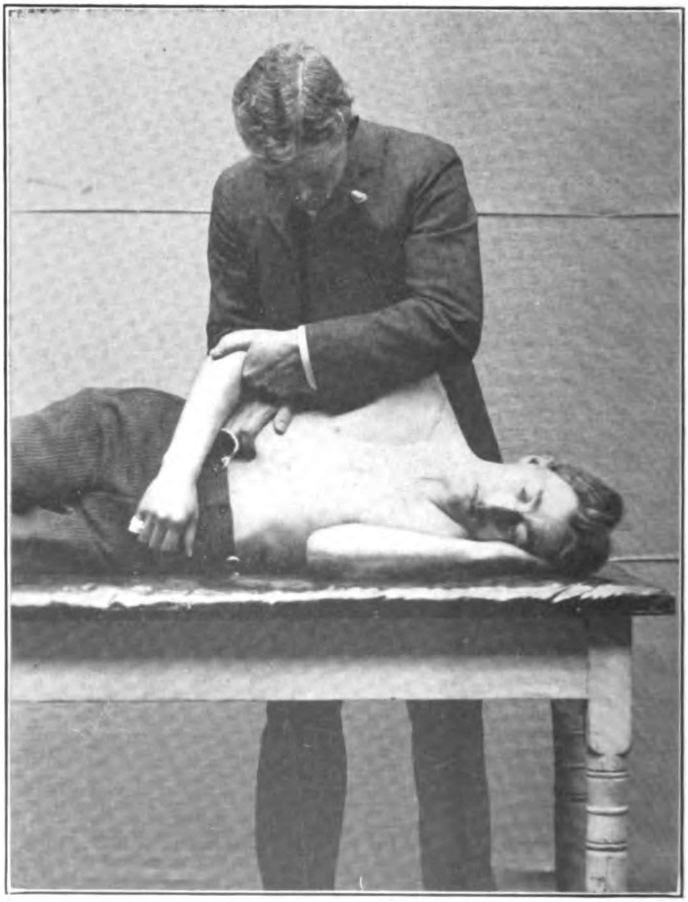


FIG. 206. The third position in lifting a series of depressed lower ribs.

Luxations of the Innominate Bones.—Examination of the innominate bones requires very close observation of all the factors concerned in tilting the pelvis and varying the length of the lower extremities.

The only way to determine the condition of the innominates is by palpation and mensuration. Have the patient stripped and sitting in a perfectly upright position on a level surface. Determine the condition of the lumbar portion of the spinal column. Have the patient's shoulders level. While the patient is in this position the relative prominence of the posterior superior iliac spines can be noted by palpation. Find the second sacral spine and note the relations of the iliac spines to it. They should all be on a level. See Fig. 91 in Chapter XIII. Palpate for sensitiveness around the iliac spines, crests of the ilia and crests of pubes. Measure from the anterior superior iliac spines to the adductor tubercles on the internal condyles of the femur, when the patient rests evenly in the dorsal position. This measurement is not entirely satisfactory, because any change in the thigh muscles or hip rotators may easily vary the measurements. The only fixed structures from which a reckoning can be made are the second sacral and posterior superior iliac spines. The relations between the sacrum and ilium are never greatly changed, therefore it requires the examiner to exclude practically all measurements which might be varied by muscular tension.

The posterior superior iliac spine may be less prominent than its fellow on the opposite side, or vice versa. There may not be enough upward or downward displacement to make a well recognized change in horizontal relations with the second sacral spine. This being the case, it is decidedly difficult to determine which side is normal and which is abnormal. Hyperaesthesia will have to be depended on to determine this point. The related subjective symptoms of the patient will decide which is the affected side.

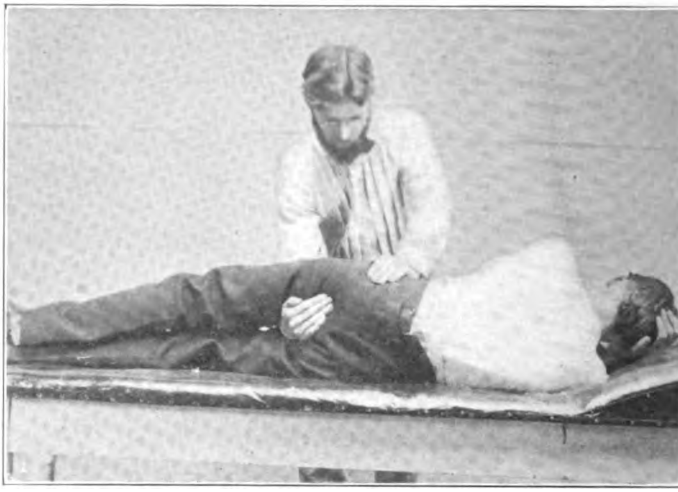


FIG. 207. Position for treatment of an upward and forward dislocation of the ilium.

The shock which is transmitted to this articulation in an accident usually strikes the tuber ischii from below, or posteriorly, or strikes the knee and the force is exerted against the ascetabulum. When the force is against the tuber ischii from below, or posteriorly, we have an upward displacement, or a twist, causing the posterior superior iliac spine to become more prominent. When the force strikes the ascetabulum by means of the femur, the twist is in the opposite direction, and the spine is less prominent.

Have the patient give details, if possible, concerning his position with reference to the direction of the force at the time of the accident, or if the condition appears to be due to other causes, strive to find out what they are.

Having determined the direction of the twist, the force of our manipulation must be made counter to that applied at the time of the accident. Since the hip joint is very movable, we cannot use the thigh as a stiff lever, therefore, our force must be applied to either the anterior or posterior surface of the tuber ischii and to the anterior or posterior superior spine of the ilium, i. e., push and pull, such as turning a wheel on its axle. This movement is illustrated in Fig. 207. The original force which this movement is trying to overcome was transmitted from the knee by the femur to the acetabulum, and resulted in a twist of the ilium which made the posterior superior spine less prominent than its fellow of the opposite side. In order to make this movement effectual, an assistant must make steady, even pressure over the articulation of the sacrum and fifth lumbar vertebra, i. e., overcome the tendency of the twisting movement to merely affect the movable sacro-vertebral, instead of the immovable sacro-iliac articulation.

By flexing the patient's thigh on to his abdomen, sufficient opportunity is given the physician to make pressure on the anterior surface of the tuber ischii, and pull forward on the posterior superior iliac spine, thus reversing the movement illustrated by Fig. 207.

Fig. 208 illustrates an effort to use the thigh as a lever to affect the sacro-iliac articulation when the posterior superior spine is prominent. This is a dangerous movement, and should not be used. The force transmitted by the thigh as a lever will not reach the joint desired, and will only result in straining the ilio-femoral ligament.

A sacro-iliac subluxation is difficult to correct, because the joint is practically without normal movement. The pelvis tends always to resist any appreciable movement in its joints, therefore the physician must devise ways of securing leverage to directly affect these joints without transmitting his corrective leverage through the very movable sacro-vertebral joint above or the hip joint below. This is a difficult condition to fulfill.

Anterior Rotation of the Ilium.—When the ilium is rotated forward, the posterior superior spinous process is less prominent than its fellow of the opposite side. This condition can be met by having the patient prone on an unyielding surface, slightly padded so as not to bruise the anterior superior spine of the ilium. Since the twist

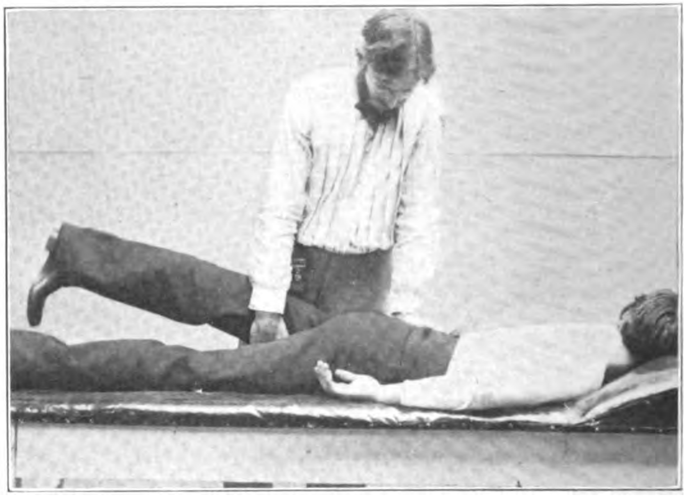


FIG. 208. A dangerous method of applying force to the sacro-iliac articulation.

FIG. 209. To correct anterior rotation of the ilium. Hard padding under the anterior superior spine of the ilium. Sudden, heavy, downward pressure on the sacrum between its first spinous process and the iliac spine, on the lesion side.

may be considered as an ilium rotated forward or the sacrum rotated backward, we may meet the conditions necessary for correction by making sudden pressure on the sacrum at a point between the first sacral spine and the crest of the ilium. This point lies sufficiently above the axis of rotation in the sacro-iliac articulation to give the operator some leverage to assist in securing reduction of the subluxation. The operator should use the hypothenar eminence of one hand, reinforced by the other hand, to make contact with the proper area on the back of the sacrum. The pressure must be exerted in a direction parallel with the iliac crest. After contact has been made with the hand the operator should prepare to deliver a sudden forceful pressure, as though he was trying to compress a very stiff spring which would not show any compression without throwing his weight on it. It may be necessary to increase the operator's advantage by putting a special pad under the anterior superior spine of the ilium so as to eliminate any support by the soft tissues of the abdomen. A further advantage may be gained by allowing

FIG. 210. To correct anterior rotation of the ilium. Flex thigh, on the lesion side, onto the abdomen. Use padded edge of operating table to support the sacrum at point between first sacral spine and spine of the ilium, while a sudden, heavy downward rotating pressure is made on the thigh and lesioned ilium.

the patient's leg, on the side of the lesion, to hang off the table so as to be at a right angle to the spinal column. This tends to tilt the pelvis backward and thus permit a greater downward movement in response to the sudden pressure. Sometimes it is advisable to use several partial applications of the pressure before the final corrective effort, without removing the contact hand. This tends to permit the patient to relax by taking away the feeling that protective resistance must be made. The operator must create and recognize the psychological moment for the application of the corrective movement.

The principle underlying the operation just described can be applied if the patient lies on his back. The leg on the lesion side should be flexed on the thigh and the thigh on the abdomen, thus tilting the pelvis backward. By placing the pelvis so that the ilium on the lesion side is just off the padded edge of the table, the operator can place his chest against the flexed leg and thigh while his hands rest on the opposite anterior superior spines of the ilia. A sudden downward pressure, coordinated with an attempt to spread the ilia apart, will be met by the resistance of the padded edge of the table against the side of the sacrum, between its first spinous process and the iliac crest. These movements have the advantage of applying corrective force without having any of that force dissipated by passing it through a movable joint before reaching the intended point of application. This is a very important factor if the patient is anaesthetized.

Posterior Rotation of the Ilium.—When the posterior superior spine of one of the ilia is apparently too prominent, care should be taken to note whether the apparent prominence is not due to a rotation and tilting of the pelvis in its relation to the spinal column. Since the flexion of the trunk on the pelvis is characteristic, in the sitting posture, and all people tend to rest themselves while standing by transmitting the weight of the body through one leg, continued maintenance of these positions changes the relation of the pelvis to the spinal column, i. e., causes a unilateral lumbo-sacral subluxation. Static errors are characterized by a compensatory tilt of the pelvis, hence all the factors that might produce such a condition must be taken into consideration. As previously noted, the one test of whether a subluxation exists is a comparison of the relative positions of the posterior superior spines with relation to the second sacral spine.

To correct a posterior rotation we use practically the same position and leverage required to correct a tilt of the pelvis on the spinal column. The patient should recline on the normal side, thus presenting the subluxation area to the operator. Force must be applied on the crest and side of the ilium close to the posterior superior spine, so as to rotate the ilium forward. The body must be rotated backward, thus tending to hold the sacrum from rotating idly with the ilium. These conditions can be fulfilled if the operator takes the position illustrated in Fig. 211, i. e., grasps the patient's elbow with his hand and presses his own elbow against the patient's shoulder, thus

FIG. 211. To correct posterior rotation of the ilium. Balance patient's body in the lateral recumbent position so that, by pushing the patient's shoulder backward the operator can make efficient pressure against the prominent iliac spine with his opposite forearm and thus secure a combination extension and torsion movement, concentrated in the sacro-iliac joint.

securing an advantageous hold for forcing the patient's body to rotate backward. The operator places his other forearm solidly against the crest of the ilium and gluteal tissues just above and external to the posterior iliac spine. By rocking the pelvis forward and the body backward a few times the patient will yield to the movement and the operator should select the moment of the patient's greatest relaxation to suddenly accentuate these opposing rotations. No attempt should be made to make more than a moderate rotation until it is felt that the patient is permitting the movement to be made without interposing any strong protective muscle tension. It is quite impossible to correct a subluxated ilium if the patient exerts any protective contraction of his muscles. The force of the rotation movement must go through the muscles without resistance, so as to reach the ligaments and other deep structures around the joint. The art of getting successfully by the muscular tension of the patient without exerting a force capable of producing trauma requires no small degree of skill. No great amount of force seems ever to be required if one has a fine sense of tissue resistance.

FIG. 212. Leverage and counter pressure to reduce a posterior iliac subluxation. Operator's left forearm makes pressure against posterior superior iliac spine. Same leverage as in Fig. 218, therefore dangerous.

By working skillfully in applying corrective force one learns to recognize a psychological moment when, by intensifying the force suddenly, the deep structures which are the object of our operation can receive the full benefit of our effort without interference from muscular contraction. The operation, at the climax of the application of the corrective force, is characterized by a popping sound.

The position here described serves in an almost identical manner for treating unilateral subluxations in the lumbar arthrodials or the lumbo-sacral articulation. The only change required is the shifting of the forearm from the ilium to some selected point higher on the crest and lumbar region. Since the lumbar arthrodials face nearly directly inward and outward, the forcing of the shoulders and pelvis in opposite directions tends to take out tension in the muscles controlling these joints and the force is evidently applied with the same angle of incidence to the surfaces of the lumbar arthrodials as we secure in the dorsal area of the spinal column by a sudden counter pressure and extension.

After a successful correction has been made of a case of subluxated innominate it is advisable to reinforce the pelvic ligaments by strapping the pelvis with surgeon's adhesive plaster. Plaster three inches wide serves very well. Apply the first strip so that its upper edge just reaches the posterior superior spine of the ilium. Pass the strip forward so that it comes just above the crease at the junction of the thigh and the abdomen, the upper margin of the strip covering the anterior superior spine of the ilium. The pubic hair must be shaved so that the ends of the adhesive strip may lap over the pubes. The second and third strips are brought around the body on lines similar to the first and overlapping each other about an inch. The strips should be put on tightly so as to bind the pelvis and give the patient a sense of security and comfort. The strips may be left on for ten days, then a series of treatments of a tonic character which will serve to strengthen the tissues is advisable. It may be necessary to repeat the corrective movements many times if the case is one of low vitality or has a static area which does not permit the pelvis to hold its normal relation to the spinal column.

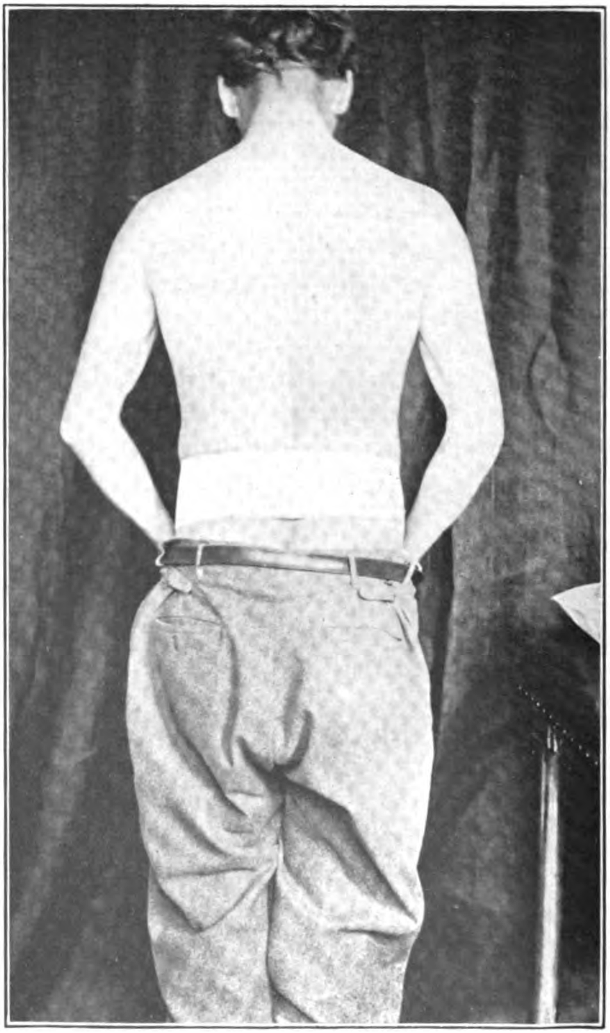


FIG. 213. Three strips of two and one-half-inch adhesive applied to reinforce the pelvic ligaments so as to retain a subluxated ilium in position after correction.

CHAPTER XXII.

TREATMENT OF THE CERVICAL REGION.

The treatment of the clavicle must be considered here, because its position so frequently interferes with the drainage of the tissues of the neck. When it is held down too closely to the first rib, by shortening of the subclavius muscle, it is quite sure to affect venous circulation in the head and neck.

To Raise the Clavicle.—To raise it place the right thumb on the first rib as illustrated by Fig. 214, then carry the patient's left forearm across his face above the head as in Fig. 215. Then as far outward as the physician's arm. This movement causes the clavicle to press down on the physician's thumb, where it rests on the first rib, and thus stretches the subclavius.

Subluxation of the Clavicle.—Articulations, such as the sterno-clavicular and acromio-clavicular, which depend entirely on their ligaments to keep them together and to limit their motion, cannot be retained in place if their ligaments have been injured. If the ligaments of the sterno-clavicular joint become relaxed, the pull of the sterno-cleido-mastoid lifts it upward. Slight irritation of the pneumogastric nerve may be occasioned by this change of position.

Preparatory Treatment of the Neck—Trapezius.—The preparatory treatment of the neck consists in movements to relax the various groups of muscles. Fig. 216 illustrates the method of relaxing the cervical portion of the trapezius. One hand on the shoulder holds it firmly down, while

FIG. 214. First position to raise the clavicle.

the other hand forces the head as far as possible in the opposite direction. Relax the opposite muscle in a similar manner.

Sterno-cleido-mastoid.—Next, relax the sterno-cleido-mastoid by separating its attachments as far as possible, as in Fig. 217, also by direct manipulation. Observe whether both muscles will relax equally. These large muscles are frequently found unevenly contracted. Since the spinal accessory nerves control these muscles, any contraction should lead the physician to examine all parts in connection with them. A reflex from the laryngeal branches as well as pneumogastric branches might account for it.

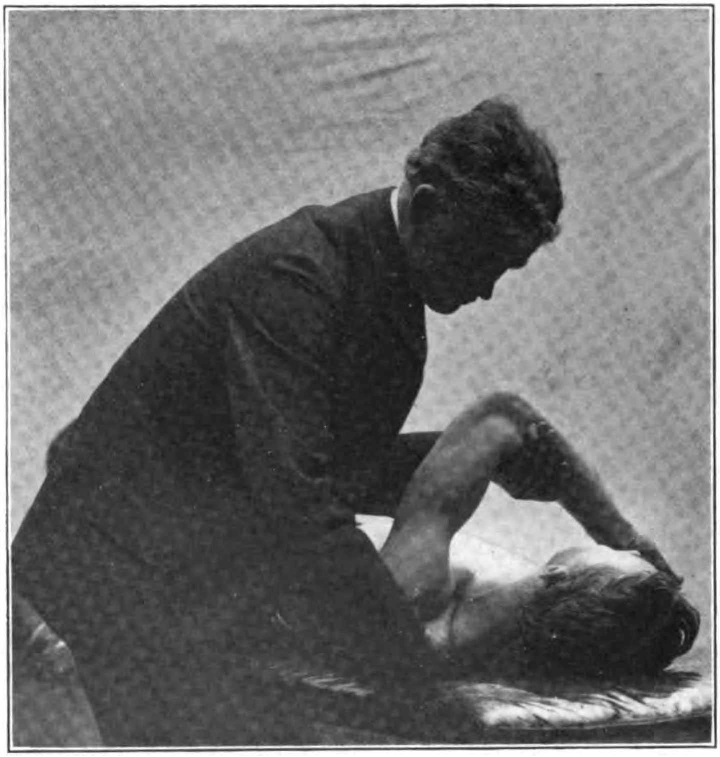


FIG. 215. Second position to raise the clavicle.

Scaleni.—The scaleni muscles should be treated as already mentioned in Chap. XXI. See Fig. 218.

Splenius Capitis et Colli.—Fig. 219 illustrates a method of stretching the ligamentum nuchae, as well as all the extensor muscles on the back of the neck. This may be modified by forcing the chin backward with one hand, while the other flexes the head as sharply as possible. This stretches the muscles and ligaments on the posterior portion of the occipital-atlantal and axial articulations. The retraction of the chin governs the amount of stretching exerted by the flexion.

FIG. 216. Relaxation of the cervical fibres of the trapezius.

Extension.—Direct extension of the neck makes an equal pull on all the vertebrae. When the patient's feet are anchored, the force of the pull is felt in the weakest portions of the spinal column. The average patient requiring this treatment enjoys a delicious stimulation after relaxation of the extension. A few who are extremely nervous may give a bad reaction. The influx of blood in the spinal cord is highly beneficial to those who have sufficient vaso-motor tone to hold it there, but those who lack this tone will feel faint or even absolutely lose consciousness. Simply allowing them to rest on the table until the vascular system reacts, will enable them to reap the full benefit of the treatment. The extension should be made with absolute steadiness. The relaxation period is usually the one in which any vaso-motor phenomena are noted.

FIG. 217. Relaxation of the sterno-cleido-mastoid.

The tension should be lessened very slowly in all cases. Fig. 220 shows the position of the physician's hand.

Rotation.—The following movement is one for which long practice is required, in order to get anything like a successful result from its use. It consists in grasping the patient's neck with the left hand as in Fig. 221. The patient's head rests against and slightly to the right of the physician's forearm. The right hand grasps the chin while the forearm rests firmly against the patient's head. The object is to hold the neck and head rigid above the point grasped by the thumb and fingers of the left hand. While holding the head and neck rigid, they are moved so as to force circumduction in the joint below the grasp of the left hand. After each circumduction the left hand is shifted the depth of one vertebra nearer the head. Thus all the intervertebral articulations in the cervical region are relaxed

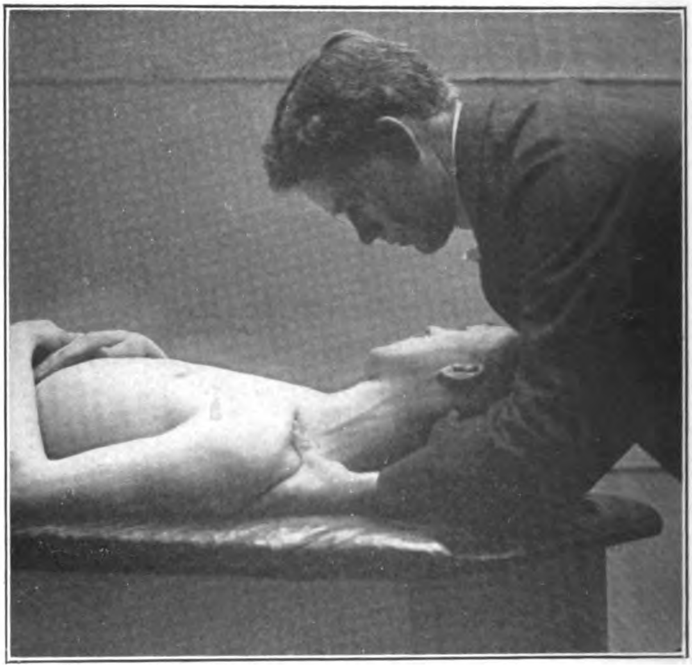


FIG. 218. Relaxation of the scaleni by depressing the first rib.

and specific work on a definite articulation can be done more easily.

The Hyoid Bone.—Work on the anterior portion of the neck consists in affecting the condition of groups of muscles forming the floor of the mouth and extrinsic muscles of the larynx.

The Hyoid bone is the movable part which can be grasped by the physician's fingers. Drawing it downward and to the right, as in Fig. 222, relaxes the stylo-hyoid and posterior belly of the digastric. A contractured condition of these muscles may affect the pneumogastric nerve.

Mylo-hyoid and Hyoglossus.—The mylo-hyoid and hyoglossus forming the floor of the mouth may be treated as in Fig. 223. When the maxillary glands are congested,

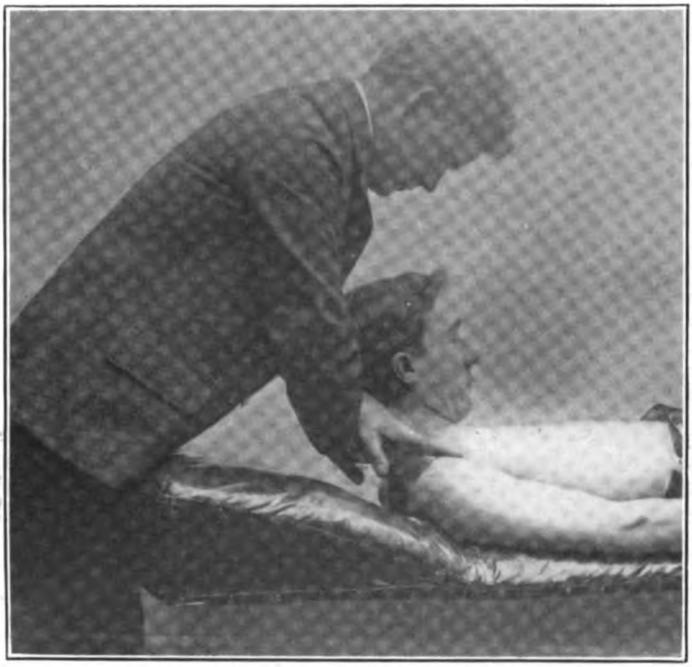


FIG. 219. Relaxation of the splenius capitis et colli.

it is necessary to relax these muscles. The physician's right hand grasps the hyoid bone, being careful to provide enough loose skin above the bone so that the force will not be exerted on the cutaneous tissues instead of the muscles underneath. After the hyoid bone is pulled downward, the tension of the mylo-hyoid is increased by using the pressure of the fingers of the left hand.

Sterno-thyroid and Sterno-hyoid.—The depressor muscles of the larynx and hyoid may be stretched by forcing these structures toward the angle of the jaw, while the free hand makes direct manipulation of the muscles. In all cases of congestion of the glands, mucous membranes or cellular tissues of the mouth, pharynx or larynx, these muscles should be relaxed if the position of the atlas has been corrected.

FIG. 220. Extension of the neck.

Intrinsic Muscles of the Larynx.—The intrinsic muscles of the larynx sometimes need attention. The crico-thyroid is the tuning muscle of the larynx. This may be demonstrated by grasping the thyroid cartilage with the thumb and forefinger of one hand, while the thumb and forefinger of the other hand grasps lightly the cricoid cartilage, as in Fig. 224. If the cartilages are slightly separated while the patient makes a vowel sound, the pitch of the voice will be perceptibly lowered. This is occasioned by relaxation of the vocal cords by separating the cartilages, which stretches the crico-thyroid. This muscle is innervated by the external branch of the superior laryngeal branch of the pneumogastric. The motor fibers of the superior laryngeal come from the spinal accessory, hence we find lesions in the cervical articulations, which are primary causes of laryngeal disorders.

FIG. 221. Circumduction of the neck to relax the muscles of the fifth layer.

The Atlas.—The atlas, on account of its position, freedom of movement, numerous muscular attachments, etc., is subject to frequent subluxation. Fig. 102 shows the normal relations of the mastoid process, transverse process of the atlas, and the angle of the jaw. Fig. 103 shows the abnormal relations of these various prominent points as they are frequently found by the osteopath. When the right transverse process is near the mastoid, the left is too close to the angle of the jaw, and vice versa.

In reducing this twist of the atlas, the physician should work on the side which shows the transverse process to be posterior. The same principle is applied in reducing this subluxation as was described in connection with the dorsal lateral subluxations. Fig. 225 illustrates "exaggeration." Fig. 226 shows lateral flexion to the left, while the physician's fingers make firm pressure back of the prominent transverse process, thus steadily taking

FIG. 222. Relaxation of the stylo-hyoid and posterior belly of the digastric.

advantage of all the relaxation gained in each portion of the movement. The termination of the movement is illustrated in Fig. 227. Sometimes the atlas slips into place with an audible "click," but more often the physician feels a "gritting" sensation as the articular surfaces rub over each other. When the subluxation of the atlas is reduced by this movement, it will hold its true position more firmly than will any other vertebral articulation which has been affected in a like manner. This is because the condyles of the occiput fit more deeply into the superior articulating surfaces of the atlas than is the case between articulating surfaces of pairs of vertebrae. Fig. 229 illustrates a

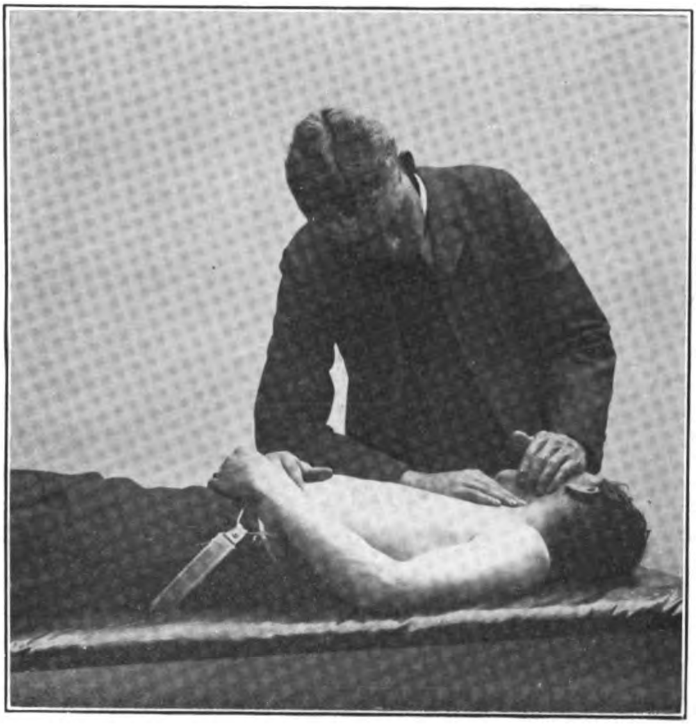


FIG. 223. Relaxation of the mylo-hyoid and hyo-glossus.

method of relaxing the muscular tension in the muscles which move the atlas. This method is used to force the atlas forward. It will be readily noted that by over-extending the head on the neck and using counter pressure on the posterior surface of the atlas the mechanical requirements for forcing the atlas forward are fulfilled. By moving the head up and down and from side to side, muscular tension will be sufficiently reduced to permit reduction of the subluxation.

Sixth Cervical.—The sixth cervical vertebra is especially difficult to treat. When the cervical muscles are well developed, it is obscured to the touch posteriorly, but the carotid tubercles anteriorly can be felt. It is not wise to

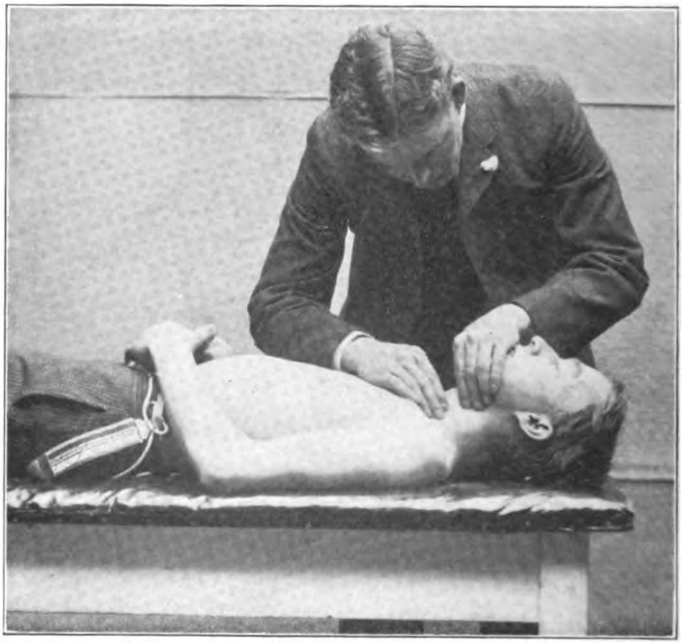


FIG. 224. Relaxation of the crico-thyroid.

exert much pressure upon bony structures from the anterior surface of the neck. There are so many glands, nerves, arteries, etc., lying over the transverse processes, that direct pressure is liable to injure them.

Fig. 228 illustrates a method of reducing a subluxation of the sixth cervical vertebra. The patient's chin rests in the physician's hands, which are placed on each side of the neck and near enough to the chin to support it by the little finger. The thumbs are used to affect the spine directly. The compression of the head and neck above the lesion, by both hands, keeps them rigid and all are moved together, first to exaggerate the lesion of the sixth, then anterior flexion is forced in the articulation affected, then lateral flexion with counter pressure by the thumb on the prominent side of the spine.

FIG. 225. Reduction of subluxation of the atlas, right transverse process too far posterior—exaggeration movement.

This movement can be applied to subluxations of the first and second dorsal.

General Principles Underlying Corrective Movements. —The same general principle, governing the correction of subluxations in other portions of the spinal column, is applicable in the cervical region, i. e., the movement, or series of movements, must be made so as to overcome the influence of a dominant muscle group. As we have pre-

FIG. 226. Reduction of subluxation of the atlas, lateral flexion.

viously noted, the position of an arthrodial joint is expressive of the relative tension of the muscles which activate it.

The Simplest Form of Correction.—The simplest form of corrective movement is extension, i. e., a direct pull in the long axis of the spinal column. This tends to put

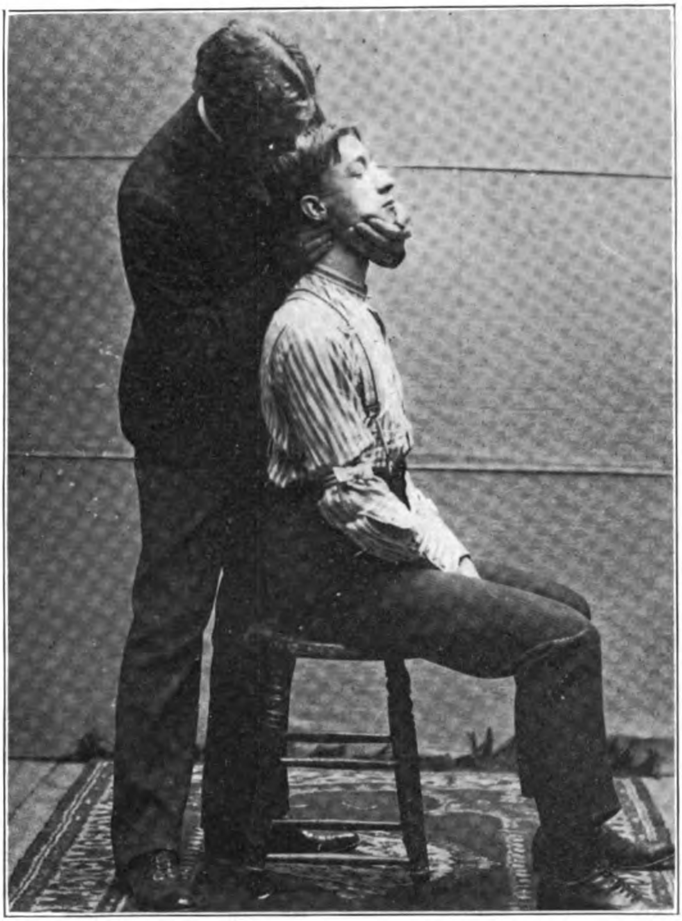


FIG. 227. Reduction of subluxation of the atlas, extension and counter pressure.

equal stress on all the joints, but, in reality, it will be felt most in any lesioned articulation. The lesioned articulation is the "weakest link" and therefore is most sensitive to the effect of the extension. Extension of this kind is grateful to most patients and when made by one who has a keen sense of tissue resistance, is practically without danger.

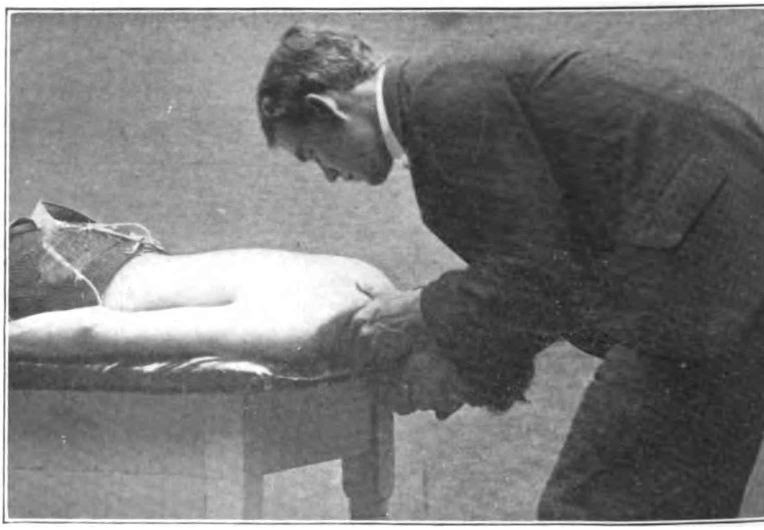


FIG. 228. Manner of holding the head and neck in order to reduce a subluxated sixth cervical vertebra.

Torsion and Counter Pressure.—Since the cervical region is normally very flexible, considerable skill is required, if an operator makes use of rotation and counter pressure for correction of joint lesions. The results secured by these means are very gratifying, but there is a larger element of danger than in the use of extension. The skillful operator must have a good knowledge of the anatomy of the region and a sense of tissue resistance. A torsion movement is a powerful lever and should be used very carefully. Although it is possible to describe the relative positions of the operator's hands and the general direction of the movements, it is not possible to convey to the reader an idea of the amount of force used, or the relative amount of resistance to be overcome. It is this variable element which makes the difference between success and failure in operative work. Normal muscle tone is equal to about six pounds' pull, hence if a patient voluntarily relaxes, or is placed in a position which does not

FIG. 229. Position for loosening structures around the atlas and forcing it forward.

FIG. 230. Movement to secure correction of a cervico-dorsal kyphosis. Many variations of this leverage may be used. The effectiveness of the movement depends on the fulcrum being properly applied.

require any exertion to overcome gravity, it is very evident that no great amount of force will be required to change the position of an arthrodial joint. If the operator will always bear in mind that great force is not required, there will be no accidents.

Rigidity.—When the patient holds his neck stiff and rigid, it is necessary to determine why it is so held before we attempt any movements to alter the condition. Disease of the vertebrae, or inflammation in the joints, is characterized by bilateral muscular tension, which is necessary to protect the structures from the strain occasioned by movement. No attempt should be made to relax this tension by manipulation. The usual case of "stiff neck" is unilateral. It consists of a unilateral muscular contraction. Usually the patient cannot turn the head toward the lesion, but can turn it in the opposite direction. This is the differential diagnostic point between a muscular and a ligamentous lesion. The ligamentous lesion does not permit rotation away from the lesion because such action stretches the ligament.

The Favorable Position for Corrective Movements.—As stated in a previous chapter, the position of election, for the use of rotation as a corrective movement, is extension. Some operators prefer to have the patient sitting and thus have the head balance its weight on the vertical vertebral column. It is then very easy to use the weight of the head as an assisting factor in securing the leverage necessary to correct slight rotation lesions. By allowing the patient's chin to rest in the operator's right or left hand, while the opposite hand supports the suboccipital region, Fig. 230, the head may be rotated and flexed, or extended, in such manner as desired by the operator, to correct a cervical subluxation. The hand, which supports the suboccipital region, is made to do double duty by acting through its lower border, as a fulcrum, over which the spinal column is bent, so as to accentuate the force of the corrective movement in a certain joint. The corrective rotation movement is always associated with a little flexion or extension, according to the character of the

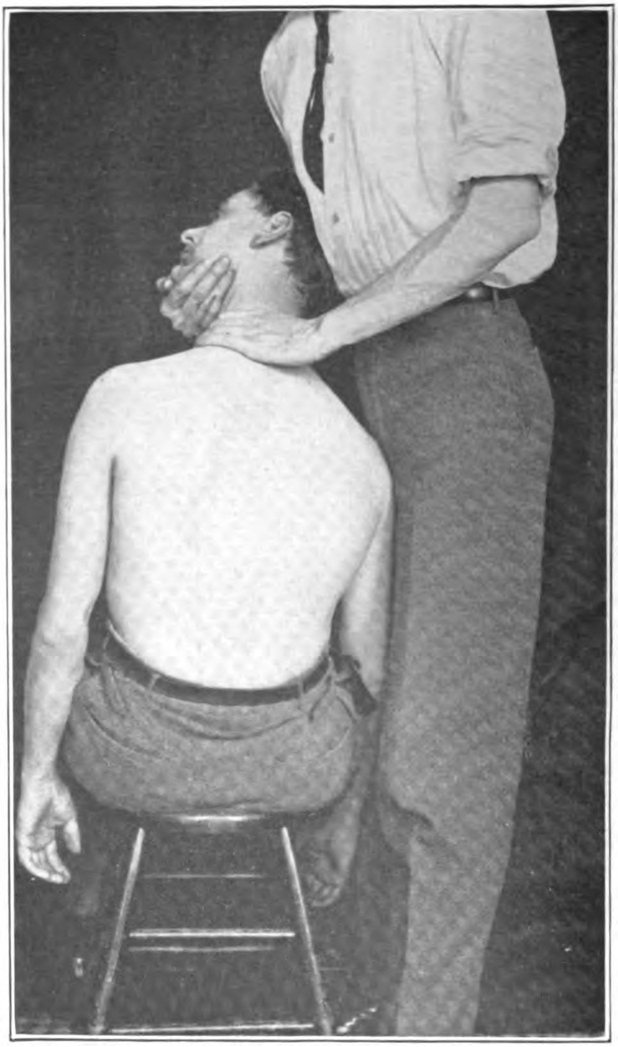


FIG. 231. The use of rotation to secure correction of cervical lesions.

lesion. The head is rocked gently in the direction required for the correction and when the rotation reaches a point where the resistance in the lesion is felt, Fig. 231, the op-

FIG. 232. Leverage and counter pressure applied to a reclining patient. Rotation is secured in the upper dorsal or any point in the cervical according to the location of the fulcrum.

erator strives to create a condition of relaxation by admonishing his patient not to resist, so that by a sudden but very slight increase in rotation the lesion will receive the full effect of the movement and yield to it. The yielding is usually accompanied by a clicking sound in the joint and a feeling of comfort. The range of voluntary movement in the articulation is increased and the patient usually experiences a feeling of added power.

The position of the fulcrum individualizes the character of a movement, therefore the shift of the depth of one vertebra either makes or mars the success of one's effort at correction. In order to use the fulcrum hand with more specificity, or force, the operator may rest the patient's chin in the bend of his elbow and then, by anchoring the head with his body, forearm and hand, Fig. 189, extend the patient's neck by a gentle lift. This extension frequently overcomes enough of the muscular tension to permit a slight additional rotation movement, with counter pressure, to correct the lesion.

Several illustrations are presented herewith, to show the manner of applying the osteopathic principle of correcting cervical subluxations by extension and torsion. The position of the patient, either lying or sitting, is purely arbitrary with the operator. The principles involved in the operation are the same in either position. Fig. 232 shows how torsion and counter pressure may be used when the patient is recumbent. The position of the right hand illustrates how the influence of the leverage may be carried into the upper dorsal region. Fig. 191 illustrates the application of the same principle when the patient is sitting. As we have previously stated, the position of the fulcrum is the part of any corrective movement, of this character, which localizes the effect. Since we are aiming to change the relations of the bony elements in a flexible lever, the spinal column, at a certain point, the fulcrum must be used with reference to the kind of movement characteristic at that point.

CHAPTER XXIII.

EXTREMITIES.

Treatment of the shoulder for synovial adhesions, ligamentous or muscular contractions, consists of movements made in the normal direction, but carried farther than the patient can do so voluntarily.

Diagnosis.—Test the extent of the movements, normal to the articulation, to ascertain whether the loss of movement is general in all directions or results from impairment of some special muscle or ligament.

Causes of Stiff Joints.—The history of the case will usually give an insight into its cause, progress, etc. The shoulder articulation is frequently stiffened by a sprain, dislocation, muscular and articular rheumatism. The simplest cases are those resulting from rest, necessitated by a broken clavicle or humerus.

The necessary rest after a dislocation gives the strained ligaments an opportunity to shorten and thicken. Movements should be frequently forced in such cases to prevent any synovial adhesions. The differentiation of cases of ankylosis is an important one. It is disheartening to physician and patient alike to find that after weeks of earnest effort no satisfactory results are obtained.

An article on "Ankylosis" by J. S. White, D. O., of Pasadena, Cal., published in Vol. V., No. IV., of The Osteopath, page 211, deserves quotation here because it notes so clearly the important points which the student ought to know. With his permission, it is quoted in full.

"**Ankylosis.**—When, from an injury, disease or other cause, a joint loses its function and becomes stiff, it is said to be ankylosed. This condition may be termed bony (complete) or fibrous (incomplete), true (intra-articular) or false (extra-articular) ankylosis."

"These are the terms used by Da Costa to define ankylosis, yet some claim that joint-stiffness caused by extra-articular contraction, or obstruction, is not ankylosis in the correct sense; but on looking at the derivation of the word (an(g)kulos—crooked or bent), it seems that the term ankylosis would be correct when applied to any form of restricted joint movement."

"The causes of ankylosis are many. First, let us consider those which result in complete and incomplete ankylosis. Inflammations in or around the joint, from whatever cause, if continued long enough for new tissue formation, will cause ankylosis. After aseptic inflammations we

FIG. 233. Manner of applying leverage to stretch the structures forming the scapulo-humeral articulation.

will most likely find fibrous, but when there is infection, bony ankylosis is more probable."

"This fibrous formation is the result of inflammation, for wherever there is inflammation there is an increase of tissue. Suppose a case of dislocation, with considerable

FIG. 234. A position for easy manipulation of the scapulo-humeral articulation.

contusion of the tissues around the joint, inflammation results, and embryonic tissue begins to form as a reparative process; the embryonic tissue sends out small processes, which start from new centers and spread through the gelatinous mass, in and around the joint, until a very irregular network is spread all around the joint surface, when the contraction process begins, the new tissue is formed into fibrous tissue, which unites the bones closely together; by cicatricial contraction the bones may be drawn so closely together that movement is almost impossible."

"Bony union of the joint surface follows fibrous ankylosis; it occurs when the bone itself is injured or diseased, and the surface of the bone eroded or broken. Ossification begins chiefly in those layers of fibrous tissue lying next to the bone."

"False or extra-articular ankylosis is caused by the contraction of tissues around the joint. These contractions, external to the joint, may be the result of many remote and obscure causes."

FIG. 235. Relaxation of the quadriceps extensor.

"First. Chronic contraction, which may be due to disease or obstruction to the nerve, at the center, or in its course to the muscles. As the normal action of muscles is dependent on normal nerve stimulus, a muscle may be affected in various ways by the stimulus of an over-irritated or inhibited nerve; excess of nerve stimulation will cause a pathological contraction, or there may be suspension of nerve stimulus and paralysis of muscles, allowing the opposing muscles to pull and hold the joint in a fixed position."

"Second. Contractions sufficient to cause permanent fixations may follow the healing of wounds, ulcers or abscesses. Active contraction, from any cause, if kept in that state any length of time, can cause the muscle to undergo a state of fibroid degeneration; tissue waste is replaced by fat and fibrous material. There is good evidence that, after a time, tissues which have not fulfilled their function lose the ability to do so, and the nutritive changes accompanying vital activity do not take place; the contiguous fibers and cells become adherent, agglutinated and united

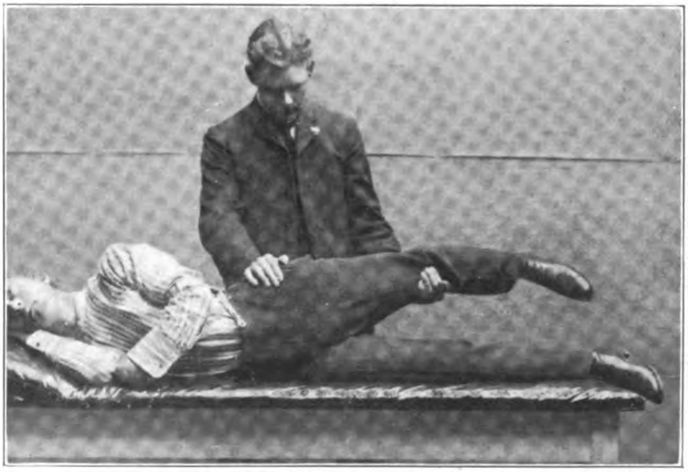


FIG. 236. Relaxation of the quadriceps extensor, sacro-vertebral articulation allowed to remain movable.

by exuded serum and waste material not carried away by the circulation, sluggish through inactivity of the muscles."

"The tendons and ligaments around the joint are thickened and hardened to the length the limb was held by the active contraction, but after the manner of all newly formed tissue, it continues to retract and draw the limb more out of its normal position."

"Third. Contractions may be the result of certain diseases (as rheumatism, gout, tuberculosis, syphilis, or any disease causing non-use of the joint or mal-nutrition of the controlling muscles."

"In examining an ankylosed joint, we must distinguish between bony and fibrous ankylosis and extra-articular contraction. A joint may be immovable, and yet not so because of bony ankylosis."

"Da Costa says that a joint immovable from fibrous ankylosis is distinguished from a joint immovable from bony ankylosis by the fact that, in the former, attempts at motion are productive of pain and subsequently of inflammation; therefore, pain on attempted motion excludes

FIG. 237. Relaxation of the adductor muscles of the thigh.

bony ankylosis from our diagnosis. An approximate idea of the extent of the stiffness may be obtained from a history of the case as to whether the disease has been severe in character and long in duration. The nerves of the joint should be examined at their point of exit from the spine and throughout their course to the joint."

"The same conditions, in general, which cause pain in a joint may cause ankylosis, whether that pain be due to local injury or referred from some other part. A contracted psoas muscle by irritation to the branches of the obturator nerve can cause pain, contraction and consequent stiffness of the knee joint."

"What can osteopathy do for this condition? For bony ankylosis nothing should be attempted, for the treatment would only result in discouragement and disappointment to both physician and patient; but if the joint is in an almost useless position, excision or osteotomy may be tried with good results. If the joint has become ankylosed through septic inflammation, it should not be forcibly broken up, because of the danger of re-infection of the

FIG. 238. Method of stretching the sciatic nerve.

whole joint, or other parts of the body, through the circulation."

"In cases of fibrous and extra-articular ankylosis osteopathy can refer to the most encouraging records, and is undoubtedly ahead of any other method of treatment. The main point in the treatment consists principally in making active the retarded circulation, gradually breaking up the adhesions, thoroughly relaxing all the muscles, and a stimulating treatment to the nerves."

"For extra-articular ankylosis the treatment is varied according to the cause. Osteopathy has a great mission to fill in finding and removing the primary cause of many cases of ankylosis. Hilton speaks of a case of diseased (tubercular) knee joint cured by ankylosis. True! the rest and ankylosis was nature's way of reducing the inflammation and disease when it had progressed so far. But the work of the osteopath is to look for the causes which made the knee joint "a point of least resistance" for the tubercle bacilli to multiply in. Examine the spine thoroughly, the sacro-iliac articulation and the hip for dislocations, which cause pain in the knee joint through irritation of the obturator nerve. But does pain alone in the joints lead to the condition known as a 'point of least resistance?' Pain prevents much movement in the joint, and remembering that continued non-use of muscles causes mal-nutrition, sluggish circulation and degeneration of the muscle, we may see how the joint may become a place for germs to multiply."

"Is it too long a course from simple pain to disease? Remember that pain is usually accompanied by contraction of muscle. Our treatment must be both preventive and curative."

"Following is a case of fibrous ankylosis and paralysis illustrating the efficiency of osteopathy to treat this class of sufferers. Vincent Pete, five years of age, had an ankylosed elbow as a result of a dislocation and break. The joint was attended to immediately after the accident by a regular physician, but was kept in the splints too long, which caused the fibrous ankylosis. The humerus was broken just above the condyles, and a small spicula of bone had protruded so that it interfered with those fibers of the median nerve which supply the flexor muscles of the thumb and forefinger to such a degree that the thumb and forefinger were completely paralyzed, as far as the flexor movements were concerned. The forearm was ankylosed almost at a right angle with the arm, and a very little movement could be made, and that with great pain; the muscles in the cervical region of the spine were sore and contracted. This was the condition of the patient when he came for treatment eight weeks after the accident. The improvement began with the first treatment, and in on month the arm was perfectly straight and movable in any direction, and he began to have power of movement in his finger and thumb; at the end of two months' treatment, his arm had returned to almost its usual strength and flexibility. I saw him a month later and the arm and

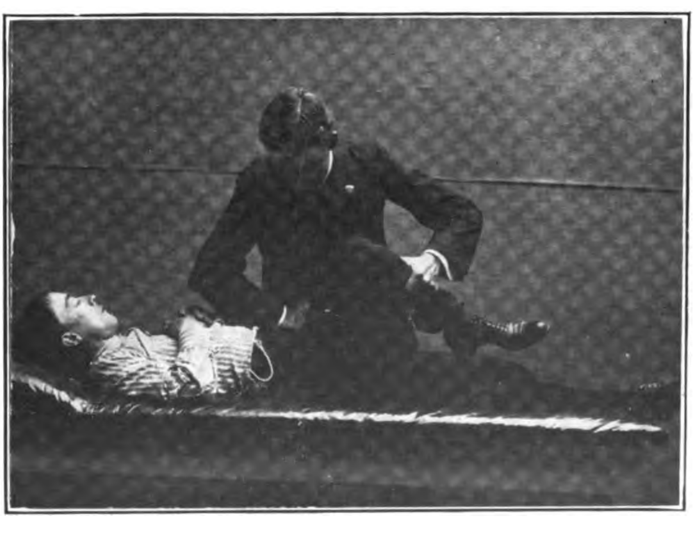


FIG. 239. Method of stretching the pyriformis muscle.

hand were perfectly normal. Contrast this case with one treated by mechanical rest, resulting in a fixed elbow joint, or perhaps a moderately useful joint following forcible breaking of adhesion under anaesthesia, which is a dangerous treatment, with very doubtful results, as the operation may have to be done over and over again before a useful joint is gained."

The Scapulo-humeral Articulation. — Fig. 233 illustrates a method of prying the head of the humerus out of the glenoid fossa, i. e., separating the articular surfaces. This movement can be used in cases of muscular rheumatism when complete abduction of the arm is impossible. It also allows an influx of fresh arterial blood.

When abducting the arm, the scapula must be held by the physician's hands. Place the fingers on the vertebral border of the scapula, while the axillary border is compressed by the thumb. By holding the scapula securely, the physician is sure that all the movement he forces is in the shoulder articulation, and not the gliding of the scapula on the thorax. The muscles of the arm may be relaxed by direct manipulation. The insertion of the deltoid is frequently tender. Any wasting of the muscles of the extremity should be carefully noted, so that the course of its

FIG. 240. Stretching the deep and superficial muscles on the back of the leg.

governing nerve may be searched for a point of compression.

Examination of the Brachial Plexus.—The principal motor divisions of the brachial plexus may be tested by simple movements made by the patient. The patient's gripping power is an index to the condition of the median nerve, and the muscles it innervates. Extension of the forearm, wrist and fingers made against resistance is an index of power in the musculo-spiral nerve tract. Abduction and adduction of the fingers are controlled by the ulnar nerve. Flexion of the forearm by the musculo-cutaneous.

Observe the condition of the first posterior interosseous muscle which forms the little muscular swelling when the thumb is adducted to the second metacarpal bone. If it is wasted there is evidence of nerve cell degeneration. This muscle should be well developed in thin hands, as well as in fat ones. If the wasting is unilateral, look for impingement on the ulnar nerve at some point in its course. If it is bilateral the cells in the spinal cord are probably at fault.

The deltoid is frequently painful as a result of pressure on the circumflex nerve. The pressure is usually at the point of exit from the vertebral canal. Relaxation of the structures around its point of exit usually gives relief.

Reduction of Dislocations by Traction.—The general method applied to dislocations of all joints of the extremities is direct traction. This is sometimes aided by pressure on the prominent point of the dislocated bone to aid it in slipping to its place. All of the dislocations of the humerus, subcoracoid, subclavicular, subglenoid and subspinous, can be reduced by using traction to stretch the muscles and ligaments of the joint to the extent that the head of the humerus will slip over the rim of the glenoid fossa. This traction may be made with the patient sitting, as in Fig. 234. The knee in the axilla springs the head of the humerus outward. The same treatment may be applied with the patient reclining. The physician should place a ball of woolen yarn in the axilla, then place his stockinged foot upon it, and make traction on the arm.

It is possible to apply the traction method in a simpler way. An ordinary canvas cot, with a hole cut in it, so that the arm can be put through while the patient rests easily on his side, should be elevated far enough from the floor to allow a six-pound weight to be attached to the wrist. This steady weight quickly relaxes the muscles and reduces the subluxation.

Traction always strains the muscles and causes some heat and swelling, therefore, care should be taken to prevent exudates and adhesions.

Reduction of Dislocations by Leverage.—Those who are expert in reducing shoulder dislocations, usually make use of a series of movements which exaggerate the lesion, i. e., make the head of the dislocated bone more prominent. In subcoracoid dislocations of the humerus, abduction of the arm causes exaggeration. The physician stands at the side of the patient, who is reclining on a hard surface. As abduction is made, the physician's free hand rests upon

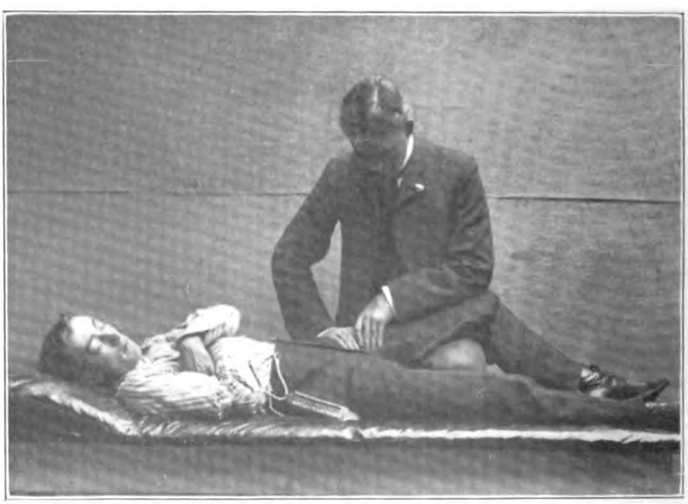


FIG. 241. Position for easy manipulation of the saphenous opening.

the head of the humerus. From the position of abduction the arm is carried inward and forward on a level with the shoulder, at the same time being rotated internally so that the external condyle will be in front of the patient's nose; then carry the arm downward to the side with a quick, vigorous movement, at the same time exerting pressure on the head of the bone as before mentioned. This series of movements must be made quickly, and the pressure on the head of the bone be most intense while the internal rotation and adduction are at the maximum .

This series of movements may be employed to break up synovial adhesions.

Elbow Dislocations.—Elbow dislocations are infrequent compared to those of ball and socket joints. The possible dislocations of the ulna are lateral and posterior. The former require traction, the latter is reduced by placing the bend of the patient's elbow over the physician's knee. Traction with one hand on the patient's wrist, while the other hand makes pressure on the olecranon, will force

FIG. 242. Position for easy manipulation of the popliteal space.

the ulna into place. This dislocation is usually complicated with fracture of the coronoid process.

The Radius.—The radius may be dislocated posteriorly or anteriorly. Lateral dislocations of either radius or ulna carry both bones together. A posterior dislocation of the radius can be reduced by flexion of the forearm, then extension with counter pressure on the prominent point of the head of the radius posteriorly. A forward dislocation requires supination of the arm and adduction of the hand, together with pressure on the anterior surface of the head of the radius.

Dislocations of the bones of the wrist or hand are reduced by traction or pressure.

Old Dislocations.—All dislocations, twenty-four hours old, require considerable relaxing treatment. The older they are, the harder they are to reduce. Nature begins to adapt herself to new conditions almost immediately. All the slack of muscles and ligaments is swiftly taken up. Those tissues most compressed by the new position of the bone are impoverished by the lack of nourishment. Thickenings and adhesions quickly form, so that old dislocations are not easily handled. Old dislocations are treated in the same manner as fresh ones, except that much relaxing and restoring of vitality is necessary.

Muscles of the Lower Extremity.—The muscles of the lower extremity may be relaxed, either by direct manipulation or by taking advantage of the movement of various joints to put them on a stretch. Direct manipulation is laborious and requires considerable time.

The muscles of the hip joint frequently contract sufficiently to make walking difficult. They contract as a result of strain, bruise, disease of the joint, subluxation of lumbar vertebrae, or luxation of the iliac bones. The subluxations irritate the nerves which innervate the muscles controlling the joint.

The movements hereafter outlined may be used for many different purposes, but they are applied here to specific groups of muscles. All the movements we have thus far outlined have been described according to the way they affect structure, not function.

FIG. 243. Position for reduction of subluxation of external semilunar cartilage of the knee.

FIG. 244. Showing position for producing free movement in the arthrodial articulation between upper ends of the fibula and tibia. External popliteal nerve lies behind the head of the fibula.

Quadriceps Extensor.—The quadriceps extensor of the thigh is innervated by the anterior crural nerve. In order to stretch this muscle the patient should lie face downward. The physician grasps the patient's ankle with the left hand, as in Fig. 235. The right hand holds the pelvis to the table. Lifting with the left hand puts the muscle on a tension which can be easily increased by flexing the knee. This movement stretches the fascia over Poupart's ligament and the saphenous opening.

Fig. 236 illustrates a movement similar to the preceding, but it is not so powerful. When the patient lies on the side, his back bends to the force of the movement of the leg. If the physician grips the ankle instead of the knee there is a great increase in the effect of the movement.

The Adductor Group.—The adductor group of thigh muscles, innervated by the obturator nerve, can be stretched as in Fig. 237. If there is any inflammation in the acetabulum, this movement will cause the patient great distress, because it stretches the teres ligament.

Dislocation of the Femur.—Dislocations of the hip joint are usually caused by the forcible spreading of the legs. The head of the femur is thus forced over the edge of the acetabulum at its dependent and weakest part, the cotyloid notch. It passes into the thyroid foramen, and if it remains there all the muscles are stretched very tightly, and no voluntary movement is possible. The direction the head takes is dependent on the direction of the force. If the knee points anteriorly at the time of the forced extreme abduction, the head, after entering the thyroid foramen, passes out of it posteriorly and takes a position over the spine of the ischium, great sciatic foramen or outer surface of the ilium, all owing to the vigorous pulling of the muscles. If the knee points posteriorly, the head of the femur travels to a position under the anterior inferior spine of the ilium.

FIG. 245. Radiograph of fractured olecranon process and exudate after removal of splints. Movement recovered after many weeks of gentle manipulation to promote absorption and break adhesions.

The movements made to reduce these subluxations take into consideration the fact that the head of the femur must be made to retrace its route in order to regain its proper position. For example, a dislocation posteriorly onto the spine of the ischium causes the toe to turn inward, and there is slight shortening of the leg. The physician takes a position as in Fig. 239 and carries the knee upward and inward. He forces the knee as far as possible across the median line, then flexes the thigh hard on the abdomen. This turns the head of the femur downward and inward. Remember that the head points always in the same direction as the internal condyle. Now, forcibly abduct and extend the thigh with a quick external rotation. These movements cannot be made successfully without a long course of preliminary relaxing treatments, that is, if the dislocation is an old one.

Direct traction may be used for all dislocations of the femur, just as for the shoulder, but the muscles are so strong that it is no small matter to overcome them, hence movements which take advantage of leverage are much more satisfactory.

The formula for any dislocation of the hip may be worked out by noting the position of the head of the femur and then carrying the internal condyle so as to make the head retrace its course. When shortening or lengthening of the leg is noted, make sure that the iliac bones are even. A half-inch difference in the length of the legs may easily be accounted for by the action of the hip muscles.

The pyriformis muscle may contract and compress the sciatic nerve in its course through the great sciatic foramen. Fig. 239 illustrates the movement to stretch the pyriformis. The physician holds the pelvis to the table by pressing on the anterior superior spine of the ilium. The thigh is then strongly adducted.

Stretching the Sciatic Nerves.—Sciatica is frequently successfully treated by relaxing the pyriformis, but the majority of cases require a stretching of the sciatic nerve,

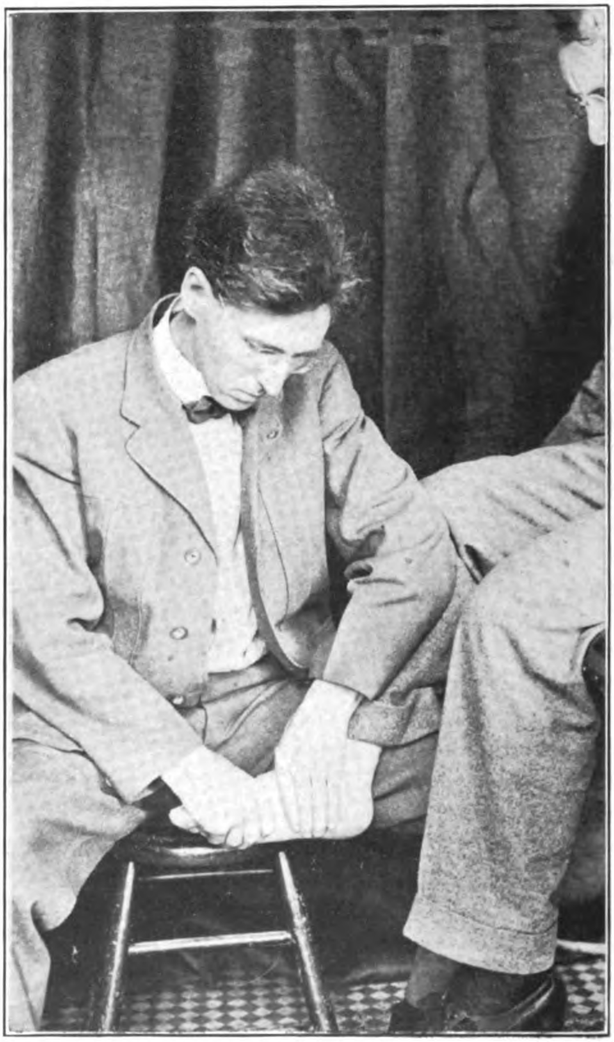


FIG. 246. Position for reducing tarsal subluxations.

which is performed as in Fig. 238. The physician has great leverage in this movement. It stretches all the flexor group on the back of the thigh.

The Calf Muscles.—The calf muscles sometimes contract and make it difficult for the patient to get the heel to the floor. Fig. 240 illustrates the method of applying leverage to the case.

Scientific Manipulation.—Every group of muscles in the body can be relaxed by stretching them, hence if the student will study their attachments and the effects of their normal contraction, a series of movements can be devised to suit the condition. Learn anatomy in a practical manner and a system of osteopathic movements will spring forth from the understanding mind of the student. The author has tried the plan of not demonstrating movements to students, but putting the whole attention to understanding the conditions in the patient which require treatment. A study of the mechanical difficulties presented and the comparison of these with the normal relations, leads the student to apply anatomical knowledge in treatment. If the student understands the case, that is, realizes the significance of the points found by the physical diagnosis, he can be depended upon to apply a rational method of treatment. As soon as the student makes a movement in a certain manner in order to copy his instructor, instead of basing it on his own understanding of the condition treated, he degenerates to mere empirical methods.

Saphenous Opening.—The circulation in the lower extremity is frequently affected on the venous side by tension at the saphenous opening. Enlargement of the superficial veins of the leg, above a point three or four inches above the ankle, denotes obstruction to free blood flow in the long saphenous vein. Abduction and tension of the thigh will stretch the fascia forming the saphenous opening, then place the thigh in a semi-flexed position, as in Fig. 241, to facilitate direct manipulation of the tissues forming this

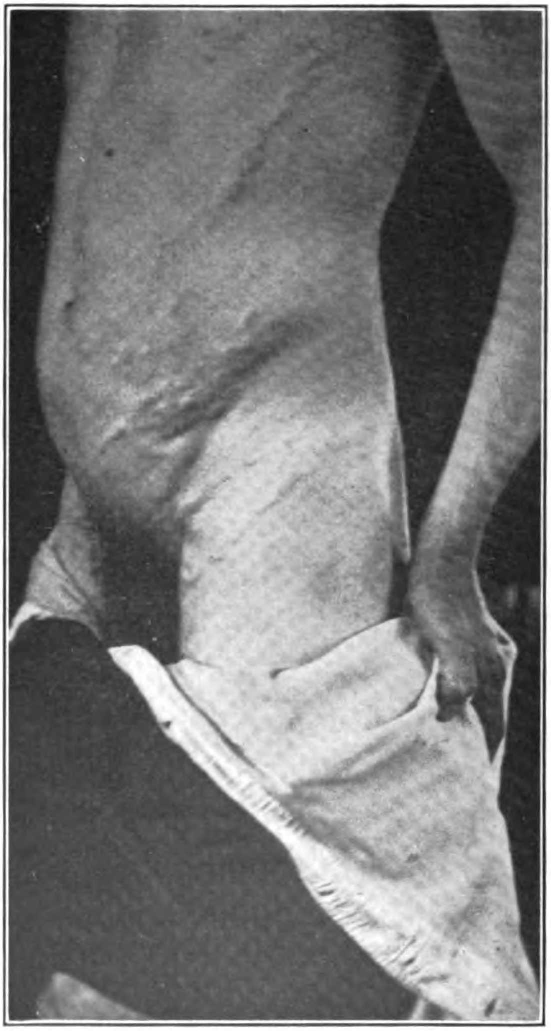


FIG. 247. Distension of veins due to tricuspid insufficiency. Varicose ulcers on both shins and under malleoli of both ankles were healed by strapping over the ulcers with strips of adhesive plaster.

opening. The deep and superficial veins of the leg have little or no communication above a point about the junction of the lower and middle third of the leg. This applies especially to the long saphenous vein. Varicose veins on the feet or ankles may be drained by both superficial and deep veins, therefore, their existence in these locations may be due to visceral causes, even when there is no obstruction to the saphenous opening.

Popliteal Space.—The popliteal space sometimes needs relaxation. This is performed by direct manipulation, as illustrated in Fig. 242. The position of the physician's hands in this illustration affect the upper portion of the popliteal space. By facing the patient the lower portion can be easily affected.

The Semilunar Cartilages of the Knee.—These cartilages, which serve to form cup-like depressions for the condyles of the femur to rest in, on the superior articular surface of the tibia, may become slightly displaced and hence act as wedges to limit motion in the joint. Since they normally move with the condyles, it is probable that some slight ligamentous strain is primarily the cause of the change in position of a semilunar cartilage. The external semilune is the one most frequently affected. The reason for this probably is due to the fact that the internal condyle of the femur is longer than the external, hence in a movement, such as pedaling a bicycle, the extension of the joint is made with the knees rather wide apart. This tends to strain the external lateral ligament. The cartilage slips slightly forward and prevents either flexion or extension. The joint remains in a semi-flexed position and is exquisitely painful. Some of these cases can be quickly relieved by having the patient sit, so that the operator can grasp the knee with both hands, as in Fig. 243. The operator's thumb makes careful pressure on the painful spot where the external semilune causes a little transverse ridge. By gently rotating the tibia and using a slight effort to slide the tibia on the condyles, without producing

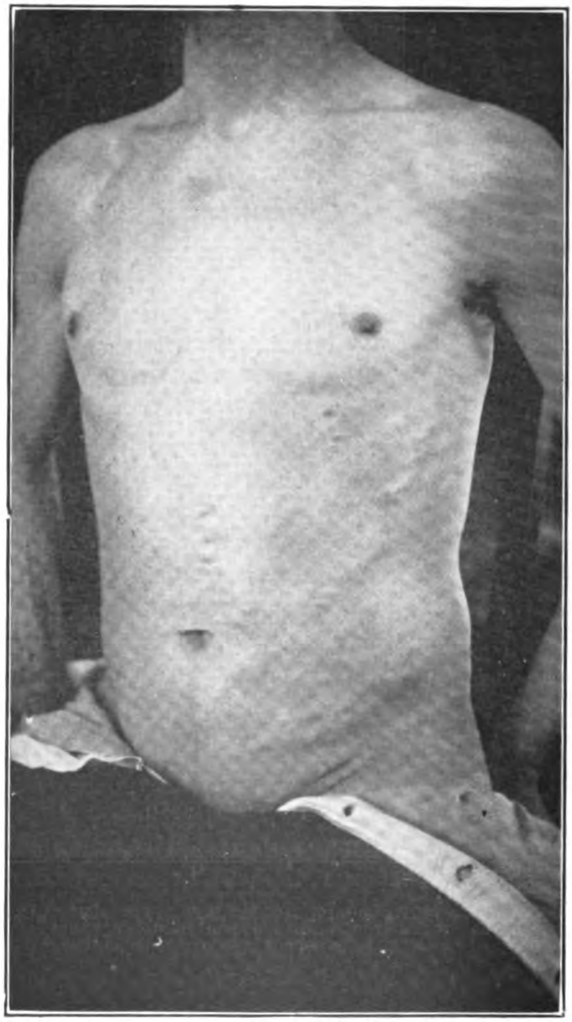


FIG. 248. Same case as the preceding illustration. No caput medusae present, thus showing that portal circulation is not seriously obstructed.

either flexion or extension, the semilune will tend to yield to the thumb pressure and resume its normal relations to the condyle. Since some swelling accompanies such an accident, it should not be expected that complete flexion, or extension, would be possible immediately after replacement of the semilune. Any trauma of a ligament is accompanied by the swelling incident to normal repair.

Paralysis of External Popliteal Nerve.—One of the most frequent forms of peripheral paralysis involves the Peroneal or External Popliteal nerve. Its position, with relation to the fibula, subjects it to possible pressure, when one knee is crossed over the other. It is also subject to injury when traction is made on the leg, for a considerable time, as is frequently done in cases of hip joint injury or fracture of the femur. Surgeons realize the danger of making traction below the knee joint, but there are still enough of these peripheral paralyses, due to this cause, to make it evident that not all physicians realize the danger. This form of peripheral paralysis is characterized by ankle drop. In cases of Peroneal paralysis due to pressure, recovery is nearly complete in a few weeks. This seems to show

FIG. 249. Illustration of typical varicose veins.

FIG. 250. Method of strapping with adhesive plaster to support varicose ulcer on the shin.

that a slight edema exists in the sheath of the nerve at the point which suffered the traumatic pressure. In those cases due to extension of the leg, recovery is always problematical, because the traumatic pressure may have been produced by a fold of fascia. This is especially the case when the anterior tibial nerve is the only branch of the Peroneal, paralyzed. These cases need to be treated by semi-flexing the knee, so that deep digital manipulation, of all the soft tissues of the knee, will hasten absorption of the edema. Judging by some of the cases we have seen, the patients would have been in more capable condition with bony deformities, due to fractures, than with the paralyses, resulting from the efforts to maintain reduction of the fractures. These paralyses are, however, unavoidable in some cases, but recovery would be more rapid and certain if intelligent manipulation was used almost from the beginning of the cases.

"Glucokinesis and Mobilisation."—Many efforts have been made to develop a method of treating fractures, that will not only insure a reasonably perfect union but will avoid the serious sequelae incident to the use of casts, splints and extension apparatus. No single method of treatment is applicable to all forms of fractures, but there are certain principles, underlying the art of manipulation, which are applicable in the treatment of certain forms of fractures. The use of a form of massage, by Dr. Just Lucas-Championniere, in the treatment of fractures, is a new development in the art of manipulation. He calls his method "glucokinesis," painless massage. It is so different from massage, as generally understood by masseurs, that none but physicians, who understand the phenomena in tissues involved in fracture, can use it intelligently. It consists in stroking the injured part very gently, in the direction of venous circulation and the muscle fibers. This stroking is rhythmical and continuous for about fifteen or twenty minutes. The stroking is so gentle as to seem quite ineffective. The first principle is: "Never be afraid of rubbing too gently, or of giving too small a dose of mobilisation; always fear that the massage is too heavy and the movement too great." The result of this stroking is the relief of pain in the injured part and a coincident relaxation of the muscles involved in the fracture. This relaxation of muscles allows replacement of the fragments. Mobilisation consists of minute "doses" of passive movement in all of the joints above and below a fracture. The "dose" should cause no pain in the limb. The application of Prof. Lucas-Championniere's methods has been excellently described by Dr. James B. Mennell in his work on The Treatment of Fractures by Mobilisation and Massage, MacMillan and Co.

Pain in the Legs and Feet.—Many cases complain of pain of variable character in the legs and feet. It is good practice to test the plantar arches in all such cases. Weakness of the longitudinal arch may not be evident except when the leg muscles are fatigued, therefore a plantar impression may not show any sagging. If no structural defect is apparent, it is safe to assume that weakness exists. The application of strips of adhesive, to parallel the suspected tendons, will give enough support to demonstrate whether the diagnosis is reasonably correct.

Tarsal ligaments may be strained, or a tarsal bone become subluxated. The pain, incident to these conditions, is very acute. Subluxations are usually reduced by passive movements, which merely tend to produce mobility in the tarsus as a whole. If this does not produce reduction, it will be necessary to use thumb pressure over the prominent painful spot and then flex and extend the tarsus with the other hand, so as to allow the pressure to become effective. In any case of weak arch, or subluxated tarsal bone, it is advisable to use some means of passive support until the acute phases are past. Some cases will recover completely under the influence of voluntary exercises, while others cannot get along without support.

Varicose Veins.—The pain incident to varicose veins may be very severe. The first thing to determine is whether the varicosity is due to local or general conditions, i. e., whether there is involvment of one group of veins in a single extremity, or a general back pressure in all the veins of the body, due to a lesion in the right auriculo-ventricular valves, or muscular insufficiency. The varicosity due to pregnancy is in a class of its own. The veins on the shin lie so close to the surface that a very slight abrasion causes a varicose ulcer. The weight of the column of blood, in the long saphenous vein, serves to break down the granulations by which healing tends to take place. In such cases, whether due to local or systemic conditions, it is best to furnish the vein an artificial support by strapping with strips of adhesive plaster directly over the ulcer and for a space of three inches on all sides of it. These strips should be about one inch wide and lapped on to each other about one-quarter inch, as in Fig. 250. This artificial support should be left in place three days, then be stripped off, the ulcer cleansed and fresh adhesive applied. The amount of exudate will decrease rapidly under this treatment. Previous to the first dressing, there should be no application of irritating antiseptics. The mechanical principle of supporting the wall of the vein is all that is necessary. The moisture of the ulcer will keep the adhesive from breaking the granulations as it is pulled off. As soon as the discharge from the ulcer ceases there is no necessity for removing the adhesive for many days. In the meantime such general help, as may be possible, should be given to overcome the conditions which predispose to a recurrence of the ulcer.

CHAPTER XXIV.

MANIPULATION FOR VASO-MOTOR NERVE EFFECTS.

There are times when the physician desires to affect the amount of blood in the tissues of the head. There may be congestion of the nasal, pharyngeal and laryngeal mucosa, as during a hard "cold." After manipulating to relax the muscles of the neck and overcome any effects these may have had on the position of the cervical vertebrae, it is well to try to cause vaso-constrictor action by stimulating nerve endings. Fig. 251 illustrates a method of stimulating deeply under the zygoma in the sigmoid notch of the inferior maxillary bone. When the patient opens his mouth, the physician places his finger over the depression below the zygoma and presses inward, at the same time making a vibratory movement of the finger. This affects the branches of Meckel's Ganglion and, through it, the nasal mucosa. It is a painful treatment, but the blood will often surge from the mucous tissues to the skin as a result of it.

About the same effect is secured by using the movement illustrated in Fig. 252. While the patient's mouth is open, the physician places his thumbs on the bridge of the nose, and his fingers at the angles of the jaw. The tips of the little and ring fingers are pressed into the depression caused by the forward movement of the condyle of the jaw on the eminentia articularis. The physician forces the mouth shut while the patient opposes. The position of the tips of the little and ring fingers prevents the easy slipping of the condyles into the glenoid fossa.

The sensory fibers around the condyle are intensely stimulated and frequently manifest it by spreading a flood of color over the face in front of the ear. This is also a painful stimulation. It is highly probable that all movements of this character which are painful secure results by causing activity of the dilator nerves to blood vessels in superficial tissues, thus depleting the blood in the congested area. A sharp pain may cause a sudden blanching, but it is followed by vaso-dilation.

If it is difficult for the patient to breathe through the nostrils, press on the nasal bones, first on the right side, then left, then make a heavy pressure over the junction of the nasal and frontal bone with one thumb above the other. This movement is very pleasant to the patient, ordinarily.

To carry off the venous blood, make a stroke from

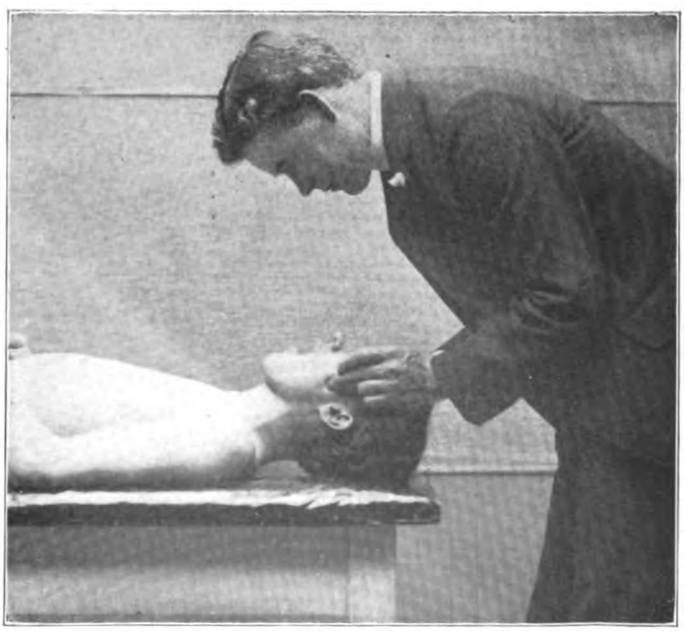


FIG. 251. Stimulation between the zygoma and the sigmoid notch of the inferior maxilla.

the inner canthus of the eye downward over the junction of the masseter muscle with the lower jaw, thence to the supraclavicular fossae.

The Fifth Cranial Nerve.—The fifth cranial nerve can be treated at its points of exit through the bones of the face. Fig. 253 illustrates the position of these points. A vibratory pressure over these points causes a dull but increasing pain. If the movement is made quickly and vigorously, there will be evidence of a reaction in a flushed appearance.

Inhibition of Suboccipital.—When there is a high blood pressure in the head and the patient is suffering with headache it is possible to give great relief by steadily inhibiting in the suboccipital fossae and temples, as illus-

FIG. 252. Stimulation by forcible closure of the mouth against resistance.

trated by Fig. 254. All nervous conditions are greatly reduced by this movement. The inhibition reduces the number of sensory impressions, and lessens the tension of blood vessels all over the body. This inhibitory movement should be used in cases of epilepsy and delirium tremens during the excitable stages. Have an assistant inhibit in the splanchnic area, thus causing a general reduction of blood pressure in the superficial and deep tissues of the body and extremities. The blood is thus drawn away from the head, and the patient becomes quiet.

To inhibit the transmission of impulses to the diaphragm by the phrenic nerves, pressure should be made as in Fig. 255. The physician's fingers compress the phrenic nerve against the scalenus anticus.

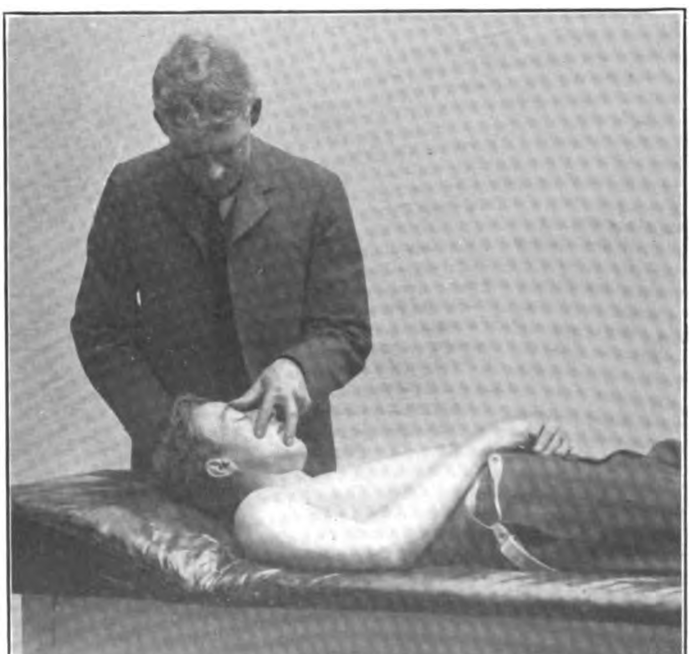


FIG. 253. Points of exit of divisions of the fifth cranial nerve.

The phrenic, pudic and pneumogastric are the only nerve trunks distributed in the body which can be easily compressed through soft tissue. Fig. 256 illustrates stimulation of the pneumogastric. The physician's fingers roll over the nerve trunk where it lies along the inner edge of the sterno-cleido-mastoid.

The general tendency of an osteopathic treatment, which aims to relax the extensor muscles of the neck and trunk, is to reduce blood pressure. Cases which are characterized by high blood pressure are greatly benefited by relaxation of muscle tension, by means of gentle leverage. The use of heavy pressure movements is contraindicated, because they might occasion involuntary resistance by the patient and thus suddenly raise blood pressure to a dangerous degree.

It is very probable that the extension and counter pressure movements we use to reduce subluxations, act also

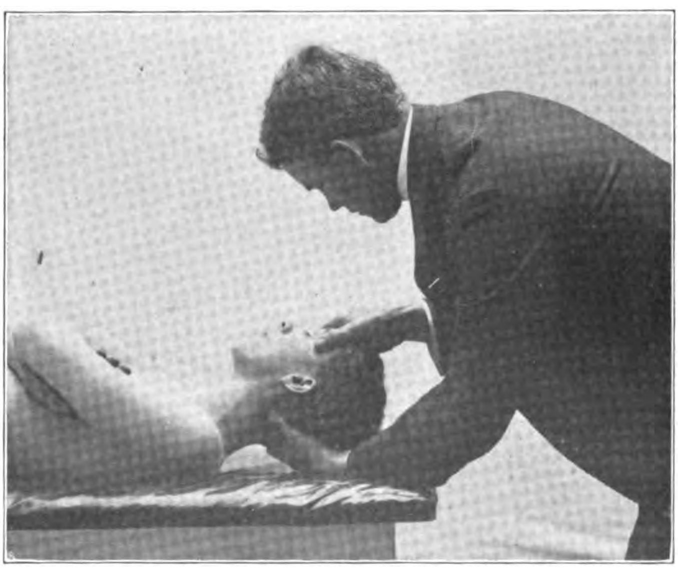


FIG. 254. Inhibition in the suboccipital fossa.

as factors in changing blood pressure in localized visceral areas.

Vaso-motor effects can be secured by various forms of stimulation applied to spinal areas. Counter irritation, cupping, heat or cold, concussion, or sudden pressure to

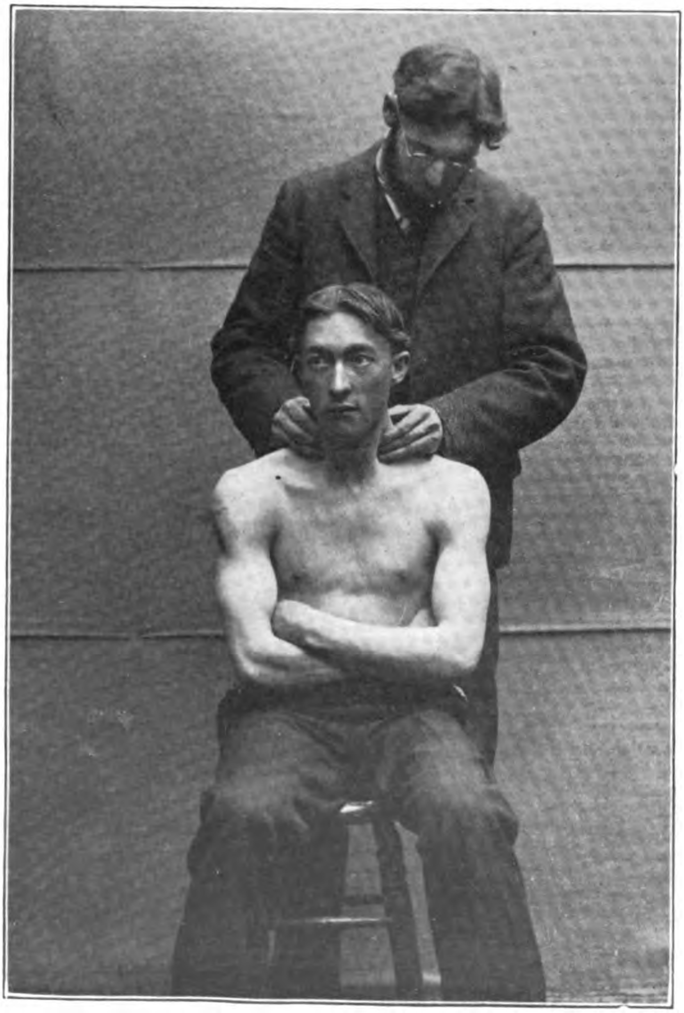


FIG. 255. Inhibition of the phrenic nerves. Center for hiccough.

the point of producing a "click" in an arthrodial joint, all produce vaso-motor effects of various degrees. They all serve a useful purpose and tend to reinforce each other in some cases.

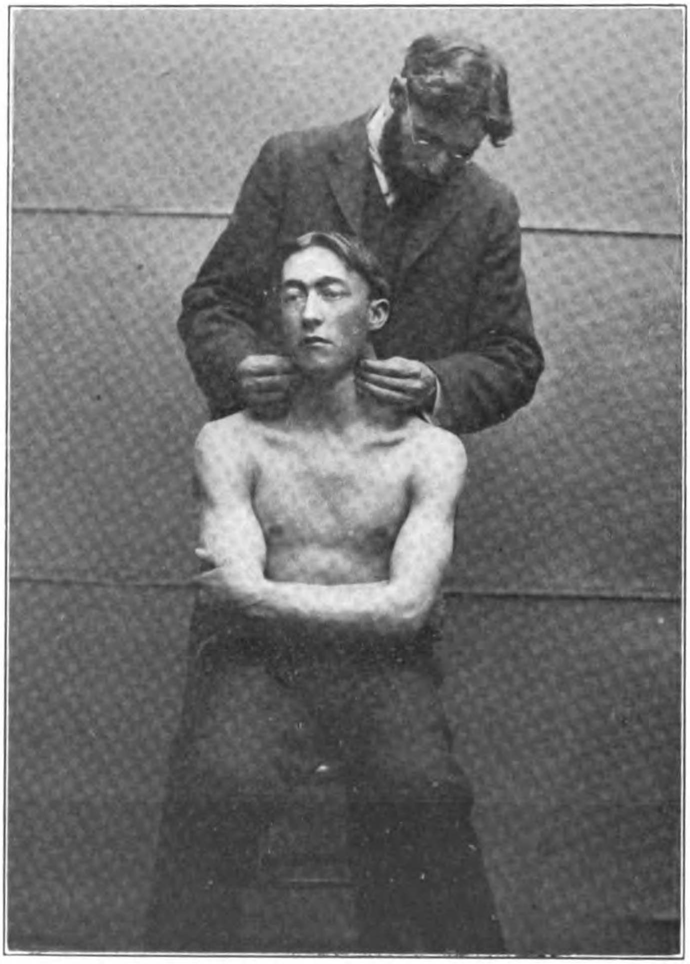


FIG. 256. Stimulation of the pneumogastric nerves.

BIBLIOGRAPHY

On Bone Setting............Wharton P. Hood

Theory of Osteopathy............Riggs

Physiology of Bodily Exercise............La Grange

Principles of Osteopathy............Hulett

Principles of Osteopathy............Hazzard

Practice of Osteopathy............Hazzard

Practice of Osteopathy............McConnell and Teall

Lateral Curvature of the Spine and Round Shoulders............Lovett

The Development of the Human Body............McMurrich

Technique............Rigsby

Autobiography............A. T. Still

Philosophy of Osteopathy............A. T. Still

Philosophy and Mechanical Principles of Osteopathy............A. T. Still

Osteopathy, Research and Practice............A. T. Still

Pain............Schmidt

Pulmonary Tuberculosis............Pottinger

Orthopedic Surgery............Whitman

Studies in the Osteopathic Sciences. Vols. I, II, III............Burns

The Integrative Action of the Nervous System...Sherrington

Diagnosis and Treatment of Diseases of Women............Crossen

Immunity............Citron

Applied Anatomy............Bardeleben

Physiology of the Nervous System .... Morot

Text Book of Physiology .... Howell

Treatment of Fractures by Mobilisation and Massage .... Mennell

Spondylotherapy .... Abrams

Hand Atlas of Human Anatomy .... Spalteholz

Eye Strain in Health and Disease .... Ranney

Abdominal Pain .... Maylard

The Abdominal and Pelvic Brain .... Robinson

Diseases of the Nervous System Resulting from Accident and Injury .... Bailey

Modernized Chiropractic .... Smith, Langworthy, Paxson

Surgical Anatomy .... Campbell

Clinical Anatomy .... Eisendrath

A Manual of Medicine .... Allchin

Manual of Physiology .... Stewart

Kirke's Handbook of Physiology .... Kirke

Diseases of the Nervous System .... Mettler

Biology, General and Medical .... McFarland

Applied Anatomy .... Clarke

Normal Histology .... Piersol

Comparative Physiology and Morphology of Animals .... Le Conte

Neurotic Disorders of Childhood .... Rachford

Anatomy of the Central Nervous System in Man and in Vertebrates in General .... Edinger and Hall

Bier's Hyperaemic Treatment .... Meyer, Schmieden

Physiologic and Pathologic Chemistry .... Bunge

Origin of Life .... Le Dantec

Manual of Osteopathic Gynecology .... Woodall

Deformities including Diseases of the Bones and Joints .... Tubby

The Treatment of Fractures........ Scudder

Principles of Surgery........ Nancrede

Lectures on Rest and Pain........ Hilton

ARTICLES

Rotary Lateral Curvature. No. 7, Vol. II of J. of A. O. A. .... H. W. Forbes

The Nature of a Subluxation. No. 5, Vol. I, J. of A. O. A. .... Tasker

How the Heart is Affected by Osteopathic Manipulations. No. 11, Vol. II, J. of A. O. A........ Tasker

Vertebral Articular Lesions. (Series begun in 1908) J. of A. O. A........ Forbes

Auto-Protective and Recuperative Mechanism of the Body. No. 4, Vol. XI, J. of A. O. A........ E. S. Willard

The Osteopathic Lesion. No. 8, Vol. IX, J. of A. O. A. .... McConnell

The Immediate Effects of Bony Lesions. No. 11, Vol. IX, J. of A. O. A........ Burns

Examples of Functional Lesions. No. 9, Vol. X, J. of A. O. A. .... H. F. Goetz

Adaptation and Compensation. No. 3, Vol. III, Western Osteopath .... Tasker

Backache. California State Journal of Medicine, June and July, 1909........ C. M. Cooper

A Consideration of the Pelvic Articulations from an Anatomical, Pathological and Clinical Standpoint. Boston Medical and Surgical Journal, May 18 and June 1, 1905........ Goldthwait and Osgood

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