PINKNEY (N)

THE

NERVOUS SYSTEM

OF

THE HUMAN BODY;

EMBRACING A DISSERTATION DELIVERED

TO THE

MEDICAL PROFESSION OF PHILADELPHIA,

AND

STUDENTS OF THE TWO UNIVERSITIES,

ON THE

SUBJECT OF THE NERVES, BRAIN,

AND

ORGANS OF SENSE.

By NINIAN PINKNEY, U. S. Navy.

PHILADELPHIA:
PRINTED BY WM. F. GEDDES, NO. 112 CHESNUT STREET.

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GENTLEMEN:

I shall now, after the preliminary remarks already made, proceed to the subject of discussion. Until Sir Charles Bell presented his exposition of the Nervous system to the Royal Society of London, which comprised six papers, nothing of importance was known as regarded its physiology. This important discovery was made in 1821, and concluded by a series of experiments in 1829. It is true that Dr. Alexander Monroe made the discovery that the ganglions of the spinal nerves were formed on the posterior roots, and that the anterior roots passed the ganglions. These were supposed by Johnstone to have been formed by nature, for the purpose of cutting off sensation. The celebrated Scarpa and Sœmerring added but little to the discovery. Great efforts were evidently made by the English and French to deprive Mr. Bell of the credit, for having established the fact, that motion belonged to the cerebrum, sensation to the cerebellum, and respiratory action to the medulla oblongata.

As I am addressing myself to men of Science, it would be unnecessary to trouble them with an explanation of the nervous system; but I cannot elucidate my points without doing so; I must therefore be excused. It consists of the brain, nerves, and organs of sense. The brain is that soft mass contained in the cranium. It is surrounded by three membranes; an internal called pia mater, a middle tunica arachnoidea, and an external dura mater. The first is vascular, second serous, and third fibrous in structure. The brain is formed by two kinds of substance, a cineritious and medullary. It is a double organ, and consists in right

and left halves perfectly alike. At present it is divided into cerebrum, cerebellum, and medulla oblongata: and I am *disposed* to add two more, the pineal gland and pituitary gland. The nerves are white cords to be seen every where in the parts of the animal economy, having motion, sensation, and respiratory action. They are well supplied with blood-vessels, which is an important consideration: their arteries and veins are numerous, and their dependence on the supply of blood immediate. When a limb is deprived of blood, the nerves are deprived of their powers, and consequently, sensibility is lost: compress it partially, so as to interrupt the free passage of blood into it, both the power over muscles and the reception of sensation through it, are interrupted. Admit the blood again, and the change is attended with a painful tingling. The nerves are formed by parallel fasiculi of fibres, perceptible to inspection, which can be reduced into fibrillœ, and then again into filaments as fine as the thread of a silk-worm. The finest filament is enclosed in its proper sheath, and in penetrating the ganglions, are deprived of their neurileme which is continued into a kind of capsule that surrounds the ganglions.

To the three functions described by Mr. Bell, I add two others, and call them functions of deglutition and sympathy.

The senses can be illustrated by an appeal to the eye. There you have the optic nerve expanded in a structure competent to convey outward impressions. Thus you have the nervous system formed for receiving impressions, with power to put in play the muscular fabric, and endowed with feeling and thought.

Anatomists of the present day describe the spinal marrow as the source of the brain. This plan accords more with my views; they commence with the spinal nerves, and finally terminate with the olfactory. Until the greatest physiologist of the age, of whom I have just made mention, ascertained the different functions of the three divisions of the brain, all the difficulty of nervous influence was explained on the idea of galvanic fluid being contained in tubes. Others ascribed it to vibration, and supposed that the same root could excite motion, and produce also sensation. This last, no doubt, led to the system now adopted, and gave the first impulse to its discovery.

Besides the nerves of smell, vision, and hearing, four systems combined into a whole, are to be found motion, sensation, respiratory action, and sympathy, all different in function from each other; the last differing in the qualities that distinguish the others. This last has been placed in the animal economy for the purpose of performing the functions of nutrition and decay—of course its action differs widely from all the others. We are aware that each nerve consists of distinct filaments, but there is nothing in them distinguishable from each other; one thread may be for motion, another for sensation, and a third for respiratory action. By tracing these to their termination in the brain, or origin as it is called, Mr. Bell was enabled to establish, beyond doubt, that splendid system of his, viz. that the spinal marrow was divided into two lateral portions, each consisting of different columns of nervous matter. Either lateral was again divided into three tracts: one for motion, one for sensation, and one for respiratory action, thus forming the whole of six columns, bound in intimate connexion, yet each pair possessing separate identity. These were called anterior, posterior, and middle; the two first can be traced into the brain, whilst the third stops short in the medulla oblongata. This tract of nervous substance possesses functions independent of reason, and performs its office without the aid of the *cerebrum* and *cerebellum*. Each spinal nerve is acknowledged to be composed of filaments coming from the anterior and posterior columns of the spinal cord. A ganglion is formed upon the posterior root, previous to its union with the anterior funiculus. In the head there is one compound nerve, the fifth pair or trigeminus, and a respiratory or portio dura, commonly called seventh pair. The reason why the latter has been named respiratory nerve of the face, arises from the fact that the trigeminus taking its origin above the medulla oblongata, and the respiratory from it, of course, unless a nerve was sent to the face to associate its action with the muscles of respiration, great want of expression would be the result. I consider the sympathetic or ganglionic nerve as entitled to an insulated description, and should be located. In speaking of this nerve, Sir Charles Bell says, that as to the origin, we cannot assign it a commencement.

It is true, that this nerve is most intimately blended with the par vagum, yet this may be accounted for by the following reasons. The cerebrum, being the seat of motion, is the least important to life; cerebellum, seat of sensation, the next most important, and the medulla oblongata, seat of respiratory action, the most important of these three admitted systems. Of course, nature was wise in establishing an intimate association between the par vagum and ganglionic nerve. I am confident that both the cerebrum and cerebellum may be suspended in their functions without life being destroyed. When it does occur, it arises in consequence of involving the pineal gland, then the medulla oblongata, and last of all the pituitary gland; death cannot take place until all these *organs* become *affected*. I am aware that by the expression of this opinion, I am opposing some distinguished anatomists, yet I cannot refrain passing my humble opinion. To their indulgent feelings I appeal for kindness, and it cannot be denied me. I am about to differ with Granville Sharpe Pattison, a very great anatomist, and in doing so I am confident my views will meet with proper appreciation. This eloquent demonstrator in his lectures six years ago, when I had the honour of being a student, gave the following as the pathology of apoplexy. He stated that if the blood be effused into the cerebrum, the result will not be instantaneous death; but if into the cerebellum, an immediate and total extinction of the vital principle will be the consequence. He therefore is of opinion, that the cerebrum belongs to moral or intellectual life, and the cerebellum to physical life. If I mistake not, he affirmed, that in every dissection of apoplectic subjects, this opinion had been confirmed. When the effusion takes place in the cerebrum, the cerebellum is consecutively involved, and thus death is produced. If the blood be thrown at once into the cerebellum, you will have a total extinction both of physical and intellectual life. Valsalva predicted that a porter had died of an effusion of blood into the cerebellum, and his friend Morgagni, after Valsalva's death, expressed a wish to ascertain how his friend Valsalva could suppose that the porter had died of an effusion of blood into the cerebellum rather than the cerebrum. The above is the explanation given by our Professor of Anatomy,

from which I differ, not by saying I do not believe it, but by giving reasons. I consider, (for none can prove it) that the cerebrum and cerebellum are purely organs of animal life. We know that the fœtus in utero sleeps constantly, until it comes into existence with creative objects, then its animal existence commences. We are further aware that both sensation and motion cease, and yet respiration continues in play. After a short interval, death ensues; but not until all these separate systems become affected, and no longer perform their functions. This state of things is best seen in diseases, where life is destroyed by degrees. In the case of instantaneous death from apoplexy, I assert that it cannot be in consequence of effused blood into the cerebellum alone, but that the penial gland, medulla oblongata, and pituitary gland become oppressed, and consequently cannot execute their offices; the result is instantaneous dissolution. These three last organs I regard as formed for organic life.

How frequently we hear of persons apparently in perfect health, while walking in the street, falling suddenly down, perfectly unconscious, with laboured respiration, and dying in a few hours, without any restoration to consciousness. In this case, the motor and sensitive organs are both oppressed with blood, the patient is deprived at once of his relation with surrounding objects; in plain language, animal life is destroyed. A few moments more, and the oppression going on, *deglutition* becomes interrupted, then respiration, and last of all, *sympathy* or *pituitary gland*, this terminates organic life. Life, therefore, being composed of animal and organic, when these are destroyed it ceases.

We will now proceed to examine the great *sympathetic* nerve, as formed according to modern anatomists. It is described as made up of branches coming from the sixth pair and fifth pair. The way this is explained is as follows: the vidian nerve, a branch of the superior maxillary, a second branch of the trigeminus or great sensitive nerve of the head, having entered the pterygoid foramen runs backwards: it splits, one of its branches passes in the carotid canal and forms with the sixth pair, the great ganglionic nerve; some add the nasal branch of the fifth pair, for the purpose of establishing a direct nervous communica-

tion between the sympathetic nerve, sixth pair or motor externus, and trigeminus through the lenticular ganglion which is formed by the nasal branch of the trigeminus and a division of the motor oculi or third pair.

I must acknowledge that I cannot, for the life of me, understand by what kind of *principle* (Sir Charles Bell) could *thus* form this nerve, after positively asserting that the three systems discovered by himself were independent of each other, and could not, though bound together, interchange their specific characters. We cannot presume to deny that the sixth pair is a motor nerve, and the vidian and nasal branches of the trigeminus are purely sensitive nerves. It is avowed by this physiologist that the sympathetic nerve, possesses neither motion, sensation, nor respiratory action. But these are the attributes of *those nerves* of which it is said to be composed. The idea I have formed of the sympathetic system, which, properly speaking, should be called *ganglionic*, has its termination in the pituitary gland. It is constituted of a series of ganglions, extending from the last sacral, to the one just named, and this is its chief organ or *brain*. The ganglions are compound; that is the opinion expressed in anatomical works: meaning that the filaments of two or more nerves go to form it. The idea of these *bodies* being formed by the union of nerves, is perfectly absurd. I should rather believe that they were primarily formed for the purpose of establishing a connexion with all the other systems of nerves. It is through the operation of this nerve that nutrition is carried on. The ultimate ganglion formed by the two sympathetic nerves, is called the coecygeal ganglion; this lies on the front of the os coccygis. There are three sacral ganglions, which can be readily found, and it is said that one or two more have been discovered; they are all placed on the anterior face of the sacrum, near the foramina for the transmission of the sacral nerves. They are united to each other by filaments which constitute the continuation of the sympathetic nerve; nervous filaments pass from each ganglion, to be united to the corresponding sacral nerve; the nerve now passes up through the five lumbar ganglions, from each of which filaments are likewise sent off to the lumbar spinal nerves. The cord of the sympathetic passes

successively through the twelve thoracic ganglions, detaching filaments to the intercostal nerves of the corresponding part. Internal branches are sent to the adjacent parts lying on the vertebral column; some of these concur to form the great and small splanchnic nerves.

The great splanchnic nerve having passed into the abdomen, becomes associated with the semilunar ganglion, which is situated on the crus of the diaphragm. This is supposed to be formed of a congeries of small ganglions arranged in the form of a moon, from which it derives its name. They are united by a reticulated work of nerves, and from them proceeds a net-work of nervous fibres, called the solar plexus; this is placed behind the stomach, and surrounds with its branches, the cœliac, superior mesenteric and renal arteries. The semilunar ganglion of both sides meet and form it. The ramifications of this plexus have added to them some from the phrenic and par vagum; a portion of this plexus, sends ramifications to the stomach, liver, pancreas and spleen, taking the three arteries as their guide. I conceive it unnecessary to discuss this part of the sympathetic system; but previous to leaving it I would beg leave to suggest one remark—to what is the frequency of sudden death to be attributed, when a severe blow is inflicted upon the stomach? I believe it arises from apoplexy or engorgement as you choose to call it, of the *semilunar ganglion.* We know that these ganglions are resolved into two kinds of substance; one filamentous, the other gelatinous and of a reddish colour. This substance is thought to be fat, and this is the view Scarpa takes of it, and of course his opinion is entitled to the highest consideration. If it is fat I am compelled to believe that this would be substantiated, by the formation of tumours in their substance. Its composition, too, differs from fat, as seen in the adipose tissue; besides, they are never absent, but are always demonstrable in the recent subject, and in their assigned places. Upon minute investigation they exhibit great vascularity, a strong argument in favour of their being endowed with certain important functions. When the semilunar ganglions, as stated above, become engorged with blood, they instantaneously cease their action in the system, and the result is

death. As these organs, for such I conceive them to be, are deprived of their peculiar function; motion, sensation, deglutition and respiratory action cease. No man in this audience can deny that when the functions just named stop, that dissolution will be the instantaneous result. They cannot further deny that the sympathetic nerve, according to present views, is acknowledged to preside over all the intricate movements going on in our bodies. These facts being admitted, the pathology just offered is entitled to some consideration.

It has been proved that no sensibility exists in the sympathetic nerve, nor in the ganglions formed in its progress. They may be cut, pinched in the living body without producing pain or motion. This establishes the fact beyond the power of contradiction, that these ganglions appropriated to the sympathetic nerve, differ entirely from those situated upon the posterior fasiculi of the spinal nerves. Those when pinched produce pain, but do not cause motion. Touch the anterior root and motion is the result. Having given a limited description, we follow the nerve through the three cervical ganglions; from each of these, filaments pass off to the cervical spinal nerves, and some ascend from the superior cervical ganglion to anastomose with the pneumogastric nerve, hypo-glossal, and facial nerves, near their exit from the cranium. Before proceeding further, it would be as well to say something in reference to the *cardiac plexus*, as regards its formation. It is constructed of three nerves, coming from the sympathetic on the right, and two on the left; they are called cardiac, and are joined by filaments sent from the recurrent nerves and par vagum, after they unite to form the cardiac plexus. This penetrates from the base of the heart to the root of the aorta, is diffused through the muscular structure of the former, its trunks follow the course of the pulmonary arteries. This correct and minute anatomy, is derived from William E. Horner, M. D. I at first started with Dr. Godman's edition of John and Charles Bell's anatomy, as my guide; but I could not rely sufficiently upon the *description* of parts held forth there. This great anatomist pursues the course of John Bell, and states that the *femoral artery*, about four inches, more or less, below the groin, sends off the *arteria profunda* femoris. This,

he says, depends upon the *size* of the *subject*. In every instance, where Doctor Pattison demonstrated the anatomy of the upper region of the thigh, he proved that the *artery* was given off from *one and a half* to two inches, and never more than two and a half. This fact was strongly fixed upon my mind, by the clear and beautiful demonstration, so characteristic of that man. Reasoning from this error of Doctor Godman, and so important a one, I concluded not to be governed by his work. I therefore adopted as my author in most points, your much esteemed Professor. Gentlemen, he is every way entitled to your kindest feelings, and you will do well to pursue that which is characteristic of him—viz. benevolence, not mingled with *jealousy* or *envy*.

Another ganglion has been of late discovered, by Laumonier, to which this great nerve is connected. He has given the name of "ganglion cavernosum" to it. This discovery of his brings us nearer still to the pituitary gland; and I believe the day will soon arrive when this will be the true *key* to the nervous system. Filaments of late have been traced from the ganglion of Laumonier to the gasserian, formed upon the posterior root of the trigeminus. It is stated that they have even been traced to the pituitary gland, and infundibulum, which is a flattened conoidal body, an inch long, with its base upward and its apex downwards and forwards. It is formed of cineritious matter: its base is hollow, and opens into the third ventricle, but its point is closed. J. F. Meckel asserts that a communication exists entirely through it, from the pituitary gland to the third ventricle: he has succeeded in proving this by passing air and liquid from this gland into the ventricle; he failed when he attempted the experiment from the third ventricle. We will presently demonstrate that the third ventricle communicates with the two lateral ventricles.

Thus far a direct communication can be traced from the pituitary gland, through the infundibulum, with the third ventricle and also the two lateral. It can be proved that the infundibulum, which establishes a connexion between the pituitary gland and cerebrum, is formed, like a nerve, of cineritious matter.

We are aware that the cerebrum and cerebellum, have two substances entering into their composition, called medullary and

cineritious: the latter substance forms the surface of the cerebrum and cerebellum, whilst the interior is principally of medullary. This state of things is reversed in the pons varolii crura and spinal marrow. Here you have the outer surface medullary, and the interior cineritious. The same holds good with nerves in general.

The third ventricle of the cerebrum, as stated, communicates freely with the lateral ventricles through the aperture called the foramen of Monroe. Under the tubercula quadrigemina, another communication is established between the third ventricle and ventriculum quartum: through this a passage is formed into the cerebellum. Thus far we have been enabled to prove, if any reliance can be placed in the dissections of a Horner and a Meckel, with a host of other lights of anatomical illustrations—

That the pituitary gland has communication with the cerebrum and cerebellum, just as much so, as it is proved by Sir *Charles Bell*, that motor nerves go to the cerebrum, sensitive to the cerebellum, and respiratory to the medulla oblongata. The two first he was enabled to prove by experiments—when the cerebrum was touched, motion took place; when the cerebellum, sensation ensued. The nerves I am trying to trace to their proper organs, and ascertain their functions, are more difficult to prove by experiment. Notwithstanding, I feel certain that many points which I have had the temerity to put forth, will yet be established as *truths*, provided proper assistance is bestowed upon this *novel* exposition of the nervous system.

According to H. Cloquet, a funiculus passed from the "ganglion cavernosum" and formed a plexus around the ophthalmic artery, and may be traced along all its branches, even the central artery of the retina. This plexus anastomoses with the lenticular ganglion, and establishes no doubt a direct nervous communication between the sympathetic, the motor oculi and first branch of the trigeminus. I regard this ganglion as a compound one, and belonging purely to the *ganglionic system.*

The spheno-palatine ganglion, no doubt, will be proved, as belonging to the sympathetic ganglions. We can already trace a connexion between it and the vidian, a branch of the second

branch of the trigeminus. The respiratory nerve of the face or portio dura, to all events anastomoses with filaments coming from it. The two ganglions, named lenticular and spheno-palatine, are sympathetic organs to the face, as the superior cervical is to the neck. We have now traced thoroughly the ramifications of the great ganglionic nerve—

1st. From the coccygeal ganglion, through the sacral ganglions. 2d. Through the lumbar. 3d. Through the twelve dorsal or thoracic. 4th. Through the three cervical, and lastly, through the ganglion cavernosum of Laumonier, and, according to a German anatomist, into the pituitary gland. This agrees with my opinions precisely, as first laid down in this dissertation, that this great nerve took its origin from the coccygeal ganglion, and terminated into the pituitary gland. From the solar plexus it can be traced through the semilunar ganglion, into the two splanchnic nerves, and finally into the thoracic ganglions.

The nerve can be traced from the cardiac plexus into five cardiac nerves; three on the right and two on the left. They pass through the cervical ganglions, and of course, terminate as they do. Having collected all the filaments of this nerve into a whole, we shall *soon* be able to demonstrate it as going to the pituitary gland. Here motion, sensation, deglutition and respiratory action, with sympathy, are so completely changed by the action of these ganglions, when reaching their proper *brain* constitute nutritive function. All these separate functions are essential to perfect health. I have often noticed when persons die of slow diseases, the following phenomena take place:—

First,—The senses, sight, hearing, smell, taste, and touch are lost, and in a little while *animal* life ceases; that is, the cerebrum and cerebellum no longer execute the functions of motion and sensation.

Second,—Inability to swallow: as I consider the *pineal gland* as the organ of deglutition, it dies. I shall explain, before finishing, why I take this view of the subject.

Third,—Respiration ceases, and immediately death ensues. Here the medulla oblongata and pituitary gland terminate their existence. This state of things occurs only when the organs of

animal and *organic* life are destroyed one by one. Injury to the medulla oblongata is instant death--pineal gland ranges next, cerebellum, and then cerebrum. The least injury to the pituitary gland would be instantaneous in its effect, because this modifies and presides over all the others. Through the infundibulum, that change which is produced by this *organ*, is transmitted to the brain, and thus animal and organic life become united.

It may be asked, why, if this nerve arises or terminates in this gland, does it not take its course in the spinal cord, like the three systems of Sir Charles Bell? My reply would be, that nature, aware of the frequent injuries to which the spine is liable, placed it where she has done, well protected, and admirably located for the function which it is called to perform. Besides, suppose she had placed it there, it must have extended throughout the vertebral canal, and there would be no security to *life*. The least injury must have ended existence.

Another reason may be adduced from the fact, that even the tract of spinal marrow, from which the respiratory nerves arise, occupies but a limited extent in this canal. If, therefore, an organ like this, next in importance to the one in consideration, is so well protected, it would appear strange for nature to *expose* the most important to frequent injuries.

Let us for a moment examine the pituitary gland, and see what are its characters. It is a reddish body, of a gland-like appearance, located in the *sella turcica* of the sphenoid bone, covered almost completely by the dura mater, except where it has connexion with the infundibulum: its shape is ovoidal, bearing in its conformation strict resemblance to the medulla oblongata: it is divided, so as to appear formed of two lobes: it is hard, and consists of cineritous and medullary matter within: its greatest diameter amounts to six lines. Let us see to what purposes preceding generations of enlightened anatomists and physiologists, have dedicated this *highly important organ*. Some, wise above others, imagined it received the superfluous moisture of the brain and then conducted it to the nose, or surrounding sinuses. What proof was produced to sustain this important point? None--the slightest attempt was omitted for the purpose of ascertaining by

what communication this was accomplished. They sat down idle speculators, advancing opinions, and ascribing functions to organs, without furnishing the world with the ground of their theory. M. Littre considered this *body* as formed of vascular structure, with muscular fibres. In the wildness of his imagination, he conceived that through its operation the air and water were brought down from the ventricles. Since that period more than a century has passed away, without further investigation either theoretical or practical, throwing more light upon this subject. Let us now see if any good reasons can be advanced for the further establishment of the opinion here held forth. A distinction of substance has been observed in this gland, and it has been considered by some as a part of the brain. Some supposed that it gave nerves to the fifth or sixth pair.

The cerebrum, cerebellum, pineal gland, medulla oblongata, and pituitary gland, are all formed in the fœtal state, not as *expanded nerves*, but as organs to receive impressions, exact their execution and perform the function of *sympathy* or *nutrition*.

It is stated by Doctor Godman, that he found in acephalous human fœtuses, the nerves of the trunk and extremities perfect, although no brain existed. Soon after, he dissected a fœtus in which both brain and spinal marrow were deficient without any imperfection of the nerves. This establishes the fact, that if the nerves are formed whether brain or spinal marrow exist, that the two latter are formed purely to receive the nerves and act as peculiar organs to them. The circle of Willis surrounds the gland; it is formed anteriorly by the *arteria anterior cerebri*, laterally by the *anterior communicantes*, and posteriorly by the bifurcation of the *bassillary artery*. Had nature attempted to have placed it in a more secure place, she must have *failed*.

The ganglions are of two kinds: those formed upon the posterior root of the spinal nerves are called simple, because it is supposed that they are produced by a *single nerve*. Those called composite, are considered as formed by two or more nerves. These last belong to the ganglionic system. Nothing could ever induce me to believe that these bodies are formed of nerves; they must be organs of a peculiar structure.

Before concluding the subject of the great sympathetic nerve, I will attempt an explanation of my views by a simile: when a *balloon* was first invented, Gusman succeeded by inflating it with air lighter than atmosphere, sending it two hundred feet above the earth; in consideration of this *wonderful* project, he was *only* regarded as a *sorcerer*. In 1766, M. Cavendish discovered a gas which he called hydrogen; and balloons inflated with it soared aloft in the ethereal regions, thousands of feet above the surface of the earth. Soon after this important discovery, a *lady* in Paris went up in one and unfortunately took a *light;* as the balloon rose with the rapidity of lightening, the weight of the atmosphere in contact with the gas expanded, and forcing its way out, came in contact with the *flame*, and explosion was the instantaneous result. Water was the product in the one instance, and *death* in the other. Since that period the ærionaut observes this precaution, and the danger is much lessened. Thus you perceive that many years have elapsed, and yet that *science* is far from being perfect. As nature has gifted *man* with this power, I believe that the day is not far distant, when he will be enabled by his own ingenuity, to traverse the atmosphere with the same dexterity as the experienced navigator does the trackless ocean. I compare the balloon to the *brain*, and the pituitary gland to the car in which the *man* is seated. We will suppose that this gland is connected by four *strings* or nerves to the brain, one for motion, one for sensation, one for deglutition, and one for respiratory action, all joined to the sympathetic. Suppose the first are divided, the *car* will incline downwards; cut the second and the inclination will be increased: when the third and fourth are cut, the car, being entirely separated, death would ensue. I believe that all the nerves, terminating in the cerebrum, cerebellum, pineal gland, and medulla oblongata, are united to the sympathetic, and when it passes into the pituitary gland, a change is produced upon the whole, and this nervous influence is transmitted to the cerebrum and cerebellum, through the infundibulum, and animal and organic life becomes connected.

By way of novelty, to make the point more clear, let us suppose that a *lady* is engaged in making bread,—she requires salt,

flour, water, and yeast; making in all four ingredients, which I shall compare to motion, sensation, deglutition and respiratory action. In the one instance, *dough* is produced; and in the other, *sympathy*. When the first is baked, *bread* is made; and when the last is acted upon by the pituitary gland, *life* takes place.

Nerves of the Encephalon, or Brain:

First--the spinal Accessory. I place this first, because it takes its origin behind the ninth pair, from the posterior fasiculus of the spinal cord, as low down as the seventh cervical nerve, and also from the medulla oblongata. This description would of course make it a nerve of *sensation* and *respiratory action*. This, therefore, cannot be *correct*, unless Sir Charles Bell is wrong. I should trace it from its peripheral termination, and having arrived at the medulla oblongata, finish it. It is distributed to the muscles of the neck and the integuments.

Second—The Hypo-glossal nerve. It arises from the respiratory column of medullary matter, called the medulla oblongata. It is distributed to the tongue, to give it respiratory association.

Third—Par vagum. This likewise is a respiratory nerve. Its destination is to the organs of respiration and to the stomach.

Fourth—Glosso-pharyngeal. This, according to Sir Charles Bell, is a respiratory nerve. It goes to the tongue and pharynx. I think that this nerve is connected with the pineal gland, and is therefore placed for the purpose of *deglutition*. I shall explain fully when upon the nerves of the tongue.

Fifth—Auditory, or portio mollis. Valsalva made an excellent distinction, when he said that the membrane of the tympanum was not absolutely essential to hearing, but only to perfect hearing. I am induced to believe that the tympanum and labyrinth are two organs, requiring the action of both for perfect hearing. That a nerve of motion, sensation, and respiratory action, are sent to either. I regard this nerve as purely a sensitive one, to be appropriated to the labyrinth. I will give my reason: Formerly the portio dura and mollis were described as one nerve, and I can see no reason why it should not be, as the trigeminus. It arises by two fasiculi or roots; the one called portio dura, arises from the medulla oblongata; whilst the other, called portio mollis, takes

its origin from the cerebellum, just behind its crus, as described by J. F. Meckel. He ascribes this as being an analogy to the other nerves of the senses, the optic and olfactory. I am disposed to agree with that eminent anatomist, and ascribe to it the sole act of sensation, by which *hearing*, produced in the labyrinth, is transmitted to the cerebellum. These are now considered distinct nerves, and pass through the meatus auditorius internus, the bottom of which is divided into two fossæ, of which the upper is the smaller. A foramen in the upper fossa, transmits the facial nerve or portio dura, as it is called, while all the others are occupied by the filaments of the portio mollis; this is the genuine nerve of hearing, and is distributed to the cochlea, vestibulum, and semicircular canals. On the portion destined for the ampullæ of the superior and external canal, there is formed a ganglion. The other portion of this nerve not connected with the *ganglion*, I conceive to be the motor nerve of the ear. The sense of hearing is conveyed to the brain by the portio mollis from the labyrinth, and by the vidian, a branch of the trigeminus, a sensitive nerve of the face; not the great sensitive, as it is called: this is perfectly ridiculous, and would lead one to believe that there were two of the same kind on either side of the head. The chorda tympani, is formed by a branch of the vidian, and becomes connected with the portio dura.

Sixth—Portio dura. It arises from the medulla oblongata, and is consequently a respiratory nerve. It passes through the stylomastoid foramen, to be distributed to the side of the face, head, and upper part of the neck.

Seventh—Motor oculi Externus. It takes its origin from the base of the corpus pyramidale, under the posterior margin, of the tuber annulare. Sir Charles Bell thinks that the object nature had in sending this nerve to the adductor muscle of the eye, was to draw the eye-ball towards the inner canthus, and to produce a similar effect on the caruncle and membrane semilunaris. We know that it is solitary in its origin and course, and that is all the information we have at present upon this point. His views are certainly incorrect; for the action of this muscle would draw the eye-ball to the outer canthus. This nerve is, beyond doubt, an

involuntary one, and placed for the purpose of associating the actions of the four recti muscles with the function of respiration. It has been clearly proved that the trochlearis or nervus patheticus, is a respiratory nerve, and is distributed entirely to the superior oblique muscle of the eye. This was clearly demonstrated by an experiment upon a monkey. This muscle having been divided, the hand was passed before it; the eye turned upwards and inwards, while the other had scarcely a motion in the same direction. When the eye was turned up, he could with difficulty bring it down again. To what was this owing is no doubt passing in the minds of many of my respected auditors? I will attempt an explanation; but before I could be clearly understood, it will be necessary to make a few remarks about the two sets of muscles appropriated to the organ of sight.

First set.—Four recti muscles; they come from the bottom of the orbit, and run forwards and outwards; they embrace the eye-ball, and are inserted at four cardinal points into it. They are for directing the axis of the eye, turning it round to every point in the sphere of vision. Three of these are voluntary, and one is an involuntary, and it is to this that the adductor nerve is distributed, according to my idea. I consider, that as nature conceived it necessary to send a respiratory nerve to the superior oblique, and a motor nerve to the inferior oblique; why should she not make the same provision with the recti, to associate their action with the respiratory function? We know that the third pair of nerves, is distributed to the superior rectus, internal rectus, and the inferior rectus and inferior oblique. This nerve, taking its origin from the organ of motion, called cerebrum, must of course be a pure motor nerve, and consequently, all these muscles to which it is distributed, are placed under the control of the *will.* Pursuing still further this reasoning, we find that one nerve is sent to the superior oblique muscle, and that another to the rectus externus muscle. If nature had not intended a different action for this last described muscle, why did she not detach a filament from the third pair to it.

The picture presented to you, gentlemen, is but a mere shadow; but I feel sanguine that it will soon be animated with life. If

minute dissection can accomplish it, my every effort shall be made, to put the *snow-ball* in motion before the rays of malice shall melt it into nothing. Some men evince a disposition to oppose the newly fledged doctrines of *others*, because they did not originate them. Such men may be *great*, but yet they act as stumps to the development of science. However, having to subsist upon their own mental nourishment, it ceases to sustain them and they die disgusted with themselves, and detested by the world. Thank heaven, that *few*, very *few*, pervade the ranks of science. The *parotid gland*, after all the noise created regarding the impracticability of its extirpation, has at *last* been acknowledged as a thing *possible*. Yet at this moment, there are some to be found, who obstinately assert, that, notwithstanding Doctor Randolph succeeded in removing it entirely it must have been something else. That it can be done, and has been done, I merely point you to the surgeon named and he will convince you.

If, gentlemen, the surgeon of Jefferson College, or the one from whom you receive instruction, was to intimate its impossibility, I should not hesitate saying that *that man* was a drawback to science. In making these observations, I have no intention whatever, making any allusion to your distinguished professor of surgery. Even if I were, my standing is so *low* in our profession, that he would not deign to pluck the unblown flower until it breathed its fragrance to the breeze of heaven. When its sweets are wafted to his sense of *smell*, then, and not until then, would he be roused from his state of lethargy.

Excuse me for this digression, and I will attempt a correct explanation of the experiment upon the monkey, but must describe the remaining muscles of the eye. They consist of the two oblique, one is called the superior and the other inferior: these roll the eye in opposite directions; the first directs the pupil downwards and outwards, the last upwards and inwards. To the superior a respiratory nerve is sent; this being cut, that motion which associates it with respiratory action is destroyed: the consequence is, that the inferior, being under the will, acted, and of course the pupil was directed upwards and inwards, which is the direction of this muscle when called to act. I should like to know by what

power the eye was eventually brought down to its original position? The reason I would suggest is, that this is produced only when the inferior oblique becomes relaxed, the will not requiring its further action. The combined actions of these muscles draw the eye-ball towards the nose. You all have, no doubt, often noticed that peculiar movement of the eye, called winking; this, I think, can be fully demonstrated upon physiological facts. We know that the two oblique muscles are in operation, when natural winking takes place; this motion is of the greatest importance to the preservation of the organ. When this occurs, without the power of controlling it in a measure, the nerve which gives voluntary motion to the inferior oblique muscle, is evidently paralized. I will try this experiment as soon as an opportunity affords, and I have no doubt but that the view I have taken, will be sustained.

Sir Charles Bell states a case which came under his observation, presenting the following peculiarities: "By a defect of motion, the eye and eye-lids remained fixed; and the consequence was, the cornea inflamed and became opaque. Another curious circumstance in this case was, that when the eye-lids were closed the patient still saw red light through the affected eye; the reason of which was, that the eye did not turn up when the eye-lid was closed." These are the remarks of that great physiologist; and I ask if from what he says of the cause, correct views could be entertained. Let us endeavour, if we can, to trace the pathological facts: we have a defect of motion, a fixed state of the eye and eye-lids, and eventually inflammation and opacity of the cornea. This is produced by paralysis of the two oblique muscles, whose functions have been thoroughly discussed. The cornea being partially exposed to light inflamed, which resulted in opacity. The way in which opacity is produced, according to my view, is as follows: the cornea, we know, is perfectly transparent, and freely transmits the rays of light. It is formed of many laminæ, placed like the leaves of a book, united by fine cellular substance, and allows them to glide upon each other. Between these laminæ an interstitial secretion of a transparent fluid is constantly going on, to keep the delicate parts moist. That this is constantly going on, may be proved by keeping the eye open

without winking, for some time, a film of matter will be spread over the cornea. When, therefore, it becomes inflamed, in consequence of constant exposure to the stimulus of light and other causes, all continuing to keep it up, adhesion takes place between all its laminæ, and thus an opaque membrane is the result. This is the only scientific reason I can offer, and I hope it may accord with your approbation. We have now to account for the red light which passed through the affected eye. A ray of light is composed of seven colours, and I suppose when it infringed upon the inflamed cornea, its transparency being affected, the red passed through, being more refractive, while all the others were reflected.

Eighth—Nervus trigeminus, or sensitive nerve of the head. Doctor Horner, an anatomist justly celebrated for the correctness and minuteness of his demonstrations, considers this nerve as composed of three roots; an anterior, posterior and a middle. The latter he traces into the medulla oblongata; thus upsetting Sir Charles Bell's views upon this subject. Were this its origin or termination, it would consist of three different functions; motion, sensation, and respiratory action. I contend that there is no such thing in the human body, as a compound nerve, formed of two roots, one possessing motion, and the other having a ganglion on its roots possessing sensation. If this nerve is compound, having motion and sensation, why should it be called *great sensitive nerve* of the head? This name would indicate that it bestowed feeling, but not motion. You may depend upon it (gentlemen) there is a great mistake in this mode of demonstration: the proper way is to trace this nerve from its three principle branches, the ophthalmic which passes through the foramen lacerum anterius, the superior maxillary through the foramen rotundum, and the inferior maxillary through the foramen ovale. These three branches collect and form a root, which passes through the gasserian ganglion, which is placed opposite the petrous portion of the temporal bone, between the laminæ of the dura mater. This being a nerve of sensation will pass into the cerebellum. That nerve which passes through the foramen ovale, should be described as a distinct nerve, its function being motion.

The same should be pursued with the spinal nerves. The mistaken and absurd notion that regular nerves had two roots, and that irregular ones had but one root, arose from the fact of their tracing all the nerves from the brain and spinal marrow. If any one of you were to trace this nerve or a spinal nerve from the cerebrum and cerebellum, along the anterior and posterior columns of the spinal cord, and finding two roots emerging from this cord, one having a ganglion and the other none, but joining its fellow and passing through the intervertebral foramina, are finally distributed to remote parts: I say, that the natural conclusion you would arrive at, would be, that this was double, and consequently possessed motion and sensation. Reverse things, and trace this same nerve from its peripheral extremity and when it has passed between the vertebræ, the two nerves separate; the motor courses along the anterior column, terminating in the cerebrum; the other passes through a ganglion, and coursing along the posterior column terminates in the cerebellum.

Ninth—Pathetic nerve. It arises from the superior part of the spinal marrow, and courses along through the sphenoidal fissure, to be distributed on the superior oblique muscle. This is a respiratory nerve.

Tenth—Nervous motor oculi. This takes origin from the internal face of the crus cerebri, and is a pure motor nerve. It passes through the same fissure as the last, and is distributed to three of the recti muscles and inferior oblique of the eye.

Eleventh—Optic nerve.

Twelfth—Olfactory nerve.

These two last are also motor nerves. I make the following arrangement of the nerves of the brain, according to their peculiar functions.

1st Set. Motor nerves. They consist of the following:

Their organ cerebrum.
- Nervus motor oculi, to four muscles of the eye.
- Optic nerve, to the retina.
- Olfactory nerve, to the Schneiderian membrane.
- Inferior maxilliary nerve. This is the motor nerve which passes through the foramen ovale of the sphenoid bone. I think it will yet be traced to the tongue, in connexion with the

gustatory, a branch of the trigeminus. Its distribution is to the muscles of the lower jaw, and also, in my opinion, to the tongue. Before concluding, I will explain my reason for thinking so.

A Motor nerve, bound up with the portio mollis, to be distributed to the labyrinth of the ear.

2d. Set. Sensitive nerves.

Their organ cerebellum. { Nervus portio mollis, to the labyrinth. / Nervus trigeminus, orbit, face, and tongue.

3d. Set. Nerve of deglutition.

Organ pineal gland. { Glosso, pharyngeal nerve, to the tongue and pharynx.

4th. Set. Respiratory nerves.

Their organ medulla oblongata. {
- Spinal accessory. Muscles and integuments of neck.
- Hypo-glossal. Tongue.
- Par vagum. Organs of respiration and stomach.
- Portio dura. Face, head, and upper part of neck.
- Motor oculi externus. To the rectus externus.
- Nervus patheticus. To the superior oblique.

Organ. Pituitary gland. 5th. Set. Great ganglionic nerve.

Spinal Nerves, consist of thirty-one either side. These are compound, and should therefore admit of the following classification:

Sensitive.	*Motor.*
Eight cervical.	Eight cervical.
Twelve dorsal.	Twelve dorsal.
Five lumbar.	Five lumbar.
Five or six sacral.	Five or six sacral.
Thirty-one.	Thirty-one.
Their *organ* cerebellum.	Their *organ* cerebrum.

We will now run over rapidly the nerves distributed to the thigh, leg, and foot. They are easy of description, being derived or rather terminating in the lumbar and sacral nerves. They are three in number.

First.—Is called anterior crural nerve. It passes under Poupart's ligament to the muscles for extending the leg.

Second.—The obturator. This passes from the pelvis to the adductor muscles of the thigh, through the thyroid hole.

Third.—Ischiatic nerve. This passes from the pelvis, through the sacro-sciatic notch. It runs to the back of the thigh into the ham. It supplies those muscles, but its chief destination is to the leg and foot. The object nature evidently had in view in thus profusely supplying the lower extremities, with motor and sensitive nerves, was, that in the event of one being deprived of its functions, the others would remedy the defect. If such a precaution had not been wisely attended to, these important parts so subject to injuries, might have been useless members.

The distinct threads of a spinal nerve are combined into a whole, as they are about to pass through the ganglion. When so collected, it is called a *fascis*, and the ganglion is formed or seated in the part where the fascis is surrounded and united to the sheath. We come now to offer a few remarks respecting the phrenic nerve. It is said to be formed by the anterior branch of the second and third cervical nerves, assisted by two or three filaments from the upper part of the axillary plexus. I do, gentlemen, unhesitatingly assert, that this cannot be the true mode of its formation; for thus constituted it would possess motion and respiratory action. Neither of these functions have ever been ascribed to it. By Sir Charles Bell, the founder of the physiology of the nervous system, it was regarded and described as a respiratory nerve. To possess this function, which no one can question, it must of necessity be traced to the medulla oblongata. Should the cervical vertebræ be fractured at the lower part of the neck, and the spinal cord crushed, the individual would breathe although no use of the parts below the fracture might exist. Life, in this instance, is sustained by the nerves of respiration continuing to act. When it occurs above the fourth cervical vertebræ, death soon occurs; but if above the second, then instantaneous destruction ensues. I shall make no remarks in reference to the nerves of the upper extremities, for I have the same view of their formation, as was explained when speaking of the inferior extremities.

Having now taken a view of the nerves of the three systems, as established by Mr. Bell, which he called motion, sensation and respiratory action, I ask the indulgence of my audience to offer

a few observations upon the external senses. They are five in number, vision, taste, smell, hearing and touch.

First.—Vision. Its organ, the eye.

Optic nerve. Motion for the retina.

Pathetic nerve. Respiratory action, for superior oblique.

Ophthalmic. First branch of the trigeminus sensation.

Motor oculi externus. Respiratory action for rectus externus.

Nervus motor oculi. Motion for three recti and inferior oblique.

Second.—Smell. Its organ the nose.

Olfactory nerve. Motion for the Schneiderian membrane.

A branch of the portio dura. Respiratory action.

Nasal branch of the trigeminus. Sensation.

Third.—Taste. Its organ, the tongue.

I am firmly convinced that the nerve which gives voluntary motion to the tongue, will yet be traced through the foramen ovale of the sphenoid bone, proving to be that *nerve* which is described as a root of the *trigeminus.*

Inferior maxillary nerve. Motion for the tongue.

Gustatory, a branch of the trigeminus. Sensation.

Hypo-glossal. Respiratory action.

All anatomists and physiologists at the present day appropriate to the tongue, another respiratory nerve called the glosso-pharyngeal. I do not at all regard the function of this nerve as one of respiratory action, motion, or sensation; but ascribe it to quite a different action in the animal structure. I regard it as intended by nature as formed for the action of deglutition. This nerve connects the pharynx and tongue, and by its influence in the act of swallowing, these parts being approximated, form a perfect channel to allow of the fluid passing into the pharynx without going into the larynx. When the tongue is influenced by this nerve, the epiglottis, being attached to its base, is drawn down, and the rima glottidis is closed. This prevents the passage of any kind of substance into the trachea, unless the fluid before a full *action,* should have wended its way into the larynx before its opening was closed. The result would be instantly followed with coughing, and tickling sensation in the throat. If the substance on the contrary, be hard, and completely shut up the chink, unless

it be immediately extracted, or an opening be made into the larynx to allow the air to pass into the lungs, death must inevitably occur.

My reason for regarding the glosso-pharyngeal nerve, as entirely distinct in its function from all the others, arises from the fact, that an individual may lose the power of swallowing, and yet he lives on. On the contrary, let respiratory action cease, and what then occurs? I answer, death. I think this illustration must convince you all, that a nerve of respiratory action is incompetent to the *task*. Of course, then it cannot terminate in the cerebrum, cerebellum, medulla oblongata, nor pituitary gland. Why may it not then, be yet traced to the pineal gland, having that as its organ. As the function of deglutition may be suspended for a time, without producing death, I give it a range at the head of organic life: for instance, 1 motion, 2 sensation, 3 deglutition, 4 respiratory action, and last of all sympathetic action. The two first belong purely to animal life, and the three last to organic life.

A word regarding the pathology of *hydrophobia*, the characteristic feature of which is an impossibility of swallowing exists. Let us, for the sake of argument, suppose that the true physiology of this nerve is as I have stated. A person is suddenly bit by a mad dog, the poison traverses by absorption the nurileme of the motor and sensitive nerves; it then gives rise to great agitation and anguish of feeling. When it attacks tho glosso-pharyngeal, then difficulty of swallowing ensues; then the nerves of respiration become affected, and difficult respiration is the result, and last of all the sympathetic; then instantaneous dissolution takes place.

Those nerves which are most extended in their distribution, are first affected, and so on, until all are involved. This is based upon the most scientific principles, and has facts to sustain it. Who can doubt for a moment, that the nerves distributed to the hand, are more exposed to inflammation than those whose destination is to the tongue. The reason why dread of water is a constant attendant upon this disease, arises from the painful convulsion that ensues. The patient is thirsty, and the moment that any liquid, or even the sound produced by its falling, is brought

near him, an effort is made to swallow, but the nerve being inflamed, is incompetent to perform its function, and a most painful feeling is occasioned. Offer this fluid again, and no attempt will be made to swallow, the patient dreading the result. A strong argument for the support of this opinion, may be adduced; and that is, the length of time the poison or contagion remains in the system, without developing the disease. It has been said to have made its appearance in twenty-four hours. I do not altogether believe this; and if it does, it is of rare occurrence, and in persons of very irritable habit. The usual time of its appearance is in three weeks to six months, though it is stated to have occured *forty* years after its insertion into the system. If ever, gentlemen, this should prove to be the fact, this nerve should be called the *nerve of deglutition.* The disease is certainly nervous, and is rarely attended by distinct febrile symptoms. The pulse in the commencement differs but little from its natural condition. After a short time elapses it becomes small, weak, and irregular, also very frequent. Death takes place about the second day, and is seldom protracted beyond the *sixth.* Were I called to treat this disease in its first stage, I should apply leeches along the course of the nerve, and cups to either side of the spine; apply volatile liniment to the throat, administer a cathartic enema, and having relieved the bowels, substitute nutritious ones; confine the patient to a dark room, and allow no noise near him; give directions that no fluids or eatables be placed in his way. By this treatment I have strong hopes that this *incurable,* "necessarily fatal" disease according to the distinguished *Eberle,* would yeild to physiological treatment. I have no doubt but that the ganglions of animal and organic life, would present traces of inflammatory action, if closely examined after death. If this should be proved, it would add strongly to the confirmation of my views. My object in administering nourishing injections "per anum," is for the purpose of sustaining the system, until I could subdue the inflammation existing in the *glosso-pharyngeal* nerve. Confining him to a dark and quiet room, at once cuts off external stimuli and allows the *senses* to repose.

When motion and sensation are destroyed in a dying man, you

will find that he breathes gasping, and that the tongue is drawn forwards to raise the epiglottis. This is accomplished by the nervous influence of the hypo-glossal nerve, and is a respiratory action. When the glosso-pharyngeal acts, the rima glottidis is closed, and consequently no air could possibly pass into the trachea. This simple fact alone must lead you to believe that it cannot be a respiratory nerve. What nerve bestows that voluntary power upon the tongue, by which it is enabled to move in accordance with the will? It cannot be the hypo-glossal, for this is a respiratory nerve, and acts without the influence of the will. I should say, that the nerve already described by *myself*, is the proper motor.

Fourth.—Touch. Its organ, the skin.

A motor nerve,
A sensitive nerve. } They come from the spinal nerves.

Fifth.—Hearing. Its organ, the ear.

The nerves of hearing having been fully demonstrated, I shall merely name them.

1st. Set.—*These are purely for the labyrinth.*

Portio mollis, for sensation.

A nerve connected with it, for motion.

2d. Set.—*These are purely for the tympanum.*

A branch of the portio dura, for respiratory action.

Vidian nerve, a branch of the trigeminus, for sensation.

A branch from the motor nerve, connected with the portio mollis.

I am strongly induced to conclude, that the vidian nerve, a branch of the second branch of the trigeminus, does not form the sensitive nerve of the ear, but is merely sent to form a connexion with the portio dura, or respiratory nerve of the face. The portio mollis, being in my opinion, formed of two roots; a motor and a sensitive. The route through the *vidian*, seem to to my mind, a very indirect mode of communicating the sense of hearing to the cerebellum. This concludes the five senses as enumerated.

The pineal gland. Organ of deglutition, is a soft greyish body, irregularly round, something like the heart of a frog. It consists

of cineritious and medullary matter, and we know that this is the construction of the cerebrum, cerebellum, &c. Its long diameter amounts to three or four lines, while the short diameter is about three lines.

Gentlemen, the field of science is open before you, and you have the same right as the oldest medical man in this assembly, to cultivate, and then bring forth its fruits for the benefit of all. A few years back, and the filaments of the optic nerves were supposed to entirely decussate each other. Now you all are aware that some pass direct to the retina, and that others decussate. Suppose I *had had* the audacity to suggest this fact, what would have been the result? I should *merely* have been considered as *an impudent little man;* but that would be of trifling consideration provided I should ever be enabled to illustrate its practicability. Excuse me, gentlemen, if I should assure you, that this idea did originate in my own mind, but I dared not reveal it for fear of being laughed at. The first time it ever occured to me, was while reading "Hennen's Military Surgery," whilst a student in Baltimore, in the years 1831–2. While engaged in attentively perusing this work, I came across the following case, which I shall state in the words of the author. The case was attended by a Mr. Hill. "It appears that a man had been under his care for a long time, with a severe injury, affecting the head generally; his friends, despairing of the possibility of saving his life, brought him to his home. Repeated attacks of fever, inflammation, and suppuration of the brain, took place. When the inflammation was in the *forepart*, the candle appeared double; when *backwards* with a circle about it; but after the free eruption of the matter, the candle appeared single and distinct." I attempted to account for it, in the following manner. In the first instance the decussating filaments of the optic nerve were compressed, while those which passed direct to the retina, produced each a separate object, and thus diplopia was the result. In the second instance the direct were compressed together with the decussating, and a circle was formed, which was nothing more than *imperfect vision.* When, however, all pressure was removed, both sets of filaments renewed their functions, and distinct vision was produced.

Sir A. Cooper says, that sensation and volition depend upon the brain, the spinal marrow and the nerves, yet the involuntary functions depend principally upon the nerves. No one of you, gentlemen, can avoid admiring this greatest of all surgeons, and therefore I with reluctance say, that if this is really his opinion of the physiology of the nerves, it is an erroneous one. Sensation and volition, according to the views set forth here, are produced by motor and sensitive nerves, with their organs the cerebrum and cerebellum. The involuntary functions, on the contrary, consist of deglutition, respiratory action, and sympathy; they are produced through the nerves, with their organs pineal gland, medulla oblongata, and pituitary gland. We are enabled to prove by actual experience, that when injuries occur to the spinal cord, the effect is in proportion to the injury committed. If sufficient to prevent the transmission of sensation and motion, and if attempts are not made for its speedy relief, the interchange which exists between the spinal nerves and sympathetic being stopped, death must ensue. Suppose this great nerve had been placed in the spinal cord, and running, as it must have done, from the coccyx to the base of the skull, to what would it have been exposed? Concussion, extravasation fracture, fracture with depression, suppuration and ulceration.

A part may be paralized, that is deprived of motion, or sensation, or both. Eberle says, that cases of partial paralysis are attended with loss only of sensorial power. According to his remarks, one would suppose that the sense of smell or vision was occasioned by these nerves. Such cannot be the fact, and I think I can prove it. What kind of nerves are those called olfactory and optic? The answer would be, motor nerves. Why are they so? Because when examined, they are found to terminate in the cerebrum. I will suppose that one of you have asked me, if the optic nerve is paralized, why does vision cease? I should reply, that if the retina (which is thought to be an expansion of the nerve,) is not presented to the stimulus of light in consequence of paralysis of the nerve sent to it, no perception in the cerebellum could be the result.

To be plain as possible, I state, that it is my belief that the re-

tina and Schneiderian membrane of the nose, are originally formed to convey outward impressions, and that a nerve of motion and sensation is distributed to them—one presents the surface of these structures to their appropriate stimuli, and the other conveys the sensation to the brain and perception is produced. When the supra-orbital nerve is wounded, Doctor Gibson says, that it almost invaribly gives rise to amaurosis, and further says, that there is probably no instance on record, in which the patient has perfectly recovered his sight. We know, then, that this nerve is a branch of the nasal branch of the first branch of the trigeminus; consequently, it gives sensation. If, then, the destruction of this *branch* should destroy vision, I am supported in my opinion that the optic is purely for motion.