

found this small error, which in the relief given proved to be the cause of all discomfort, I would have turned away nearly two-thirds of my patients unrelieved. Some of these patients brought painful eyes and 0.5 cylinders prescribed by ophthalmic surgeons of deservedly high standing. The change from the 0.5 + or — cylinder lens which over corrected, to the 0.25 cylinder which made the lines on the dial uniform, removed at once the discomfort complained of. It enabled patients to read by the hour when with the stronger glasses they could not use their eyes at all. This magical and immediate change was brought about by no other treatment than the recognition of the low degree of astigmatism, and the substitution of 0.25 for 0.5 cylinder. In some cases of defective vision sight would be improved from  $\frac{1}{30}$  to  $\frac{1}{15}$  by these weak cylinders.

As I have been pursuing this line of investigation for several years, and have learned to suspect low degrees of astigmatism in eyes painful in use, which exhibited  $V. = \frac{2}{30}$ , in seeking for it I find it. I could readily, from my case-book, give the detailed account of hundreds of patients, who, from not being able to read for more than a few minutes without glasses, could by the aid of a 0.25 cylinder, read for many hours.

It is only necessary to call attention to the frequency, and to the annoyance of these small degrees of astigmatism to have others find them as frequently as I do. The more familiar one becomes with these minor defects the more readily are they detected. I am sure that every month's experience adds to my facility, and also to the number of cases seeking advice. For the year 1887, 546 painful eyes showing only 0.25 D. fault were prescribed for in my private practice, and were relieved.

Through this paper I desire to impress others with my conviction, that painful eyes with  $V. = \frac{2}{30}$  very frequently means astigmatism. Also that experience will show, that the most useful cylinder for the correction of eye and head pains in this very large number of patients, is the 0.25 D. cylinder. From my standpoint it becomes the most valuable astigmatic lens of the Trial Case.

DR. H. CULBERTSON: As to the 0.25 diopter being the more useful of lenses in the correction of ametropia, I can verify Dr. Chisholm's position to the letter. Not infrequently I can double vision with a D. 0.25 + or negative. As to the correction of ametropia upon the apparent refraction of an eye, I would say that I have not infrequently been compelled to do this after having used mydriatics and when the latter denoted the employment of different glasses.

As to binocular astigmatism, I must assure the Section, and especially Dr. Savage, that my views are original on this subject, and that I had not seen his article on this theme until he kindly pre-

sented me with a copy since I read my paper before the session. The doctor and myself have both been engaged in investigating this form of ametropia for about the same length of time and independently and unknown to each other.

Being a devotee to truth and not wedded to any solution of the *modus operandi* of binocular astigmatism, or claiming in my paper more than a hypothesis as to the cause of this anomaly, I can only learn with pleasure of the views of Dr. Savage. In looking over his brochure on this subject hastily I understand that gentleman to hold that the entire phenomena of binocular astigmatism is due to anomalies of the four oblique muscles. If I am correct in this inference, I am compelled to differ on this point, believing that the state of the recti are concerned in this anomaly not infrequently, as well as the oblique. The five-minute rule will not permit me to enlarge upon my views on this point.

As to the relation of the ciliary muscle to this anomaly I cannot now state a positive opinion, for my investigations as yet do not permit me to say that it has not a positive or negative influence in the phenomena of binocular astigmatism. As for myself, future investigations must determine this point.

### SOME OF THE INFLUENCES OF THE SYMPATHETIC NERVOUS SYSTEM IN DISEASE.

*Read in the Section on Practice of Medicine at the Thirty-ninth Annual Meeting of the American Medical Association, Cincinnati, May, 1888.*

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My attention was drawn to the influences of the sympathetic nervous system, in diseases of mucous membrane, in connection with my studies in rhinology and laryngology. In a paper read before the fourth annual meeting of the American Rhinological Association, at St. Louis, in 1886, on "Naso-pharyngeal Catarrh, as a Cause of Neurasthenia," I attempted to show that functional derangement of the different portions of the body were effected through the great sympathetic nervous system. Also, in a paper read before the American Rhinological Association, at Washington, last September, on "The Pathology and Treatment of Naso-pharyngeal Catarrh," in which I attempted to demonstrate that the diseases of the nasal and pharyngeal mucous membrane, generally called naso-pharyngeal catarrh, was not an inflammation of the mucous membrane, but was a condition produced by paresis of the sympathetic ganglia and nerves supplying the mucous membrane and blood-vessels of these parts.

In the last mentioned paper I alluded to the

fact that if paresis of the cerebral and cervical ganglia and nerves of the sympathetic nervous system caused catarrhal and other troubles in the upper air passages, that it might be the means of explaining a great many pathological conditions in organs and portions of the body supplied by the sympathetic nervous system. It is for the purpose of calling attention to the pathological conditions of the sympathetic nervous system, or to the pathological conditions of the parts supplied by this system of nerves, that I present this paper. The term pathology is too frequently used where pathological anatomy should be used. In a large number of troubles produced by paresis of the sympathetic system, we are not able to detect anatomical lesions. Pathology bears the same relation to pathological anatomy that physiology does to histology.

I will not take up your time with the anatomy of this great nervous system, taking it for granted that every member of the American Medical Association is familiar with the anatomy and histology of both the cerebro-spinal and sympathetic nervous systems.

The anatomy, histology, physiology and pathology of the sympathetic nervous system is one of the most interesting and of the greatest importance to every medical man. Yet it is a subject that is very much neglected in our medical colleges and by medical men after they enter practice.

This system of nerves is sometimes called the ganglionic nervous system, and the nervous system of organic, or vegetable life. By a more thorough knowledge of the sympathetic system we might be better able to understand what appears to be some of the mysterious phenomena of disease.

Commencing as it does within the cranium by the ophthalmic ganglia, with its double chain extending down on either side of the spinal column, terminating below in front of the coccyx in a single ganglion—the coccygeal ganglion.

In the cranium we have four ganglia, called the cerebral ganglia, the ophthalmic, the sphenopalatine, the otic, and the sub-maxillary. In the neck there are three cervical ganglia; the superior, middle, and the inferior. In the chest are situated the twelve thoracic ganglia, corresponding to the twelve ribs. In the abdomen we find the great semilunar ganglia, sometimes called the abdominal brain, with its large plexus of nerves, called the coeliac plexus. In the lumbar region, in front of the spinal column, are the four or five lumbar ganglia. In the pelvis we have the four or five sacral or pelvic ganglia, and terminating below and in front of the coccyx, is a small single ganglion, the last of the double chain called coccygeal ganglion, or ganglion impar. Thus the sympathetic nervous system, or cord, as it is sometimes called, consists of from twenty-eight to

thirty ganglia on either side of the spinal column, terminating below in a single ganglion. Each ganglion is connected by nerves with the other ganglion of the same portion, each group of ganglia being connected with the group directly above or below. Each ganglion is also connected with the cerebro-spinal nervous system, receiving filaments from the cerebro-spinal afferent nerves and giving off nerves to the cerebro-spinal efferent nerves in addition to the filaments it gives off to the organ or tissue it supplies.

The question has frequently been asked as to the dependence of the cerebro-spinal and sympathetic nervous system upon each other. In a course of lectures recently delivered by Dr. Gaskell, before the Royal Institute of London, he claims that no new nerve fibres arise in the sympathetic ganglia, but that the fibres destined to them from the cord comes from the inner portion of the posterior horns and inner portion of the gray matter. They are medullated, but in passing through the ganglia they lose their medullary sheath and divide into smaller strands. The old distinction between the two nervous systems, that the cerebro-spinal needs repose, whilst the sympathetic does not, since it cannot be proved, and indeed, is highly improbable that the activity of the brain and spinal cord is ever completely in abeyance. Dr. E. Long-Fox, in his excellent work on the sympathetic nervous system, gives a number of instances of the natural dependence of the two systems. He says, "The fact, that in spite of this natural dependence the sympathetic, under conditions of lesions of brain or cord, is enabled within certain limits to act independently." Parks states that nutrition is probably carried on with complete destruction of the cerebro-spinal centres.

Fox states that "reflex irritation of the vaso-motor nerves can be entirely limited to the particular organ or tissue supplied." Thus in Vulpian's experiment, some days after the transverse section of the sciatic nerve, or of the brachial plexus, when the corresponding pulp of the paws of the animals had become quite pale and anæmic, he was able by slight rubbing of these pulps to cause a reflex congestion. The fact of the continuance of the heart's action for a time in some mammals after its separation from the body, in the frog, after the destruction of the brain and medulla oblongata, irritation will cause congestion of the limbs. In mammals, after section of the cord at the mid-dorsal region, sensory excitation of one posterior limb will cause reflex heart phenomena in the other.

While the sympathetic ganglia may not, and probably do not, have the power of generating nerve force independently of the cerebro-spinal system for any great length of time they do seem to act as storage batteries and accumulate nerve force generated by the cerebro-spinal system.

This accumulated force is capable of carrying on the life process after the cerebro-spinal system ceases to act. But this action can only be kept up for a limited time unless reinforcement is received from the cerebro-spinal. This reinforcement is received through the afferent filaments going to each ganglion. If a lesion of the cerebro-spinal system takes place in the region of these afferent nerves, or the afferent nerve is severed, the ganglion will only retain its power for a limited time and the same result will take place that is found after the lesion of the ganglia or its nerves.

Fox says, "Lesions of the cervical cord may cause the same oculo-pupillary phenomena as lesions of the superior cervical ganglion." Lesions of the cervical cord (seventh cervical and first dorsal) may cause the same vaso-motor paralysis evidenced by unilateral vascular dilatation of the face, ear, and head, as is seen in lesions of the cervical sympathetic ganglion.

Hemisection of the lower third of the dorsal region of the cord produces vascular dilatation in the lower limit of the corresponding side, and so increase of temperature.

All lesions of the spinal cord, and pressure on it, may enfeeble the vascular tone of the parts in relation by their vaso-motor nerves with the region of the cord below the lesion. The general distribution of the sympathetic nerves is to the mucous membrane, and possibly to integument, to non-striated muscular fibres to the heart, and particularly to the muscular coats of the arteries. The parts principally supplied with sympathetic nerves are usually capable of none but involuntary movements, and when the mind acts on them at all it is only through the strong excitement or depressing influence of some passion, or through some voluntary movement with which the action of the involuntary part are commonly associated. In the volume on the nervous system in "Flint's Physiology of Man," we find a long list of experiments made upon the sympathetic system, for which I am much indebted, as I make use of a number of them.

In 1727 Petit made some experiments upon the cervical portion of the great sympathetic nervous system. His experiments only showed its influence upon the eye, also, that the influence of the sympathetic nerves was propagated from below upwards towards the head, and not from the brain downward, as in the cerebro-spinal system.

In 1816 Depuy removed the superior cervical ganglia in horses with effect of producing infection of the conjunctiva, increase of temperature in the ear, and abundant secretion of sweat upon one side of the head and neck. In one experiment upon the removal of the ganglia on both sides, in a horse already feeble and emaciated, the face and ears became hot and moist. He says that "the consequences of destruction of the ganglia are, contraction of the pupils, redness of the conjunc-

tiva, general emaciation, as well as œdema of the extremities, and a general cutaneous eruption. These experiments show that the sympathetic has an important influence on the circulation, nutrition, calorification and secretion.

In 1851 Bernard repeated the experiments of Petit, dividing the sympathetic in the neck on one side, in rabbits, and noted on the corresponding side of the head and ear increased vascularity and an elevation in temperature amounting to from 70° to 110° F. This condition of increased heat and vascularity continued for several months after division of the nerve. In 1852 Brown-Séquard repeated these experiments and attributed the elevation of temperature directly to an increase in the supply of blood to the parts affected. He made a most important advance in the history of the sympathetic, by demonstrating that its section paralyzed the muscular walls of the arteries, and further, that galvanization of the nerve in the neck caused the vessels to contract. This was the discovery of the vaso-motor nerves.

The experiments of Petit, Bernard, and of Brown-Séquard, were of great value, as they demonstrated that the sympathetic influences the general process of nutrition, and that many of its filaments are distributed to the muscular coat of the blood-vessels. Flint says, "when the sympathetic is divided in the neck the local increase in temperature is always attended with a very great increase in the supply of blood to the side of the head corresponding to the section. The increased temperature is due to a local exaggeration of the nutritive processes apparently dependent directly upon the hyperæmia. There are numerous instances in pathology of local increase in temperature attending increased supply of blood to restricted parts."

If the sympathetic is divided in the neck of a rabbit and both ears are cut off just above the head with a sharp knife the artery on the side on which the sympathetic has been divided will frequently send up a jet of blood to the height of several feet, while on the sound side the jet is always much less forcible, and may not be observed at all.

Analogous phenomena have been observed by section of the sympathetic in other parts of the body. Samuel has noticed an intense hyperæmia of the mucous membrane of the stomach and intestines following extirpation of the cœliac-plexus. By comparative experiments it was shown that this did not result from the peritonitis produced by the operation.

When the sympathetic filaments distributed to a gland are divided the supply of blood is very much increased, and an abundant flow of the secretion follows. Dr. Moreau has made a series of observations on the influences of the sympathetic nerves upon secretion of liquid by the intestinal canal, which are particularly interesting in their

bearing upon the sudden occurrence of watery diarrhœa. In these experiments the abdomen was opened in a fasting animal and three loops of intestines, each from four to eight inches long, were isolated by two ligatures. All the nerves going to the middle loop were divided, care being taken not to sever the blood-vessels. The intestines were then replaced and the wound in the abdomen was closed with sutures. The next day the animal was killed. The two loops with the nerves intact were found empty, as is normal in fasting animals, and the mucous membrane was dry, but the loop with the nerves divided was found filled with a clear, alkaline liquid, colorless, or slightly opaline, which precipitated a few flocculi of organic matter on boiling. I will not enter into the details of the function of the sympathetic nervous system. It is well established that it regulates the blood supply, the temperature, the nutrition and secretion. And in the experiments mentioned it has been seen that the destruction or removal of any ganglia, or section of the sympathetic nerves supplying a certain part or organ of the body, alters the circulation, temperature, nutrition, or secretion, or all these, in the part of the body or organ which receives nervous supply from that portion of the sympathetic nervous system. It is thought that the sympathetic has the power both of conducting, transferring, reflecting, and possibly of augmenting or of inhibiting impressions made on it. Near the terminal filaments of the sympathetic nerves there exists numerous ganglionic cells.

The marvelous effects of reflex action in health and disease, in connection with the sympathetic nervous system, is well recognized by every medical man. For coarse stimuli the spinal cord and medulla oblongata are the chief centres for vasomotor reflex action. But the heart is more or less independent of these great nerve centres. A reflex arc exists in its own substance. Reflex movements are excited from all sensory nerves, not only spinal, but also sympathetic. Claude Bernard has shown that reflex action can occur in the sub-maxillary gland when all nerves that communicate with the cerebro-spinal centre are cut. If the superior cervical ganglia are separated from the higher nervous centres oculo-pupillary phenomena can be reflexly excited. That the uterine centres can act independently is seen in the occasional expulsion of the child after the death of the mother. The expulsion of fœces *per anum* after the death of the patient shows also that the sympathetic ganglia of the intestines are centres for independent reflex acts.

In a paper read by Dr. Woakes before the International Medical Congress, at London, he speaks of the sympathetic ganglia as reflex centres. Drs. Fox and Woakes give a number of examples to show the reflex power residing within the sympathetic system.

It is not my object in this paper to call attention to the reflex phenomena of the sympathetic system, but apply the physiological facts we have mentioned to the influence of this system of nerves upon the circulation of the blood and the condition of the blood-vessels, more particularly to that condition called catarrh, or inflammation of mucous membrane, and to the deranged function of certain organs dependent upon disturbance of local circulation. It is impossible to give a definition of inflammation that will be brief and exact at the same time. Inflammation is a term implying a whole series of processes, partly vascular, and partly textural, and their processes admit of great varieties of combinations. We have certain characteristics of inflammation but the whole content of the term cannot be fully indicated without describing briefly the process to which the term is applied. Four cardinal symptoms of inflammation are well recognized, namely: *redness, swelling, pain and heat*, with impaired function. The *redness* is from increased afflux of blood to the part. The *swelling* to an increased volume of blood in the part, and from exudation. The *pain* is caused by the swollen condition of the parts, which cause pressure upon the sensory nerve filament, or by chemical irritation. The *heat* comes from the excessive flow of blood through the part in the stage of hyperæmia.

In inflammation we have both vascular and textural changes. The first vascular change is produced by some *irritant* which being applied there is a general dilatation of the vessels, first of the arteries, then of the capillaries and veins. The flow of blood through the widened channels is more rapid at first. This is the stage of hyperæmia. After a time the speed diminishes, and at length the flow becomes slower than in the normal condition. This constitutes the stage of congestion. During this stage we have a migration of the blood corpuscles through the walls of the veins and capillaries into the surrounding tissue, but not from the arteries associated with the passage of the corpuscles. There is always an escape of liquid, which is comparatively rich in albumen. This is the stage of exudation, or infiltration.

All these changes and stages depend upon a molecular alteration in the walls of the blood-vessels. Mere paralytic dilation does not give rise to slowing of the current or to the passage of the blood corpuscles through the walls of the vessels. The inflammatory changes in the blood-vessels must of necessity be associated with tissue changes. These changes vary with the nature of the exciting cause, and with the intensity of the inflammation, with the character and extent of the vascular disturbance, and with the nature of the tissue. Inflammation cannot exist without molecular death.

Is it possible to have these cardinal symptoms of inflammation, *redness, swelling, pain and heat*,

with impaired function dependent upon paresis, or paralysis of the sympathetic nervous system, without inflammation, without structural change in the blood-vessels, without molecular death? This question opens up the question of contractions, dilatation, erectility and reflex vaso-motor effects. The function of the vaso motor nerves most frequently called into exercise is contraction.

Fox says, "The motor nerves that preside over the muscular contraction of vessels, and rule the local circulation, are the nerves that issue mainly from the ganglia of the great sympathetic, creep along the arterial walls, and can be followed into the middle muscular coat of the arteries. The vaso-motor apparatus therefore is in a state of permanent activity, never in repose, never inert. The muscular tunic of the vessels is in a state of semi-contraction—in other words, of vascular tone. Variation in this tone will be the necessary consequence of various modifications of the nervous apparatus."

The vaso-dilators are also in a constant state of action but are fewer in number than the contractors. Were it not for the pressure and action of the vaso-dilators, the vaso-contractors would cause undue and complete contraction of the vessels. The arteries possess both elasticity and contractility; the small arterialis contractility only. The vaso-contractors and dilators acting together keep up the proper calibre of the vessels.

When from the presence of some irritant upon the vaso-motor nerves, or as the result of mental impressions, etc., by reflex action, the vaso-motor nerves become affected, lose their tone, the ganglia soon loses its power, paresis, or partial loss of power takes place, the vessels dilate and remain dilated. As the result of this ganglionic paresis, we have *redness* from the increased afflux of blood to the part, we have *swelling* from increased amount of blood in the part, and after some time from the excessive nutrition furnished the tissue, the *pain* being produced by the pressure upon the sensory nerves, the *heat* from the rapid and excessive flow of blood through the part, we do not have changes taking place in the vascular walls. In the experiments made by Petit, Bernard, Brown-Séquard, and others, to which allusion has been made in this paper, it was shown that by removal of the ganglia, or section of its nerve filaments, that the part of the body supplied from that ganglion had an increased flow of blood into and through the part. That there was considerable increase of temperature, *redness* and *swelling* of the part, and, no doubt, *pain*. That there was increased secretion and nutrition.

In conclusion. When we take into consideration the anatomy and distribution of the sympathetic nervous system, together with its physiological functions, and its pathological action under artificial impairment, is it not reasonable to sup-

pose that if a ganglion becomes impaired and loses its power that we might have such conditions taking place that would explain a number of the phenomena occurring in diseases of organs or other parts of the body supplied by the great sympathetic nervous system?

Would it not explain many of the functional brain troubles? of eye, ear and nose, pharyngeal and laryngeal troubles. Pneumonia can be more easily explained in this way than in any other. Some heart, stomach, and kidney troubles can be explained by sympathetic paresis. Gynecological troubles lose half their terror when viewed from this light.

We all are aware that in the cases of troubles mentioned recovery is more rapid and complete when treatment is directed to the sympathetic nervous system.

#### A PLEA FOR THE BETTER RECOGNITION OF THE OCULIST IN THE SERVICE OF THE U. S. PENSION DEPARTMENT.

*Read in the Section on Ophthalmology, Otology and Laryngology, at the Thirty-Ninth Annual Meeting of the American Medical Association, May, 1888.*

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The U. S. Pension Department has been established for the purpose of remunerating those who have become disabled while in the service of their country by reason of injury, sickness or deprivation.

While the Government is endeavoring to provide for these persons, it becomes necessary to guard against impostors, for the recompense is amply adequate to induce those who are so disposed to make the effort to obtain it. For this reason boards of examining surgeons and special agencies have been established throughout the country, as well to enable the deserving to procure what is justly due them as to prevent others from obtaining that which does not belong to them.

At present the applications for this beneficence are in great profusion, for the reason, perhaps, that many of the older ones who served in the late civil war mistake their physical impairments from age for disabilities from wounds and exposures from army life; while others who received injuries while in service or suffered from the sicknesses and privations consequent to a camp life, although not considered at the onset sufficiently disabled for a pension, have developed with increasing years diseases and infirmities which have rendered them confirmed invalids.

It is doubtless the design of the Government authorities that the machinery of the Pension Bureau shall be as complete as possible; for the nearer it approaches perfection the more will the