

## **A treatise on diseases and injuries of the nerves / by Joseph Swan.**

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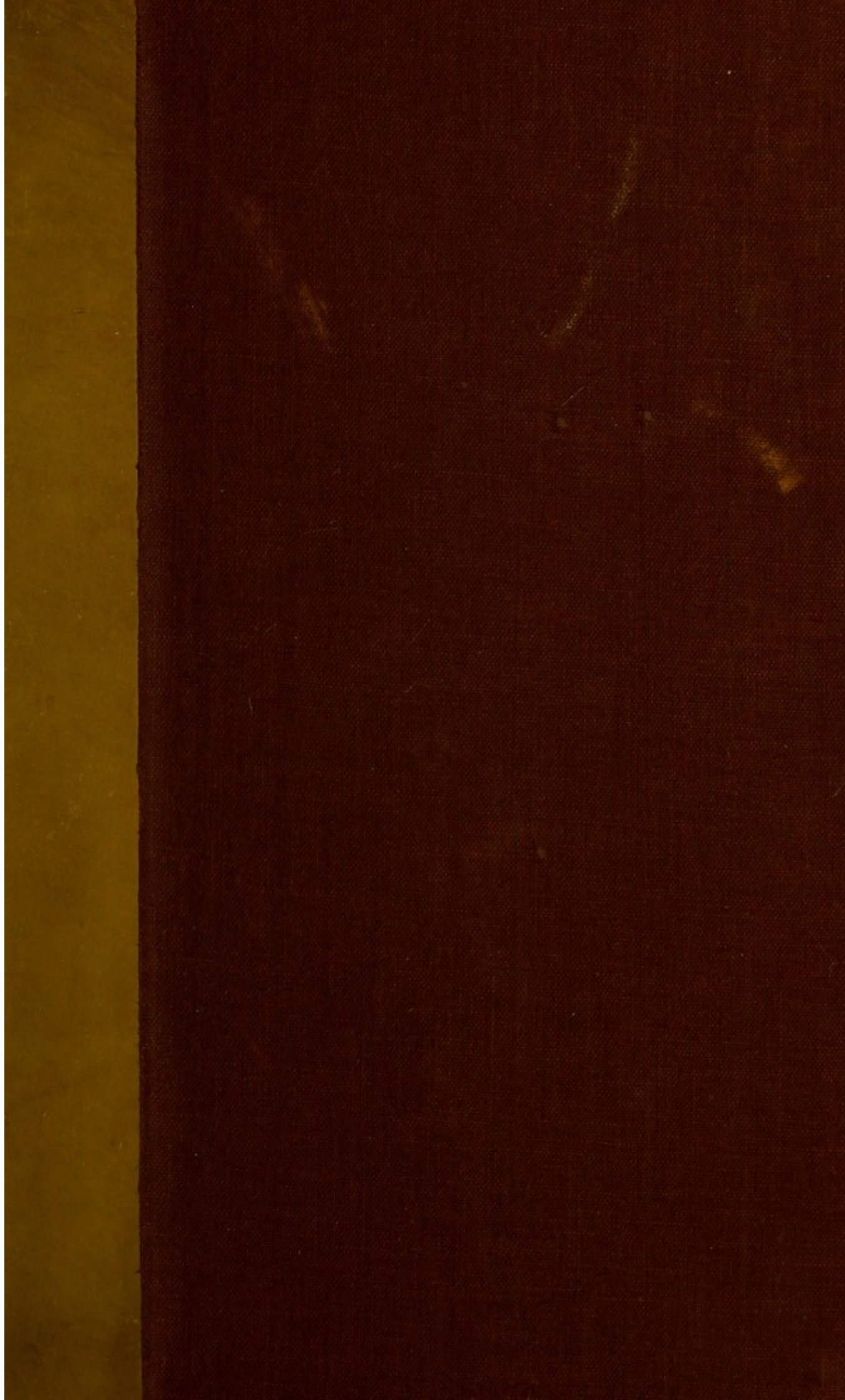
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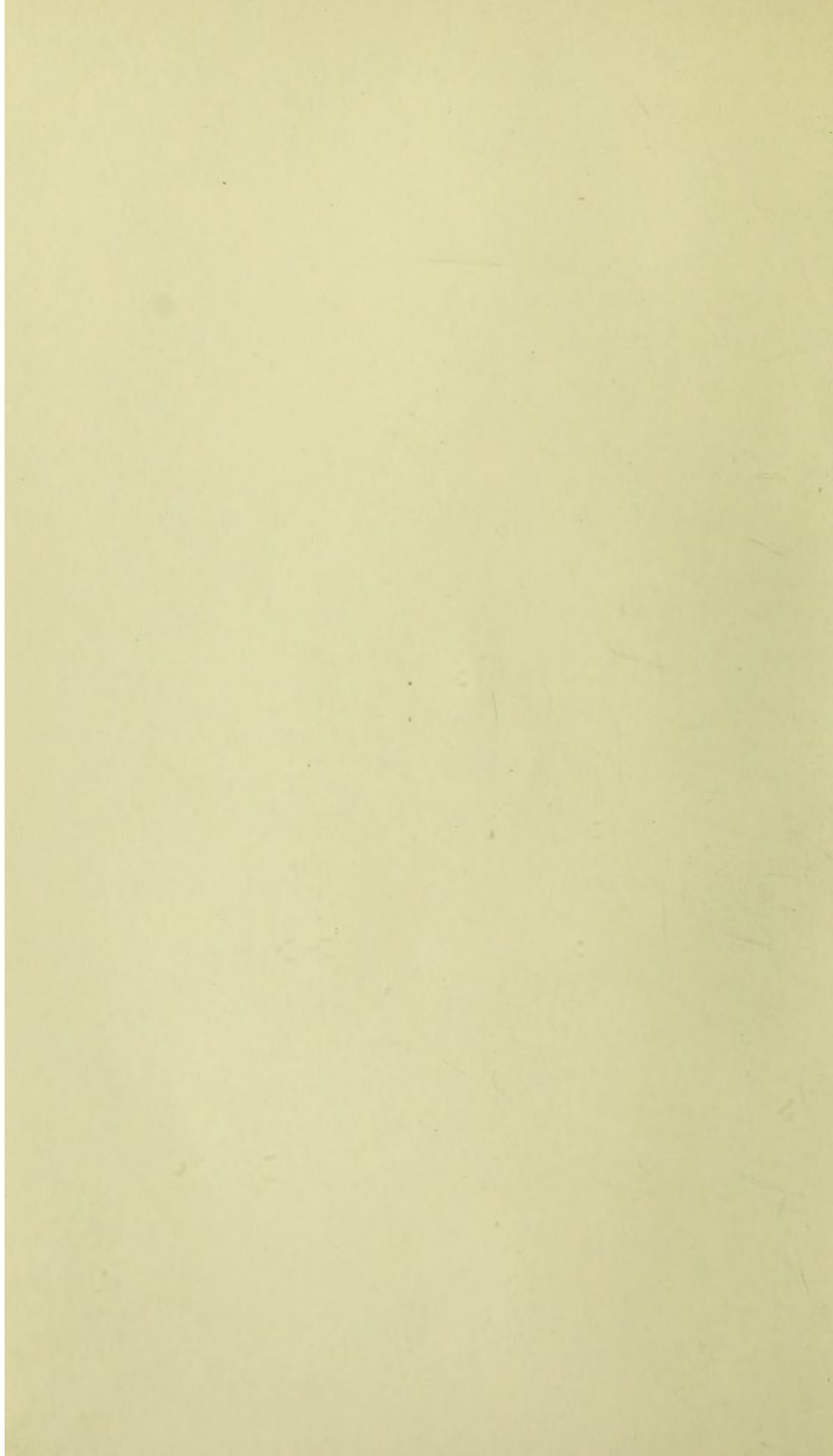


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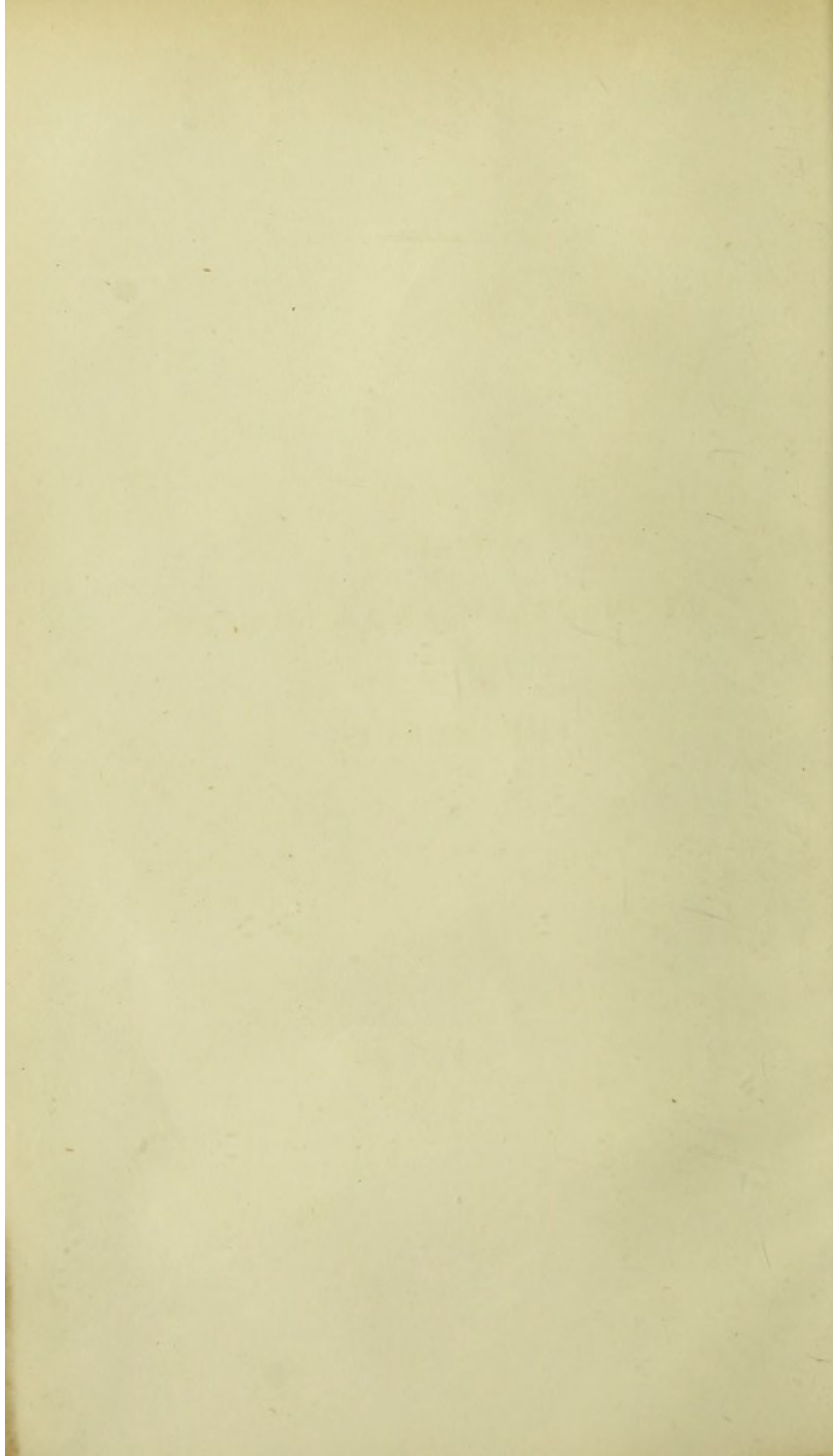


A TREATISE

ON DISEASES AND INJURIES

OF  
THE NERVES.





A TREATISE  
ON DISEASES AND INJURIES  
OF  
THE NERVES.



BY THE SAME AUTHOR.

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A TREATISE

ON

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DISEASES AND INJURIES

OF

THE NERVES.



BY JOSEPH SWAN.

“Non scribo hoc temere. Quo minus familiaris sum, hoc sum ad investigandum curiosior.”—CIC. EP. AD FAM. Lib. iv. Ep. xiii.

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VERY CONSIDERABLY ENLARGED.

LONDON:

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A TREATISE

ON

DISEASES AND INJURIES

OF

THE NERVOUS SYSTEM

LONDON:

BRADBURY AND EVANS (LATE T. DAVISON),

WHITEFRIARS.



## P R E F A C E.

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THE first edition of this work having been long since disposed of, it seemed to be required that the Author should reprint it, with various other papers published by him at different times on the same subject ; he has therefore embodied nearly the whole of these in the present volume.

In the last few years, many communications have been made to the Profession, relating to diseases of the nerves ; most of these have been in detached papers by different individuals, and, although several are in themselves of great interest, yet, when arranged for the purpose of forming a system, they leave many spaces almost unoccupied. In the present volume, the Author has attempted to supply some of the deficiencies, but more with a view of creating inquiry, than of laying down rules for the cure of the respective diseases.

Much has been done by the eminent physiologists of the present day regarding the functions of the nervous system ; much however remains to be accomplished. As the knowledge of physiology advances, many things in pathology will be explained, and it is therefore desirable that every new fact or appearance produced by disease should be recorded ; for however singular it may at first sight appear, it will not fail of being duly appreciated, when observations have been multiplied, and sufficiently enlightened views entertained.



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A TREATISE  
ON  
DISEASES OF THE NERVES.

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CHAPTER I.

OF PAINFUL AFFECTIONS OF NERVES IN GENERAL.

THE nerves most subjected to painful affections are the fifth, and those arising from the whole length of the spinal chord. It may be expected that I should state whether pain be felt only by the posterior bundles of the spinal nerves, which have been termed sensitive, and not by the anterior, or those termed muscular. When a muscular nerve is irritated, an immediate contraction of the corresponding muscle takes place; it must therefore be endowed with perceptibility; but whether this be cognizable by the mind as a sensation in the common acceptation of this quality, is very difficult to determine, nor is it less so whether its morbid condition be productive of pain. The facial portion



of the seventh pair of nerves conveys the power of action to many of the muscles of the face, but is subjected to painful sensations. Experiments on the par vagum have given rise to various opinions. When this nerve has been either divided or inclosed in a ligature, the animals have expressed the most uncomfortable sensations, but whether these have been feelings of ordinary pain or only suffocation, I cannot determine; but it may have been either one or the other, as its disorder produces a sense of suffocation in the lungs and pain in the stomach. The morbid condition of a single nerve, and particularly of part only of its origin, can seldom come under the consideration of the pathologist, for almost as soon as it has left the brain or spinal chord, it has either communicated or become intermixed with other nerves. When it has been affected at its seat in the brain, some other portion of this organ besides the precise spot giving origin to it, has been implicated in the disease. Experiments for determining the sentient qualities of nerves have not been so satisfactory as to have carried conviction to the minds of unbiassed persons, for when animals of the same species have been subjected to the same treatment, one has expressed the keenest suffering, whilst another has been altogether unmoved. But observe what takes place on the performance of an experiment. Incisions are made through sensitive parts; these are forcibly retracted



for allowing the separation of the specific nerve from its surrounding connections, and the state of the wound is momentarily varying, so that when the nerve itself is irritated, it is impossible in many instances for the most candid observers to form a correct judgment.

Of all the disorders to which the human species is liable, there are few more afflicting than painful affections of the nerves. The sufferers are generally incapacitated for any employment, for between the horrors of excruciating pain, the consequent debility, and the use of narcotic and other medicines, the greatest resolution cannot fail of being subdued.

There are few diseases so little understood as those of the nerves, and their obscurity in many respects must be ascribed to the more than ordinary difficulties attending their investigation. Opportunities of inquiring into their nature by dissection have seldom occurred, consequently various opinions have been formed, many of which are altogether unworthy of notice. The pain in many cases has been so entirely confined to one nerve, and attended with so little apparent disorder of the system generally, as to have led to the belief of its having been entirely local. But, on the contrary, since an operation for intercepting the communication of the affected nerve with the brain has proved so often unsuccessful, the conclusion that the disease is constitutional has been



as generally adopted. Before advocating either of these opinions, it will be necessary to examine into the state of the several parts of the body which are more or less implicated in its production and maintenance.

It may be esteemed a matter of curiosity, but it is nevertheless one of importance, to know how the nerves are affected in the production of pain. It would take me very far beyond the proper limits of this work, if I were to give a dissertation comprehending every variety of pain ; for then I must consider the particular action of the blood-vessels, and many other circumstances connected with each species of inflammation in every structure. I shall therefore with as little digression as possible confine myself to an inquiry into the nature of pain constituting *tic douloureux* ; the peculiarity in its mode of attack ; and the means by which it is excited through sympathy with distant parts.

Whether there be action so as to produce motion for the ordinary functions of the nerves is not determined, but from the great retraction after their division, and the sometimes straight and sometimes waved or tortuous appearance of the fibrils, it is most probable that their state is not altogether passive. I conceive that in some cases there is a contraction of the nerve itself, which produces pain. I have often observed a quivering motion of the cutaneous nerves underneath the skin on the outside of the leg, which appeared very similar to



the action of muscles in an animal recently killed. In one of the cases of a wounded thumb related in the chapter on partial divisions of nerves, motions could be observed in different parts, and from the description of the patient, I cannot help thinking that what she called spasms were contractions of the nerves producing shocks. These motions are not always attended with pain, but I conceive that contractions of the nerves may take place and produce pain, in the same manner as those of the muscles during their violent action in cramp or tetanus.

The healthy condition of the body, or any of its particular organs, depends upon the proper balance in the circulation of the blood between the arterial and venous systems, and in no part is this equality more necessary than for the well-being of the nervous system. There can be no question about the necessity of a sufficient supply of arterial blood for the healthy state of the brain and nerves, and, without this, the necessary energy, which enables each nerve to perform its proper functions, is either not formed or becomes stifled by the redundancy of venous blood. If too much arterial blood be supplied to any part when the nerves are in healthy action, inflammation of the active kind is produced. When there is not a proper supply of arterial blood, or when an organ is not duly supplied with nervous energy, congestion or inflammation having the venous character takes place. If the powers of the



lungs be imperfect, either from a division of their nerves, or the failing functions of the brain, these viscera cannot effect a sufficient change in the blood, neither can the stomach digest the food; so in the liver, when the strength of the body is too much reduced, congestion will be present, and gouty inflammation in the foot will be rather of the chronic kind, and have in the highest degree the venous character; or when the lungs and stomach imperfectly perform their functions, gout, seated in the upper extremities, will have the same appearance. How far painful affections of the nerves are modified by venous congestion, it is difficult to determine, but it is a matter well worthy of serious consideration\*. Bichat says "I preserve the sciatic nerve of a subject, who suffered very acute pain in its course, and which presents at its superior part a number of small varicose dilatations of veins penetrating it." In examining the limb of an old man who had died of mortification of the foot after a very gradual and very painful extension of the disease from the toe, I found the sciatic nerve loaded with veins containing blood; the arteries of the whole limb were very much ossified. In those cases of painful affections of the nerves in which the limb is cold, and the pain is prevented or relieved by warmth, I conceive the

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\* Anatomie Generale, tome i., page 177.



languor of the arterial circulation may favour the congestion of the veins of the nerves, and thus produce distension of their fibrils; and that warmth, by increasing the action of the arteries, and favouring the return of the blood and the cutaneous exhalation, may take off or prevent this loaded state of the veins, and relieve the nerves.

That the nerves require a proper supply of blood is proved by the pain and imperfection of the functions of the parts in which they terminate, if too great heat, or too intense cold, influence them; also, if the blood be intercepted by a ligature, which may act both as preventing the accession of the arterial, and return of the venous. If a large artery be tied, the functions of the limb are some time before they perfectly recover. A gentleman, advanced in life, had a severe cold, for which a spare diet was recommended. Whenever he sat up, he had great pain in the extremities, and particularly the fingers, resembling that produced by intense cold; so that he was obliged to keep principally in the recumbent position, until his usual vigour was restored by stimulating medicines and a generous diet. If he were perfectly easy and got up, the pain very soon became so severe as to oblige him to lie down again; and these symptoms were, I believe, entirely produced by the deficient circulation.



In many cases of aneurism, in which the pain has been severe from the stretching of a nerve, it has ceased entirely after the application of a ligature on the artery. Violent pain may, however, be produced in the limb from some change in the circulation, as in a case\* of aneurism in which Mr. James passed a ligature around the aorta. He says "the symptom which most demands elucidation was the terrible pain in the limb, which seemed far to surpass that of the operation. For this I can assign no adequate reason, nor did the examination of the body afford any, at least as far as I could with the utmost care discover. There was no evidence during the time he lived of the circulation below the ligature having failed."

Sir Astley Cooper says,† "a man who had undergone the operation for popliteal aneurism, complained in the evening of his leg being painful, and a dresser going through the ward, applied a lotion of the acetate of lead, and when the rags were removed on the following morning, the limb was mortified."

When pain is excited in this manner, it is difficult to state precisely the cause, but it may be owing to the distention of the fibrils of the nerves by congestion of the veins, as I have previously stated, or the imperfect supply of blood by the arteries, and similar to the pain

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\* Medico-Chirurgical Transactions, vol. 16, page 17.

† Medico-Chirurgical Transactions, vol. 2, page 252.



produced by intense cold. If it be from the imperfect supply of arterial blood, it is difficult to determine how the nerve becomes affected, unless it be from contraction.

\* Van Swieten thus speaks of the infliction of tortures on criminals :

“When the man is hung up by his hands, weights are hung to his feet, which being gradually increased so as by degrees to augment the distraction of the parts, the pain becomes more and more severe, till it has arrived at its greatest pitch.”

“And when the executioners have violently extended all the limbs of criminals in the way of torture, they know that by pouring cold water upon them the pain becomes still much more intense.” Did not the cold water act by producing contractions of the muscles, and also of the nerves ?

Different states of the circulation affect the brain with various disorders, and the diminished quantity of blood produces pain, and impaired functions, and it is therefore reasonable to suppose that the nerves may be affected in a somewhat similar, but modified manner.

In some cases a sudden and irregular action of the blood-vessels of the nerve may cause *tic douloureux*, in the same manner as an increased and irregular action of the vessels of the choroid coat produces dizziness.

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\* Commentaries upon Boerhaave's Aphorisms, 221, 228.



But the nerves of the senses not being subject to pain like the other nerves, it is not felt in the eye in dizziness. That the blood-vessels have a principal share in the production of pain in some cases, may be inferred from their increased size in nerves that have long been thus affected. Many examples of this kind might be produced. In the musculo-cutaneous nerve\*, Mr. Hunter was obliged to use a ligature to stop the hæmorrhage, which could never have been necessary in a sound nerve. In the case of William Richardson†, the peroneal nerve bled very profusely; and the portion removed was much redder from vessels than a sound nerve.

If the nerve in *tic douloureux* be affected by its blood-vessels in the same manner as the retina is by the choroid coat in dizziness, *tic douloureux* ought to arise from a too plethoric state of the body, as well as from a debilitated one; and this, in fact, is sometimes the case. When I have observed it in a patient of this description, and with a tendency to apoplexy, I have cured it by antiphlogistic treatment. It may appear strange that a complaint of this sort should be produced by two such opposite states of the body, and that it should continue longer in a debilitated per-

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\* Transactions of a Society for promoting Medical and Chirurgical Knowledge, vol. ii. page 154.

† See chapter on Ulceration of Nerves.



son than a plethoric one : but when the body is strong, the nervous system is generally not irritable : slight occurrences do not easily affect it, so as to produce any disturbance in the sanguiferous system ; whilst, on the contrary, in the atonic state of the body, the brain and nervous system are generally very irritable, every little thing agitates the patient ; and the action of the heart is easily hurried, and this susceptibility tends to increase the irritability of the brain and nerves, by causing the blood to flow to them at irregular times.

It generally happens that a painful affection of the nerves, and especially when it has been of long duration, is attended by an increased heat of the part, and likewise by a local increased action of the blood-vessels ; this is shown by the appearance of the parts to which the affected nerve is distributed, and frequently by the increased secretion of saliva, when the nerves distributed to these glands are implicated.

Although the irritation of the nerve be the cause of the increased action of the blood-vessels, yet this may tend to increase or keep up the irritation of the nerve, and even to continue the local disease after the cause has ceased to exist.

Nerves may become enlarged from irritation in the same way as the muscles from continued action, without losing their healthy character. On the contrary the functions of those enlarged from inflammation are



more or less impeded, and coagulable lymph is found to have been deposited between the fibrils.

Pain affecting the nerves comes on in momentary shocks at irregular periods, but in some cases begins at one particular hour, and is continued for a longer or shorter period. When it comes on regularly it is presumed from its similitude to the return of ague that it is not an affection of the nerves, but this is a mistaken notion; it is however a curious occurrence, and worthy of due consideration. The following case shows that it may be entirely owing to the irritation of a nerve:

#### CASE:

Charles Chelsop, aged thirty years, was admitted into the Lincoln County Hospital on the 14th of August, 1820, with an aneurism in the right ham. He dated its commencement from a fall he had from his horse about twelve months before. The aneurism had been very painful for the five preceding weeks; and at the time of his admission the whole leg was œdematous, and in a state of inflammation, but these symptoms were considerably diminished by confinement to bed, and taking some purging medicine.

On the nineteenth I tied the femoral artery with a single ligature of strong silk. The ends of the ligature were left hanging out of the wound. The greatest part of the wound united by the first intention. There



was no disorder of the constitution. The ligature came away on the fifth of September, when, as the wound appeared healed, he walked out of doors, and was discharged from the hospital quite well on the ninth.

For five weeks before the operation, he told me, the violent pain came on in the leg every night about half past ten, and went off about two in the morning. It appeared to be entirely in the sciatic nerve. This might have been accounted for, by supposing him to have lain so as to press the nerve in the upper part of the thigh, as it always came on in the night; but it returned just at the same time for several days before the operation, when he was entirely confined to his bed. It was never felt after the operation.

In the same manner I have known an ulcer placed over cutaneous nerves near the ankle to be affected by the most excruciating pain, at the same hour early every morning, whilst other ulcers on the same leg were hardly noticed. The subject of this case died of apoplexy.

All local affections of nerves appear to come on, or at least to be aggravated, periodically. Why this should be so, it is difficult to explain. It may be, that a nerve cannot at first bear a diseased action without rest, any more than it can a healthy one, and therefore the diseased action, after a certain period, ceases to make any impression. But after this rest, the nerve



acquires fresh power, and is again fitted for the same action.

In the case of Charles Chelsop, the structure of the nerve could not have been altered from the pressure of the aneurism; but I conceive the aneurism irritated it, and at the particular time of the approach of violent pain, produced some change in the nerve. It may be supposed that the aneurism itself became enlarged at this period, either from a greater determination of arterial blood to it, or some impediment to the free return of this by the veins, and thus extended the nerve to a greater degree, or that there was an increased action of the blood vessels of the nerve itself, or that the nerve was in a state of spasm or contraction, and during the period of ease became passive and yielding from exhaustion, and incapable of being acted upon without further rest.

In healthy persons who lead regular lives, there are regular returns of appetite, sleep, evacuations, &c.; but those, whose minds are immoderately occupied in business, study, or enervating pleasures, have such alternations variously and imperfectly effected. In diseases there exist similar laws, but these are subject to be infringed upon by the many vicissitudes that are perpetually occurring in the physical and moral world, to which every person, whether in health or disease, is more or less subjected. Were all people therefore



formed alike, and in every respect placed under the same influences, both mental and corporeal, it might be expected, that all diseases would follow the same rules, and that every species would be distinct and without variation.

Still, however, it may be a question with some, whether the periodical attacks of pain in nerves be not attributable immediately to some febrile exacerbation, and this to some fault in the digestive organs. Different individuals may fix upon the stomach as the centre of the causes of many of the morbid phenomena exhibited in several diseases, because its healthy or disordered functions always produce comfortable or uneasy feelings throughout the system; but would it not be proper rather to refer these to the nerves from which the sensations entirely proceed?

After every argument used for eliciting the truth, it must be conceded that the cause of the periodical returns of all disorders is a principle or law inherent in the constitution, and with every show of probability is seated in the nervous system; and from this same cause proceed the different types of fever, modified by the excitement producing them, as well as by the constitution and the physical and moral laws to which this is subjected; and if the first excitement be made in the digestive or other organs, it is in the nerves of these that the law is implanted.

In fever excited by injuries there are periodical exa-



cerbations, and by experiments on animals it has been ascertained that the ganglia of the sympathetic nerve are more or less vascular, or irritated in proportion to any local injury that has been inflicted, and in the same degree is produced fever and its effects. It is most probable that this nerve and the par vagum are the only nerves or parts of the nervous system primarily affected in fevers, but it will be admitted that the brain and the other nerves through the medium of the par vagum and sympathetic may be more or less implicated, and then produce peculiar symptoms according to the degree in which they have been excited. Why intermittent fevers observe different types may depend on the different portions of the nerves that have been affected, or upon different poisons influencing them. In intermittent fevers the first effect is depression, but could this be so if it were produced by irritation of the nerves? This is not difficult to conceive, for the first act of irritation is disorder, and this in the nervous system is depression and is observed after accidents, and particularly those affecting the nervous system. When the heat of the body and the air are temperate, and all the sensations healthy, putting the feet into hot water will bring on a sense of chilliness. This can only proceed from a disorder of the functions of the nerves produced by the suddenly increased circulation of the blood. A person with active inflammation of the skin will complain of chilliness in the affected part.



It is the experience of every one that disorders of the digestive organs will produce painful sensations in various parts of the body, and that these will cease on the removal of the offending cause, as by vomiting, the neutralization of acidity or a free evacuation of the bowels ; and it is a matter of no small importance that a careful diagnosis should be formed and the cause of pain speedily removed, not so much on account of the present suffering, as of the future comfort and well-being of the patient, for when pain has been excited in any distant and previously healthy part by a disordered organ, and has arisen in the first instance merely from a contraction or spasm of the nerve, it may have been so often repeated as to have produced sufficient action of the nerves and blood vessels, for making the surrounding parts irritable and liable to be affected by a variety of fresh causes, even when the organ that first produced the pain has resumed its healthy functions : therefore the sooner proper remedies are applied, the greater is the chance of removing the local disease, and preventing this from reacting on the original cause, for a long succession of these interchanges of morbid excitements so entirely subverts the functions of every part of the system, as to render the return to health almost entirely hopeless.

It has just been stated that disorders of the digestive organs may produce pain in some distant and other-



wise healthy part, and it is equally necessary to know that an irritated nerve will on the contrary disarrange the functions of the stomach and other viscera. When a child is about cutting its teeth, the gums will be inflamed and incessant vomiting produced, but as soon as the painful part is divided, the stomach will immediately become tranquil. \* Mr. Pearson has related the case of a gentleman who had an issue in the thigh which produced both vomiting and deafness, and he has also stated that both these symptoms were entirely removed by healing the ulcer. † Bichat says in neuralgic paroxysms there are often spasmodic vomitings, increased actions of the heart, &c. The same symptoms may be produced in making experiments. Thus in acting on the nerves of the inferior or superior extremities, by irritating them in any manner after they have been exposed, I have often produced vomitings, or convulsions in muscles, not supplied by the nerves I irritated.

‡ Mr. Wardrop has related the case of a woman, who had pricked the fore-finger of her right hand with a gooseberry thorn; the two first phalanges were very painful, and so acutely sensible as not to endure being touched. After having suffered very much for twelve

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\* Medical Facts and Observations, vol. vi., page 109.

† Anatomie Generale, tome i., page 186.

‡ Medico-Chirurgical Transactions, vol. viii.



months, the finger was amputated, and she got completely well.

“The nervous paroxysms usually attacked her two or three times a day, and one of them always came on at the time of her rising out of bed. During these attacks the pain extended along the finger to the back of the hand, and between the two bones of the fore-arm, darted through the elbow joint, stretched up the back of the arm to the neck and head, producing a sensation at the roots of the hairs as if they had become erect. To these feelings succeeded a dimness of sight, and the pain afterwards went suddenly into the stomach, followed by sickness and vomiting. She had constantly the feeling of a lump at her stomach, and always vomited after taking food or drink. Her flesh too was much wasted, and she had become extremely pale.

“No sooner had she got into bed after the operation, than she experienced a remarkable difference in her feelings; the sensation of a lump in the stomach, and the sickness, which she had so long felt, immediately subsided; and in half an hour after the operation, she said she felt, for the first time, as well as she had done previous to the accident, except merely a slight pain in the stump.”

It would be interesting to know by what course pain is conveyed from one part to another, but this investigation is attended with considerable difficulty. Although



attacks of pain appear to have so many variations, they are no doubt subject to particular laws, and would by mature researches be found to be dependent either on some variety in the cause, or some peculiarity in the constitution and circumstances of the several patients at the time.

When pain is conveyed from the viscera to the different parts of the body, or from these to the viscera, the sympathetic nerve and the par vagum form the medium of communication. It is not, however, easy to determine either the precise state or part of the viscus that excites the pain, as this differs so much, and there are not usually any concomitant symptoms decidedly indicating the visceral disease, for sometimes the pain is manifested in one of the largest and most sensitive nerves with which the extreme part of the sympathetic communicates, as in the second trunk of the fifth in the upper lip, or in that spot in the temple where the temporal branch of the malar nerve is joined by the branches of the facial nerve which pierce the temporal fascia. In a disordered state of the liver, pain is felt in the right shoulder, but it may be also felt in the superior scapular nerve, after this has passed through the notch in the scapula to supply entirely the muscles. When the viscera cause neuralgia, what is their precise state? It is not acute inflammation, for then pain, or some mark characteristic of the disease,



would be present; but it is an impaired condition of their functions, which is insufficient for exciting pain in the branches of the sympathetic nerve distributed to them, but capable of producing disorder, and this, communicated to the more sensitive nerves, of exciting pain.

There is another arrangement of nerves, formed of branches of the sympathetic and those from the spinal chord, mixed together, and supplying the bladder, uterus, and rectum; the irritation of the bladder is manifested in the end of the penis, at the termination of the most sensitive nerves communicating with those distributed to this viscus; but in other disorders, and particularly in the ulcerated state, pain is experienced in the sole of the feet. So are pains felt in different parts of the extremities in diseases of the uterus and rectum.

Another state exists, in which the pain passes entirely by the communication of similar nerves, distributed on the same side of the body. In the case of Miss Willson, which will be presently related, the finger of the left hand was slightly wounded, and pain passed from this up the arm and neck to the face; the left half of the body was weaker and more susceptible of pain than the right; and although ten years have elapsed since the accident, the brain has never suffered. I cannot help concluding that pain is conveyed from one place to another, as in this case, entirely by the



nerves, and not at all through the medium of the brain. Sometimes the pain does not reach far beyond the affected part, but produces a great weakness of all the muscles of the limb, with wasting, and an imperfect generation of heat. In some cases of tumour in the nerves, the brain has been affected as in epilepsy; and from a violent cause the irritation of a nerve may be extended to the brain, as in the case of a general officer, related by Dr. Hennen\*, in which some of the axillary nerves had been included in ligatures after amputation of the shoulder joint, and pain was felt in the course of the brachial nerves, just as if these had existed, whenever the ligatures were gently pulled; but on one occasion only, when these were forcibly extended, his head became suddenly affected. In any of the preceding instances I cannot think that the irritation was conveyed from the affected nerves to the brain, and from thence to another part. It is reasonable to conclude that, in some instances, a disordered viscus may irritate the brain, and that this organ may at the same time excite pain in nerves at a distance. Or a diseased part of the brain may irritate the stomach, or other viscus, and the disorder of this may affect with pain those nerves which particularly sympathize with it. Diseases of the brain will produce pain in particular

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\* Military Surgery, p. 191.



nerves; and on the contrary, in some rare instances, violent and long continued pain in the nerves may produce disorder of the brain. Is there any good ground for the opinion that tic douloureux is a constitutional disease? The preceding considerations would lead to the conclusion that the continuance of disorder may produce the most complicated changes in the system; but there is no sufficient reason for inferring from thence that it is generally constitutional. It is desirable to lean as little as possible to such suggestions, which are the mere opinions of despair, and not only tend to increase the sufferings of patients by taking away hope, but to prevent that due attention to pathological researches which may extend the means of relief.

It will not be denied that there is a susceptibility of the nervous system to disorder, from very slight impressions, arising from a peculiarity of its formation, as when mania has been an hereditary disease in the family of any one afflicted with tic douloureux; or from a delicacy of the whole frame, or some particular organ; but these circumstances ought not to lead the pathologist to relax in his endeavours, as there have been many people of good and healthy constitutions affected by such diseases from some accidental cause or some local injury. Morbid affections of the nerves may attack those whose constitutions were originally,



and had continued a long time, healthy, but whose powers had been undermined by corporeal and mental excesses, such as a too constant attention to business, or too much subjection to the depressing passions, by irregularity in the mode of living, a too frequent use of fermented liquors, disorders of the digestive organs, or any other cause that tends to weaken the body. By these means the brain and nervous system, originally healthy, are rendered morbid in their actions; but there are some people who are naturally susceptible of this irritation, from their being descended from parents who were subject to mania, or some other disorder of the nervous system.

Debility is a state the most fitted for keeping up a morbid excitement of the nervous system; and when this has been once produced, a habit is formed which continues the irritation, and generally becomes stronger and more obstinate the longer it is unopposed by such remedies as have the power of breaking through it. Sometimes, however, the complaint will appear to terminate spontaneously, and sometimes by the coming on of another disorder, as in the following case.

#### CASE :

Mr. H., forty-three years of age, received a blow on the right eye, which produced a great extravasation of blood between the conjunctiva and sclerotica; he was



likewise bruised on the head. He could see very little with this eye before the accident, but he is now entirely blind. At first he complained of very violent pain in the eye, for which he was bled, took purging medicines, and used cooling washes. Shortly after he complained of stabbing, or darting pains, which went from the temple down the face, and sometimes to the ear; these came on in paroxysms, and were at first very violent and frequent, both day and night, and then seldom came on in the night; afterwards the paroxysms became gradually fewer; at the end of ten weeks he had two or three every day, when an eruption like that of the nettle rash came all over his body.

After this he had no return of the pain; he improved in his health, and became entirely free from complaint.

During all the time before the eruption his spirits were much depressed. Much anxiety always increased the paroxysms, as well as any thing that caused him to be angry; much stooping, or motion of the head, likewise brought them on. During the paroxysms there was a great pulsation of the temporal arteries.

He used no particular remedies but those first prescribed for him, except occasionally some leeches, as the pain, though very excruciating, kept gradually diminishing.

In this instance the pain was produced by the injury, but the constitution seemed to be concerned in its



continuance, as was proved from its entire removal, as well as of all the other nervous symptoms by the eruption.

After the eruption his appetite became good, which had not been the case for a length of time.

Whoever names every painful complaint *tic douloureux*, and expects to cure it by any specific medicine, will not only be disappointed, but will find, when it is too late, that he has done much, if not irreparable, mischief. When a mechanical injury has been inflicted, it may generally be known with accuracy what nerve has been wounded; but when the seat of the disease is to be judged of by the part at which the pain is felt, even with the utmost caution, erroneous decisions may be formed. It is, therefore, necessary, before any treatment be adopted, that the strictest inquiry should be made. It should be ascertained whether the pain may be referred to some disease in the brain, the spinal chord, or their membranes; whether to the bones inclosing these organs, and through which the nerves pass to their respective terminations; whether there be tumours in the nerves, or aneurisms, tumours, enlarged glands, or synovial bags distending or pressing upon them; whether the pains are to be attributed to disorders of the digestive organs, or those of absorption, excretion, respiration, circulation, generation; therefore to expect that painful affections depending on any of these systems, or any of the



various diseases to which each of them is liable, are to be cured by a specific medicine, is to betray the ignorance of the empiric.

Before any treatment is commenced, it is necessary to inquire particularly into the state of the functions of every organ of the body, as sympathies between remote parts very often exist. If the body be not emaciated, and the functions of the digestive organs be well performed; and if pain in the head and dizziness be complained of; if there be flushings of the cheeks and fever; it is very probable that the brain is oppressed by a too great fulness of the blood-vessels; and apoplexy will be the consequence, unless blood be extracted, and antiphlogistic remedies made use of.

If there be no disease of any organ, and the body be emaciated, whether from mental exertion or depression, or from debility of the digestive organs, a generous diet, with strengthening medicines, should be administered; change of air and scene, and every thing that can contribute to the restoration of the healthy functions of the body, should be had recourse to. If it have proceeded from an accident, although the part may have recovered from the mechanical injury, the symptoms may remain until the health be restored by breaking through the morbid habit.

In many instances, when the body is debilitated, and the digestive organs are suffering, the greater the care



that is taken in giving small quantities of light food, blue pill, &c., by way of restoring the secretions, the further is the patient from the chance of recovery. When the body is weak the powers of digestion are weak also, and the nerves of the stomach, as well as those of every other part, are incapable of supplying the necessary quantity of nervous energy for the completion of digestion. If mild food be taken into the stomach it is not digested, but remains as a source of irritation: if, on the contrary, stimulating food be eaten, with a sufficient quantity of wine, &c., the nerves are stimulated, and allow digestion to be completed; and under this plan the state of the tongue and every part of the system will be improved. Here a debilitated state of the body is spoken of, and not one in which organic changes have taken place in any of the viscera.

In attempting the cure of this complaint, if no previous plan of treatment have been adopted, and there exist any doubt respecting the state of the functions of the viscera, it will be best to administer some purging medicine, and afterwards, if the secretions of the liver and other organs be not healthy, alterative doses of mercury and some bitter infusion, with or without that of rhubarb, and soda, or ammonia. If there be a want of appetite and much perspiration, the diluted sulphuric may have a good effect. If there be fever, saline



and antimonial medicines must be given. By this plan sometimes the complaint will be removed, when it would have been aggravated by other treatment. It will, however, if no benefit have been derived, be known that the fault is not in the secretions, and other remedies may, therefore, be more judiciously chosen.

In the treatment of visceral complaints there is some difficulty in knowing when the inflammatory action has ceased, and venous congestion has taken place, and the last state is keeping up in a considerable degree the symptoms the first occasioned. In many instances, after the disappearance of inflammation, the affected organ becomes debilitated, and the functions of its nerves so ill performed as to prevent the secreting powers, and consequently the veins are beyond measure distended with blood. It is in this state that a change of treatment is required, and one the very reverse of that employed during the inflammatory action gives the necessary stimulus to the nerves, restores the secretions, and relieves the organ and the distant parts which sympathised with it.

It would be to little purpose for me to attempt to state what medicines should be made use of for the restoration of each particular organ that may be disordered, as these would, on most occasions, be the same as when an affection of the nerves did not exist. When there is not any general inflammatory action, or mark



of congestion, or other tendency to disease in the brain, and pain and debility are the only symptoms, there appear to me to be two principal indications of treatment for the cure ; the first consists in strengthening the constitution, and thereby enabling it to counteract the habit which favours the continuance of the complaint ; the second, in allaying the local irritation itself.

The first is best fulfilled by the exhibition of tonic remedies in doses, which must be repeated frequently, and at regular intervals, so as to produce new and regular actions : and when the pain is very violent, sedatives must be given, both with a view of alleviating this, and assisting the constitution to overcome the morbid habit. The best tonic remedy for effecting this change is bark, which should be taken regularly in doses, from half a drachm to a drachm every three or four hours, day and night ; wine and malt liquor should be allowed rather freely. Derangements of the digestive organs have been frequently restored during this plan of treatment.

The subcarbonate of iron, as recommended by Mr. Hutchinson, has very often succeeded in curing this complaint ; and when tonics are not contra-indicated, from half a drachm to a drachm may be taken twice or three times daily, in some liquid, or in honey, treacle, &c. Let it be remembered that this medicine may be productive of much excitement in the uterus, and that



congestion of the blood-vessels of this organ may take place, and be relieved by a profuse discharge; so long, however, as this does not often recur, and produce debility, it may not be of much consequence; but when menstruation is becoming irregular, it is necessary to be careful that inflammatory action and its consequences be not excited.

Besides the use of medicines, the patient should be regular in his diet; he should take gentle exercise, and cease from every exertion of the mind that can be attended with any irritating effects.

The second indication of cure is best fulfilled by reducing the heat and action of the part by leeches and evaporating lotions; and if cold applications disagree, the pain may be moderated by fomentations, and the use of an opiate liniment.

In some cases, and particularly after injuries, even heat is not generated as in other parts of the body, and it is necessary to keep the whole limb well covered with flannel, and to have the skin of this part throughout rubbed twice a day with the camphorated liniment, which is as soothing under these circumstances as the use of cold is under those accompanied by excitement.

When the complaint is confined to a particular nerve, and comes on with such excessive violence, and in frequent paroxysms, and the bark, or subcarbonate of iron, has failed in giving relief, it is difficult to know



what most to recommend. The arsenical solution, some narcotics, as belladonna, cicuta, and extract of stramonium, have been given in some cases with advantage; but there are many cases, on the contrary, in which none of these have succeeded; and when they have not, and the patient's sufferings are very great, the division of the affected nerve must be tried, which has been sometimes successful, though, on the other hand, it has very often been performed without effect.

When every thing else has failed, a discharge of matter, produced by a seton, or issue, made as near to the affected nerve as possible, has in some cases relieved the complaint; and sometimes the application of the actual cautery over the part where the affected nerve is situated has entirely removed, or very much mitigated, the violent symptoms.

It must be borne in mind that pain from a diseased or wounded nerve may produce a disordered state of the digestive organs; and, therefore, when the usual remedies for restoring the functions of these have been employed, the most sedulous endeavours should be used for removing the local irritation by soothing applications, and, if necessary, by the internal use of anodynes.

When the operation of dividing painful nerves was first proposed, very sanguine expectations were formed respecting its utility; it was, therefore, frequently



practised, but, unfortunately for the sufferers, it was soon found to be very inadequate for their relief. The experience, however, thus obtained has not been altogether unavailing, for it has led to more accurate investigations; and although these have proved that the disease is sometimes very far beyond the reach of surgery, by its being seated in the brain or some other organ, it has nevertheless led to a more rational method of treating it medicinally. Seldom, therefore, is the operation now practised, except when it is dependent upon an injury, or when a nerve has become implicated in a tumour. Cases do now and then occur in which relief has been thus obtained, but it has not often been either perfect, or of long duration, and the part the nerve supplied has, from the want of nervous influence, become exposed to injuries from slight causes, and even to mortification. Notwithstanding all these discouragements, the operation should be performed when no other disease is present, and a trial of the usual remedies has failed of giving relief.

When a nerve has been in a state of irritation a long while, a very trifling thing will keep this up. In such cases I believe an enlargement of the nerves takes place, and a long time is necessary before this will subside, after the irritating cause has been removed. For this reason the mere division allows the nerve to reunite and perform its functions before the affected



parts have forgotten the irritation they had previously been so long used to. At what time a nerve is sufficiently restored after its division for producing pain, it is very difficult to determine, but it is presumed it may be capable of doing this long before it is sufficiently restored for serving the purpose of voluntary motion, as paralytic limbs are frequently painful when the muscles have not the least power of motion. If this be so, two advantages are derived from cutting out a portion of the nerve; in the first place, because the divided portions would be longer in uniting, and more time thus afforded for the diseased action to subside; and, secondly, because they would retract out of the reach of the external wound, and be less liable to partake of any inflammation or other irritation occasioned by this.

From the experiments\* made by Dr. Haighton on the par vagum, it seems that the substance by which the divided nerve is united, produces some communication of the nervous influence at the end of nine days, and that in six weeks it has very considerable power to this effect. It appears that the reunion may be established sufficiently for the reproduction of the distressing symptoms in twenty-four days, as in a case† related by Sir Everard Home, where the patient was

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\* Philosophical Transactions for 1795.

† Philosophical Transactions for 1801.



affected with spasms from an injury of the thumb, which began always in the thumb and fore-finger, and for which the branch of the median nerve going to these parts was divided, but in this latter instance the adhesion of the divided nerve to the cicatrix may have created pain, even if no reunion of the nerve had taken place.

Perhaps it will be said, that in these cases the communication of the nervous influence was carried on by anastomosing branches ; but I think Dr. Haighton's experiment, in which he again divided each trunk of the par vagum, nineteen months after their first division, must prove beyond all doubt, that the performance of their functions after the first division depended entirely upon their reunion, otherwise the communication by anastomosis must have become so much developed as to have prevented the animal's death after the second division.

It is a question whether the nerves have the power of communicating their influence to other nerves whose connections with the brain have been cut off, in the same manner as the arteries have whose direct communication with the main trunk has been intercepted by a ligature ; it may be confidently asserted, that it can only exist in a trifling degree, and in some particular cases. Tie the femoral, or even the external iliac artery, and divide the sciatic nerve, and see how wide



the difference is: scarcely any inconvenience is felt from either of the former operations, for the circulation of the blood will almost immediately be carried on nearly as well as it was in the most healthy state of the limb; whilst the latter will be many months before its functions can be well performed; and if a portion of the nerve have been removed, it will be very long indeed before such a reparation can be effected as to enable the parts to preserve their vitality even with the greatest care.

After attentive consideration it must be concluded that the inferior portion of a divided nerve can receive very little, if any power, from the communications it may have with uninjured nerves. After making experiments, I was at first astonished at seeing how much an animal could move its limb a short time after the operation, and concluded that misconceptions have arisen from considering the general motions of the limb as indications of the restoration of the nerves. Greater exertion and use of a part will gradually increase the size and strength of the muscles, and thus the power of these above the division of the nerve will become greater than before, and supply the deficiency arising from the diminished action of those muscles that received their nerves from the parts below the division.

I relate the following case to show how little power the anastomosing branches have of conveying the nervous influence.



## CASE :

February 8, 1820. Joseph Mason, aged thirty-one, asked my advice about a troublesome ulcer on the fore-finger, which arose from a blister produced by the frost. He gave the following account of himself: That two years ago he fell from a scaffold on an axe, and cut his fore-arm at a distance of three inches from the wrist. The cut appeared to have extended across the arm, to have been very deep on the radial side, but of little depth on the ulnar side: the ulnar nerve did not appear to have been wounded, as he had the sense of feeling in the little and ring fingers, and in the corresponding parts of the hand to which the ulnar nerve is distributed. He has no feeling in the thumb or the other two fingers, or in the corresponding part, either in the palm or back of the hand; so that it appears as if both the median and radial nerves had been completely divided. The parts deprived of the nervous influence are constantly cold, whilst those parts, to which the ulnar nerve is distributed, are warm. He feels as well on the radial side of the ring finger as on the other; but does not recollect whether this was the case at first, or how long it has been so.

He called upon me the next year, when he had lost the end of the thumb and one of the fingers; whilst the hand remained exactly in the same state with respect to sensation.



## CHAPTER II.

## OF PAINFUL AFFECTIONS IN PARTICULAR NERVES.

PAINFUL affections of the nerves have been variously denominated,—intermitting pains of the head ; hemi-crania ; tic douloureux, &c.; but they appear to be all the same disease, only varying in situation and degree. They come on generally in paroxysms, and in many instances periodically, recurring at nearly the same hour daily.

The pain attacks sometimes the whole head, sometimes half of it, sometimes one side of the face, but generally only a part of this, as the appendages of the eye, the upper lip and nose, the gums, &c., and varies, in every degree, from a common headach to the most exquisite anguish. During the paroxysm the parts will frequently be in such agony as to deter the patient from moving them for any purpose. The length of the paroxysm varies, and returns very often at uncertain periods. It is most regular when the complaint is beginning, and, if no remedies are used, will become almost continual.



In the beginning of the complaint the pulse is generally natural, though it is sometimes rather quicker, the appetite is most commonly bad, and the spirits depressed.

When pain is confined principally to the head, and has become almost continual, it may be suspected that there is some disease within the cranium; on the contrary, if there be a perfect intermission in the twenty-four hours at about the same time, or if the pain, though constant, become more violent at the same hour, and continue so for some time, and then somewhat abate; if it strike down the face, and wine does not increase it, and if the patient have been bled from the arm, and experienced no relief; in all these cases, it may be judged to be an affection of the nerves of the parts situated on the exterior of the cranium.

Tic douloureux in the nerves of the head and face may arise from a spasm of the nerve through sympathy with a distant part; from inflammation of the periosteum and enlargement of the bone contracting the size of the foramina through which the nerves pass, and producing compression or distension; from exfoliating portions of bone exciting irritation and sometimes producing ulceration; from decayed teeth; from spiculæ of bone irritating the brain; from too much vascular action in the brain; from tumours pressing on the



brain and the origins of the nerves ; from too great vascular action in the painful part ; or from connection with an inflamed part as in iritis.

Sometimes a person has experienced a paroxysm of intense pain, which has lasted only a few minutes ; it has come on for several days together, and spontaneously gone entirely away, although it has generally continued a long time, if its course has not been interrupted by medical treatment.

This complaint may be produced by a slight injury of a particular organ, as in the following case.

CASE :

Mr. M., seventeen years of age, applied to me on account of an excruciating pain in his face, for which he had used remedies prescribed for him without any relief. About two months before, he received a blow on his face, which broke one of the middle incisive teeth of the upper jaw ; some swelling of the face was occasioned by the injury, but in a short time it entirely subsided. When I saw him there did not appear to be any particular cause for the pain, as his general health was not much impaired, although he had become thinner by the continuance of the pain. I ordered him to take two scruples of powdered bark with the following draught every three hours, and to drink several glasses of wine daily :



℞ Decoct. Cinchon.

Infus. Caryoph. āā. ʒvj.

Syrupi ʒj. M. Ft. Haust.

After the use of these remedies for a short time the pain entirely left him, but confinement again brought it on, when recourse being had to the bark in larger doses, the pain gradually subsided, and he afterwards had no relapse.

I have before observed, that whatever tends to weaken the body produces a morbid sensibility of the nervous system, and disposes to the production of disordered functions of the nerves. In the following case the complaint came on in consequence of poison taken into the stomach :

#### CASE :

Mr. B. having eaten some hashed hare, became ill, with others who partook of it. It was afterwards discovered to have stood in a brass pan, which was found on examination to be covered with verdigris. From this time he was never well ; and when I saw him some months after, he had an affection of the nerves at the back part of the head, which caused excruciating pain, and had tormented him a long time. He had become very weak and much emaciated in consequence of the almost continual severity of the pain, and in short he quite despaired of ever being better. He had used a



variety of remedies, without any abatement of the complaint.

I ordered him half a drachm of powdered bark, to be taken every three hours, and a blister to be applied to the back of the neck; and, as the pain was usually more severe in the morning, to have a draught, with thirty drops of laudanum, to be taken at that time; and I recommended him to drink wine and malt liquor. Soon after he was put on this plan of treatment the pain began to be less severe, and it kept gradually diminishing, and at length quite left him. As the pain diminished, his bodily strength increased; and in the course of some months he became as strong as he had ever been at any period of his life. At first the bark was taken regularly every three or four hours, but afterwards not quite so regularly, and it was continued altogether for about six weeks.

I have seen several severe cases of this complaint, which no means seemed to lessen; and it was only when the teeth on which the disease depended had been extracted that the symptoms yielded. Many people are unfortunate in being obliged to lose several teeth before the right one is discovered, but the diseased one may generally be known by striking the teeth with a piece of iron, or by feeling between them with one of the bent instruments used for filling them when decayed.



In one case, where the patient suffered the most excruciating pain in the tongue and throat, and could only swallow with the greatest difficulty, a small portion of the alveolar process irritated the tongue. I removed this with my finger, and the pain immediately ceased, and did not return.

Diseases of the bone have often produced this complaint. Spiculæ of bone have pressed on the brain and caused the most violent symptoms. Other cases may arise from a thickening of the bone or periosteum in the different parts of the head and face, and thus compress the nerves. Sometimes the pain entirely ceases, either from the subsidence of the thickened parts, or from their progressive increase, until they have compressed the affected nerve so as to impede its functions. If there have been a recent syphilitic disease, a mercurial course should be adopted, but if this shall have already been persisted in, alterative doses of mercury should be given with the compound decoction of sarsaparilla.

It is not unusual in diseases of the lungs for the functions of the brain to become disordered, and to be accompanied by severe pains in the head and face, resembling *tic douloureux*. If the perspiration has been checked by acids, &c. ; it ought to be restored, as the best way of relieving the brain and the affected nerves.



Very severe symptoms have been occasioned by tumours pressing on a portion of the brain, or the origin of the affected nerves.

In the following case some disease existed in the brain, which produced the painful affection of the nerves of the left lower extremity, and afterwards of the nerves of the face:

CASE :

Thomas Porter, ætat. eighteen years, had suffered much pain in his left hip for some time, so that he walked with difficulty ; there was great tenderness on pressure, some swelling, and pain extending down the whole limb. He had a caustic issue made behind the trochanter, on the 4th of September, 1823, and he took some opening medicine. On the morning of the 7th, he had an apoplectic fit. Sixteen ounces of blood were taken from the arm without affording relief. A drachm of powdered ipecacuanha, with one grain of emetic tartar, was then given him in divided doses, and at length, by irritating his throat with a feather, vomiting was produced, and he became sensible. Some tough phlegm was ejected. His tongue was white, and when he laughed the left side of his face was drawn up. He took opening medicine, which did not purge him until the next day. He complained much of his head, and saw double. He talked incoherently.



His pulse was very little affected. In the evening he complained much of his head, and his face was flushed. He was again bled from the arm with relief. 10th. In the evening he is in the same state as on the preceding evening. He was bled again, and had a blister applied to the back of his neck. 13th. He was bled again ; after this his head was better, and he was more quiet. 26th. Though his cheeks were not much flushed, pain in his head returned every evening ; and at different parts of the day he complained of violent pain on the right side of his face, exactly like *tic douloureux*. He still continued incoherent. He complained of pain on the inner side of the right knee. He was ordered to take fifteen grains of subcarbonate of iron, and the same quantity of powdered bark, every three hours. 27th. He was no worse ; he had some cough. He ate a quantity of bread and butter in the afternoon of yesterday, which made his stomach uneasy, and by way of relieving himself, he produced vomiting by putting a feather down his throat. He was ordered to have some animal food at dinner. 28th. He has continued the powders. The pain did not come on yesterday evening. He rambles rather more, and coughs, and expectorates. He complains much of his left knee and right hip. The slough has quite separated, and some peas have been put into the ulcerated part.



After this, he was better for some time, but his mind was never perfectly sound. His friends let the issue heal, and the pain in the left hip went away, but he continued to complain of the right knee as long as he was sensible. He was again taken with violent pain in the head and intolerance of light. He was bled copiously, and was much relieved; he complained of excruciating pain, principally in the left eye and temple. He became more and more insensible, and died in November.

It is most probable that there was a tumour, or some other morbid growth within the cranium, but his friends would not allow the body to be examined.

When organic disease does not exist in the brain, and the pain is owing entirely to vascular action and congestion, bleeding may remove the complaint, as in the following case, communicated to me by Sir Anthony Carlisle.

#### CASE :

A lady, aged eighty years, had tic douloureux in the sub-orbital branch of the fifth pair of nerves. The pulse was very full, therefore sixteen ounces of blood were taken from the arm. Three days after she thought herself relieved, but as the pulse continued still very full, twelve ounces more of blood were taken away. Three days after the last bleeding she was bled again



to sixteen ounces. She was now entirely free from pain, and never had any return of it, and died two years after this period of apoplexy.

When patients complaining of pains in the nerves of the face are advanced in life, it becomes a matter of great importance to determine whether the disease be not at the origin of the nerves, and connected with too great vascular action of part of the brain, or its investing membranes.

It would be a matter of the greatest interest to be informed of the state of the patients supposed to have been cured of this affection, after the lapse of a few years, as it is suspected that many ultimately die of apoplexy. Such knowledge might tend to make the practitioner cautious in recommending, and the patient in continuing a too free use of stimulating food and medicine after the constitution has regained its usual vigour.

I would suggest to the consideration of those who push this plan to the utmost extent, whether the administration of carbonate of iron, bark, and a stimulating diet, may not produce congestion in the liver, or other viscera, and thus retain such a redundancy of venous blood in the system as to stifle those sensitive properties of the brain conducive to the acute perception of pain, and whether this state does not tend to the production of apoplexy?



Sometimes the nerves in other parts of the body are affected in the same way as those of the head and face, of which the following case is an instance :

CASE :

A gentleman, about forty years old, had pains in various parts of his body, but most frequently in his limbs. These resembled *tic douloureux* in violence, and were sometimes confined to a small spot in one leg, sometimes in the other, or in the arm, or shoulder, and when in the latter part he was usually very sallow. His complaints arose from a disordered state of the digestive organs, and were brought on by anxiety of mind, improper diet, &c. ; by the use of blue pill and aperient and tonic medicine, he was always very much relieved, and for some time remained quite well. When the pain was in the lower extremities, the cause was generally a collection of *fæces* in the larger intestines, and he was relieved by purging.

When painful affections of the nerves are complained of, and particularly in the extremities, every inquiry ought to be made respecting the state of the intestines, and the urinary and genital organs, and particularly the urethra as to stricture, and the rectum as to piles and other diseases. Sympathies with parts at a distance are so common that it is difficult to discover the cause of the painful excitement. But it is absolutely



necessary that this inquiry should be made, and particularly before the operation of dividing the nerve going to the painful part is had recourse to, otherwise the patient may have been subjected to hazard without a fair prospect of benefit.

Diseases of the alimentary canal will produce partial affections of the nerves of the limb, and sometimes of a single finger. Pain does not always affect the nerves immediately connected with those of a diseased organ, but sometimes such as are at a distance. One gentleman had generally pains in the fingers whenever he had a motion; another, at the backs of the fingers in evacuating the bladder when much distended. Pains are also felt in the upper extremities in affections of the uterus, as in the following case:

#### CASE.

Mrs. W. had pain in the left arm, which extended in the course of the ulnar nerve from the elbow to the little and ring fingers, both of which were weak and painful to the touch; the pain was not constant, but came on by fits: there was an evident disturbance of the digestive organs, with palpitations of the heart.

She used a spirituous embrocation for the arm, and took five grains of the mercurial pill at bed time, and a mixture, with camphor and the volatile tincture of Valerian, by which the pain was diminished. She



was then attacked by a severe affection of the uterus ; and after some time, when she was recovering from the complaint, the pain in the nerve ceased entirely, and never returned.

After accidents which have affected the muscles or the nerves, pain and weakness will continue for a long time, and the general health become impaired. In several of these cases the subcarbonate of iron taken in large doses has strengthened the system, and allowed the local morbid irritation to subside. Besides the pains of *tic douloureux*, others less violent frequently occur ; these, however, often harass the patient, and perplex the practitioner, and are considered of more importance than they are in reality, and thus lead to a plan of treatment not only useless, but often detrimental to the constitution. On some of these complaints I shall therefore make a few observations.

When pain in the course of the spine has been complained of, and particularly if there has been any tenderness on pressure, it has been determined that inflammation existed in the ligaments, or some other parts equally affecting the integrity of the spinal column. The opinion founded on this symptom alone, has sometimes been verified by subsequent changes, but has too frequently proved erroneous, even when pain, tingling, and other nervous affections, have been present in the extremities.



If there be no disease in the seat of pain, or in the tender part, from what does the altered sensibility proceed? When it is merely in the skin, the different parts of this, by being supplied with the spinal nerves, may have the morbid excitement conveyed to it through the sympathetic nerve. Thus, in diseases of the liver, pain is felt in the shoulder, from the communications between the hepatic plexus and the phrenic nerve. So each part of the sympathetic being also in connexion with each spinal nerve, may, according to the viscus affected, excite a morbid sensibility in that spinal nerve communicating with it, and appear in the termination of this in the skin. The same tenderness, from similar causes, may be present in the integuments of the chest and abdomen. But in some people the pain may be in the muscles, or the nerves supplying these, and arise from the same connexions with the sympathetic, but with a modified cause; for the same nerves can convey one impression to the muscular parts and another to the sentient, as may be instanced in the former by the use of the *nux vomica*, and in the latter by opium. The origins of the morbid excitement may be seated in the stomach itself; it may be also in the liver, intestines, kidneys, the bladder and uterus, and sometimes in the viscera of the chest. It is hardly necessary to mention that pains may be excited from the connexions of similar nerves, as between those of



the uterus and limbs, and be felt in the extremities of the different branches of the nerves, in the same way as pain is experienced in the penis in diseases of the bladder.

When pain in the spine is complained of, and there is tenderness on pressure, should a constant recumbent position be had recourse to? If there be actual disease in any part of the spine, such as a projection of the spinous processes and thickening of the surrounding parts, no one can doubt the necessity or utility of keeping it in this manner perfectly quiet: but mischief may be going on in the anterior part of the spine and no decisive diagnostic symptoms be present. Is therefore so formidable a disease as that affecting the vertebral column and the parts connected with it, to be risked, because no external appearances of disease are present? If there be an equal probability that the cause of the pain, &c. is not seated in the spine itself, should the recumbent position and a state of continued rest be enjoined, merely because a sense of weariness or pain is to be obviated? If the confinement were to be of only a short duration, it could not be altogether objected to, but, in a modified degree, might co-operate with the other medical treatment in removing the irritating cause. When the disease is not in the spine itself, the pain and tenderness vary, both as to their seat and intensity, with the state of the digestive



organs. But if there be considerable doubt about the cause of the symptoms, the recumbent position may be so used that the patient shall keep the spine sufficiently quiet, and yet not remain continually in this state. If a patient be kept in an entire state of rest in the recumbent position, and a beneficial result be not obtained within a moderate space of time—say after the lapse of some weeks, the consequences peculiar to this treatment must ensue. It will be asked, what is to be dreaded from so apparently harmless a remedy, or how can any mischief be produced? The circulation in the head must be increased by a position which favours the ascent and retards the descent of the blood; and by this, after a time, every part within the skull is encroached upon, the furrows on its inner table are deepened and extended in every possible manner, and we cannot suppose that the bone shall be thus acted upon by the increased circulation, and the cerebral mass remain uninjured? Undue pressure from diseases may produce great changes and a diminution of the brain, and I have seen this effected by a long continued determination of blood to it, and believe this state may be induced by disease, too much indulgence in the recumbent position, or too stimulating a diet. It is known that the muscles of the spine, and even the bones themselves, have their strength diminished by inaction, and consequently, after a long use of the



recumbent position, are unable to hold the trunk erect without the greatest exertion. But the change in the circulation in the head, arising from a long-continued recumbent position, leaves the brain unsupported by a sufficient quantity of blood, and produces most uncomfortable symptoms: doubtless the change in the position of the other viscera creates some uneasy sensations, but in a very inferior degree. After an attack of paraplegia, from an affection of the brain, should there be an indentation larger than natural between two spinous processes, or deformity of one of these, and therefore it be supposed that the symptoms proceed from a diseased spine, and a recumbent position be strictly adopted, if the patient could walk before this treatment was begun, it will be found that, partly from the oppression the brain has been subjected to, he has entirely lost the command over the muscles, and that he cannot return to his former state until a long time has elapsed.

If the cerebral mass shall have suffered a diminution, can it be restored, or must it be supplied with the same inordinate quantity of blood continually, in order to put it in a sufficient state of tension? The brain and the circulation of its blood may be brought to their original condition by sufficient care and attention, but not without the greatest resolution; for besides the uncomfortable sensations produced in the brain itself, the difficulty of keeping the body erect is not a little



increased by the pain excited in various parts from a change of position.

If the brain suffer, as I believe it does, ought a recumbent position to be used without the greatest caution? It is not in supposed diseases of the spine that the brain becomes oppressed, but frequently from slight indisposition and indolence. Thus a person feels unwell, and lies long in bed; he becomes enervated, and this position, if continued, increases his complaints: he soon becomes weary when up, and rests again and again until such a change is effected in the brain that he cannot, without the greatest difficulty, return to his former state. And if a change of so much importance can be thus effected, is it not of sufficient moment to pause before such a state is produced as time can with difficulty obviate? And ought not this to be a subject of serious consideration, not only to the medical profession, but to every class, both as respects their comfort, their health, and, above all, their mental faculties. Too much vascular action, whether produced by overfeeding or indolence, may injure the mental faculties.

Many cases of painful affections of nerves have occurred in which various remedies have been administered, some have been permanently, and others only temporarily relieved. Some might have been esteemed curious, but to have related these could not have



answered any useful purpose. Unless there be visible signs of suffering in patients, it is sometimes difficult to know how to place much confidence in their assertions, nor is it less so when they exhibit spasmodic contortions of various parts, and gesticulations. I have suspected that in these cases there has been a state of brain somewhat similar to that producing mania and epilepsy. I have been able to determine that some of these persons could voluntarily put a stop to the contortions, and bring them on with equal facility. If the seat of the disorder be in the brain, it becomes a serious question whether the quantities of opium, ether, and stimulants, so frequently had recourse to in these cases, have not a tendency to increase the malady, and whether the moral treatment of the patient would not be more likely to effect a salutary change.



## CHAPTER III.

## OF INFLAMMATION OF NERVES.

NERVES are subject to inflammation, which takes place generally in those contiguous to inflamed parts. When a nerve partakes of the inflammation of the part in which it is situated, it becomes increased in size from a deposit of coagulable lymph between its fibres.

Chronic inflammation of the nerves generally arises from a communication of diseased actions from surrounding parts, or sometimes from injuries. It is generally attended by much pain and a paralysis or imperfect sensation in the parts supplied by it. When there is only adhesive inflammation in the parts involving the nerves, leeches and evaporating lotions should be used. But when suppuration has taken place, fomentations and poultices should be applied until cicatrization has been almost completed; after this period if the heat be great, evaporating lotions may again be found of advantage. The system must be soothed by anodyne medicines, and the strength supported by tonics and suitable diet during the absence of fever.



The following affection of the digital nerves was the effect of inflammation and suppuration under the palmar fascia.

CASE.

Mrs. Baxter, upwards of fifty years of age, was pricked with a fork in the middle of the end of the right thumb in August, 1821, at twelve at noon. At 10 P. M., the thumb became suddenly swollen and painful. The wound was dilated with a lancet. Swelling of the arm up to the shoulder came on. Matter formed and was let out at the back of the hand between the little and ring fingers a fortnight after the accident. In another fortnight, matter was let out at the wrist nearly over the radial artery. Matter formed also in the little finger. I received this account from the patient on the 23rd of February, 1822, when I first saw her. She then complained of great heat and a pricking pain in the three large fingers, and the sensation was imperfect, but neither the little finger nor the thumb was affected in this manner. The three large fingers had been bent down to the palm, but these had been gradually straightened again. Oily applications disagreed with her, and she used a lotion with two ounces of laudanum to fourteen of water. She had a great variety of general nervous symptoms. In March she took subcarbonate of iron, apparently with much benefit, and soon after began to use her hand by knitting.



Dr. Hennen says\*, "A secondary paralysis very frequently takes place without any immediate injury of the nerve, as in those cases when a ball has passed so close to a large one, or the plexus from which it proceeds, as to occasion an inflammation, and consequent thickening of the neurilema, or investing membrane; or where, in a more distant transit of the ball, the tube formed by its passage swells to an extent sufficient to press on the nerve or plexus."

"Œdema† is a very frequent consequence of gunshot injuries of the extremities, and is generally complicated with pressure on the lymphatics, or injury of the nerves, either immediately, or from the tumefaction of the parts from inflammation. By the use of gentle friction, with moderately stimulant embrocations, succeeded by the local shower-bath, and the subsequent application of a firm flannel roller, this troublesome symptom will be in general benefited after some time. I have also derived essential relief from the distressing numbness of the fingers in such cases by the frequent evaporation of sulphuric ether upon the part."

In the following case there was an enlargement of the median nerve, from an injury to the wrist; it was attended by much pain and deficient sensation.

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\* Military Surgery, p. 190.

† The same, p. 195.



## CASE.

David Franklyn, aged twenty-two years, was admitted into the county hospital about the middle of October, 1820. He said that, seven years before, he was holding a horse, with the halter tight round his hand, when, the horse running back, the wrist was injured, and became immediately bent. The part was violently pulled after the accident, and thereby further injured. He had great pain in the wrist and palm of the hand ever after, and a slight pain at the back of the hand. The skin at the back of the hand was injured, and was continually ulcerating. The thumb and three fingers were always bent towards the wrist, and could be extended only in a very small degree, and the sense of touch was lost. As the hand was quite useless, and the source of much inconvenience, I amputated it, and the part soon healed.

On examining the hand, I could not perceive any other alteration in the carpal joints, except what would arise from their being kept constantly bent, and it did not appear that any serious injury had been inflicted on them. The muscles in the anterior part of the forearm had contracted a permanent shortening. The median nerve, where it passes under the annular ligament, was much enlarged, and its natural connexion with the sheath of the tendons of the flexor muscles of the fingers thickened. Several of the digital nerves,



towards their termination, had a gangliform enlargement.

In this instance, it is probable that if the joint had been kept quiet at first, and leeches and evaporating lotions had been used to subdue the inflammation, the hand might have been restored to its healthy state.

In a valuable paper by Mr. Langstaff\* on the healthy and morbid conditions of stumps, the case of a female is related, whose symptoms were very similar to those in the preceding case, when amputation at the fore-arm was performed, but not with the same beneficial results. Mr. Langstaff says, "The stump, I understand, did not unite favourably, and she suffered distressing agony, which affected her health so that she became extremely nervous. She was discharged from the hospital, and afterwards admitted into Cripplegate workhouse, where she had my advice, and was strictly attended to by my son.

"When I saw her, the surface of the stump presented an unfavourable appearance; the skin covering the ends of the radius and ulna was very thin, excessively vascular, and the ends of these bones seemed likely to cause its absorption. There was also a constant state of convulsive action of the muscles of the stump, accompanied with agonizing pain. Every thing

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\* Medico-Chirurgical Transactions, vol. xvi. p. 140.



that could be done to improve the health, and to relieve the pain she experienced, was fairly tried for several months, without the least good effect.

“Poulticing, opiate lotions, belladonna, and gentle pressure by bandage, were employed, which did not lessen her sufferings.

“She was hysterical, and the paroxysms were frequent; the spasmodic affection of the muscles of the arm became more evident, and a pulsation almost aneurismal could be seen and felt at the extremity of the stump, in the situation of the ulnar and radial arteries. It now became a serious consideration to know what could be done to prevent the exciting causes of the morbid actions. Having seen, in several cases, symptoms similar to these, caused by the extremities of the nerves becoming ganglionic, and a second operation rendered requisite for the alleviation of the patient's sufferings, I concluded this could be the only mode of treatment adopted in the present case. But I did not wish to propose amputation without having the opinion of gentlemen capable of deciding on what was to be done in such a case. She was, for that purpose, sent to Bartholomew's hospital, where the opinions of two of the surgeons were obtained. The conclusion was, that they thought it would be advisable to make further attempts to improve her health, and thereby prevent the necessity of a second operation.



“ This advice was strictly attended to for a considerable time, but without effect. She had frequent convulsive fits ; the irritability of the muscles and the aneurismal pulsation became more violent, and her health so much more affected, that I thought it my duty to propose the removal of the arm above the elbow-joint, which she willingly agreed to. I performed it by the flap operation ; and, previous to securing the arteries, I drew out each nerve to the extent of half an inch from the surface of the stump with a tenaculum, and cut through them, to prevent their interrupting the progress of cicatrization of the integumental parts, which I have done in other instances with success, and I was astonished that the division did not occasion greater pain than was complained of by the patient.

“ She was relieved of all the painful sensations she had so long been distressed with ; had no recurrence of hysteria or convulsion ; her health improved ; a good stump was effected ; and she is now able to obtain her livelihood.

“ In this preparation the median, radial, and ulnar nerves are shown, which are remarkably large ; the extremities of the two latter greatly increased by deposition and organised lymph.”

In the case of David Franklyn, after the amputation the pain never returned in the stump. In that



of the female related by Mr. Langstaff, the first amputation did not improve her condition. Were the nerves, in these two cases, in a different state? In that of David Franklyn the median was enlarged into a bulbous form near the wrist, but the nerve was not diseased higher up; in that of the female there might have been a more general enlargement of the nerves, similar to that exhibited in the preparation, just above the stump. The disease, in this case, might have been supposed to be constitutional, but the last amputation decidedly proved that it was entirely local. In all similar cases, for which a second amputation is required, it would be very desirable to adopt the practice of Mr. Langstaff, by drawing out the extremity of each nerve with a tenaculum, and then cutting off half an inch, by which means it would escape the general inflammation of the parts forming the stump, and remain free from that connexion with the cicatrix, which alone may cause the most painful symptoms.

Chronic inflammation often occurs in the extremities of nerves in stumps, very much like that enlargement produced as the bond of union in a divided nerve. After a perpendicular section of the nerve and tumour, the nervous fibrils may be traced down to the tumour, and coagulable lymph seen to have been deposited between them; but the horizontal section of the



tumour has a close and uniform appearance, nearly like a piece of cartilage. When the nerves are in this state, the patient suffers so much pain, and especially from the least touch, as to be obliged to submit to a second amputation.

The nerves contiguous to a diseased joint are apt to become much enlarged. In one case of scrofulous disease of the elbow-joint, much pain had been experienced. The ulnar nerve was very much thickened and enlarged as it passed behind the internal condyle of the arm-bone; the median nerve was also enlarged, but not in the same degree.

I have been consulted by several patients who have complained of great pain in the arm, especially about the deltoid muscle, and almost the same inability to raise the limb as when the muscles have been affected by paralysis. These symptoms have continued for a great length of time, and, in some instances, have never entirely gone off. I have supposed the pain and paralysis proceeded from an enlargement of the circumflex nerve in some cases, and of the musculo-cutaneous in others. In more than one instance the pain was much aggravated by any surprise.

I have found blisters repeatedly applied to the arm, and ointment with tartarized antimony, the best remedies for removing the pain; after which it has been of advantage to give passive motion to the arm, and



at the same time, improve the general health by tonic medicines and a strengthening diet.

In many instances of the complaint called sciatica the pain is generally so exactly confined to the situation of the sciatic nerve, and the adjacent parts are so free from any appearance of disease as to make it probable the nerve is the only part that suffers; and that there exists an inflammatory action in the neurilema, which frequently ends in an effusion of a serous fluid.

When people of a very robust habit are affected with this complaint, it is necessary to take some blood from the arm, and at the same time locally by leeches or cupping; afterwards a large blister should be applied over the seat of the pain; preparations of colchicum and purgative medicines should be administered.

When the complaint does not yield to these remedies, the extract of stramonium should be given in doses of a quarter of a grain, gradually increased to two grains, three times a day. In some instances, when every thing had failed, an entire confinement to bed, with the use of tonic medicines, and as much opium or other anodyne as moderated the pain, has been found to succeed. In obstinate cases, it will also be of use to have an issue made near the trochanter, and a grain of submuriate of mercury given every night, with ten or fifteen grains of the compound powder of ipecacuanha.



Cases of partial paralysis of the face are frequently occurring and giving rise to great alarm and distress. This complaint is generally produced by cold, and by a draught of air on the parts about the external ear. Some inflammatory action affects the facial nerve, and it is most probable that it is communicated from the surrounding parts. Sometimes these cases are attended by much pain.

The treatment should consist of leeches applied behind the ear, and after a few days a blister. Purgatives should be administered, and then sudorifics, as James's powder, and saline medicine. In people of very irritable habits soothing treatment is necessary. Sometimes the preparations of camphor, and the ammoniated tincture of valerian may be sufficient. It is difficult to assure the patient that the paralysis does not proceed from an affection of the brain; and although such advice may generally be given with great confidence, yet cases do occur in which some hesitation is necessary, and particularly in those persons of a very full habit, who, at the same time, complain of great pain in the head, and are predisposed to apoplexy and other diseases of the brain.



## CHAPTER IV.

## OF ULCERATION OF NERVES.

EVERY surgeon must have witnessed patients lingering out a miserable existence under the severest sufferings, without having it in his power, in many instances, to mitigate them in any material degree; and it is from my having observed the agonies of patients suffering from some ulcers on the legs, and my inability to relieve them, that I have attempted to investigate their nature more accurately, in order that, if possible, some method hitherto not practised might be resorted to, which would hold out a prospect of relief; and though, for want of sufficient opportunities, I have not succeeded to the utmost of my wishes, yet I think the result of my researches, contained in the following pages, may not be uninteresting to the profession.

When an ulcer forms on the outside of the leg, and continues small, and does not extend deep, though it be of an irritable nature, it may be cured; but when it has extended far, and become deep, it can hardly fail



to implicate the nerves which are about it, by communicating an inflammatory disposition to them, and thus increasing the irritability of the parts, and causing the disease to extend till the nerves themselves have become ulcerated. When this happens, great pain is produced, and there is frequently such an increased action of the blood-vessels, that the parts immediately surrounding the ulcer become enlarged, and then this disposition gradually spreads over a great portion of the limb. The skin is increased many times in thickness, and the bones themselves are enlarged. The muscles and tendons become involved in the ulcerative process, and even the parts that escape are so altered as hardly to be recognized. What I have described is the usual progress of the disease when it has been uninterrupted in its course; and when it has reached this state the constitution becomes so worn out by the continued sufferings, that the patient must die if it be not removed.

## CASE :

William Sharpe, a soldier, aged fifty-four years, when about fifteen years old, was wounded in the tibia by a splinter of wood. A piece of this bone exfoliated, and the wound was perfectly healed in nine months, and he continued well until the year 1814, when he received in the same part a kick from a horse, which



made a wound that continued open, and became so extensive as to occupy a space of about six inches in length, and three in breadth.

Some small pieces of bone exfoliated, and the ulcer gradually got worse, and in June, 1817, began to have a fungous appearance: in June, 1819, it had still the appearance of a fungus, which bled very much on being touched, and small bits of bone continued to exfoliate. For about two months escharotics, as muriate of antimony, &c., were applied to the sore, which destroyed the fungus so as to make it nearly even with the skin. Before these applications, he had suffered such violent pain in the thigh and leg as far as the ankle, that he wished to have the limb amputated; but it was hoped that the above applications might reduce the fungus, and allow the wound to heal. This, however, not being the case, he was so wearied by the continual pain, for he hardly ever slept, that I amputated the limb above the knee on the 30th of June, 1819; he never after had any pain in the thigh, and in a month was quite well.

On examining the limb, the skin, for some distance round the sore, was very much thickened; the whole of the bone upwards was enlarged; and where the ulcer was situated there was a very considerable hollow in it, which was filled up by the fungus; in this hollow the bone was very spongy and soft, but none of its



exterior part seemed dead. The fungus seemed to grow from the hollow in the bone; and not to be, as was supposed, occasioned by the irritation from some exfoliating bone.

The greatest part of the muscles of the leg had lost their proper characters, in most places having their fibrous appearance, but very much resembling fat.

The sciatic nerve was very much enlarged, but many of its branches were more so in proportion.

The greatest part of the nerves was covered with a layer of a substance resembling fat, but very different in appearance from the other fat of the limb, or from that which is usually about the nerves; when freed from this, most of them had the nervous appearance, though they were apparently of a closer texture than sound ones. Several varicose veins were observed in different parts of the sciatic nerve. Some of the nerves were unusually soft, and easily torn. The following is a particular description of each nerve:

The branch of the anterior crural nerve accompanying the saphena vein was somewhat enlarged; about an inch and a half above the ulcer it was still larger, and it was nearly surrounded by the ulcer, and at the upper part of this was firmly united to the adjacent parts for an inch and a half; it then became more loosely connected with them, and again for rather more than two inches was firmly united to them; near



the inner ankle it became of its natural size and appearance.

The peroneal nerve was very much enlarged; and the anterior tibial and dorsal branch of the peroneal were nearly twice the size they are in a healthy limb. The dorsal branch proceeded of the same size down the leg, part of it was surrounded by the ulcer, to which an inch and a half was firmly united; an inch of this appeared rather smaller, and in a state of ulceration, and in one place nearly divided: after this it became as large as in the upper part of the leg, and, at the instep, divided into branches; these were rather larger than natural, but, nearer the toes, became of their usual size and appearance.

The anterior tibial nerve was enlarged, and proceeded firmly united all the way to the surrounding parts; near the ulcer the tibia was so much enlarged as to leave a very little space between it and the fibula, and here for some way the nerve appeared less, and so confused as to be only just recognized; it then again became enlarged, and continued so as far as the instep, where it divided into branches.

The long cutaneous branch of the peroneal nerve was very much enlarged.

The posterior tibial, at the upper part, was larger than natural; but towards the bottom of the leg was still larger, and continued so until it had got beyond



the inner ankle: about the middle of the foot its branches were of the usual size.

In the following case, although the trunks of the nerves were not exactly ulcerated, yet they were so connected with the diseased parts, and many branches from them were distributed in such a manner to the fungus, as to occasion the same symptoms.

CASE :

Susannah Hostler, aged forty-three years, unmarried, and having scars from scrofula in most parts of the body, was admitted into the County Hospital on the 27th of August, 1820, with a large fungous ulcer in the lower part, and chiefly on the outside of the left leg.

The formation of the ulcer was preceded by a white scale and ichorous discharge, and after the separation of the scale it began immediately to increase. It had existed between two and three years, and from its first commencement caused violent pain. About the Christmas preceding, it began to have a fungous appearance, accompanied with a most fetid discharge, and she had since suffered excruciating pain, which darted down to each side of the ankle and the top of the foot. The pain she experienced was continual, but became the most violent in the night, and generally about the time she was going to sleep. Towards morning she



would fall asleep, but never slept more than two or three hours, notwithstanding she took a large teaspoonful of laudanum every night. Various escharotics had been applied to the fungus with a view to its removal, previous to her admission into the hospital. The only thing that ever gave her relief was the application of ten leeches to the ulcer.

She had a bad appetite, a quick pulse, looked very pale, and was so much emaciated as to lead me to suppose that it would be impossible for her to live long in her present state; and as it appeared vain to hope that any remedies could lessen the disease in a short time, and that if there was much delay, no chance of saving her life even by amputation would remain, I therefore amputated the limb above the knee on the 30th of August.

The day before the operation, she had great tenderness in the inside of the thigh, but this had gone off before the next day.

A few days after the operation she began to improve in her health, and was discharged cured from the hospital about the middle of October.

The day after the limb was amputated, I injected it by the popliteal artery, first with white spirit varnish and vermilion, and then plaster of Paris and vermilion mixed with water.

On dissecting the limb, the peroneal nerve was found



much larger in the lower part of the ham than it was higher up. The long cutaneous branch which unites with a branch of the posterior tibial, and is distributed to the outer side of the foot, could be easily traced until it came near the fungus, with the posterior part of which it became quite blended, and was then so much enlarged and confused, as not to appear like nerve; but when it got beyond the fungus it again had its natural appearance.

The anterior tibial nerve could be traced easily until it came near the fungus, but was then covered by a firm and very vascular membrane, from which it could hardly be separated. This was the case most of the way through the fungus, after which it had a more natural appearance.

The dorsal branch of the peroneal nerve could in the same manner be traced to the fungus, when it exhibited nearly the same appearances as the anterior tibial. Just at the beginning of the fungus it gave off to its base many filaments, which were very much enlarged in consequence of the irritation.

Small filaments were distributed to the surrounding parts from the several branches of the peroneal nerve, but none of them had the same disposition as those of the dorsal branch.

The skin on a great part of the leg, but more parti-



cularly about the ulcer, was very much thickened. The bones were enlarged from the local inflammatory action, but did not appear otherwise diseased.

The muscles were so much wasted, and had such a diseased appearance, as to be hardly recognized.

In describing the fungus, I shall divide it into two parts; viz. the base and the spongy part.

The base appeared to consist chiefly of an intricate plexus of blood vessels; it received many branches of nerves.

The spongy part arose like threads from the base, whilst sometimes several appeared to proceed from a small point: these threads were hollow, and frequently communicated together, so that this part when inflated by a blow-pipe had very much the appearance of a piece of sponge. The blood vessels went from the base towards this part, and were largely distributed to the inside of the cells.

It had always been very difficult to account for the immense discharge in fungous diseases from a surface of a given size, compared with that secreted by an ulcer; but when it was considered that the extent of the surface was multiplied by the structure that has been described, the great discharge was at once satisfactorily accounted for.

From what has been stated, it will be seen why



escharotics will not cure a fungus. The reason seems to be this ; that they only destroy the spongy part, and do not reach through to the base that forms it.

A fungus is painful or not, according to the parts it has implicated in its structure. At first it has not apparently a very inflammatory disposition ; but after a while this increases, and extends deeper, and then involves any neighbouring nerves, which become connected with it, partake of the inflammatory disposition, and produce excruciating pain.

When a patient is suffering very excruciating pain from an ulcer on the leg, of long standing, and the usual remedies have failed, I would recommend, as the most probable method of relieving him, the removal of a portion of the affected nerve, as was done in the following case.

#### CASE :

William Richardson, aged forty-eight years, was admitted into the County Hospital on the 21st of October, 1820, with a large ulcer on the left leg. It began about the middle of the leg, and reached nearly to the instep. It extended across from beyond the inner edge of the tibia to the fibula. Its appearance was that of an exuberant mass of granulations, such as is frequently observed after severe burns. It bled very profusely, and had done so for four months. It was



attended with excruciating pain, which hardly ever allowed him to rest, and it was so bad at night as to oblige him to get out of bed. The pain came on with violent stabs like spasms, which extended up the outside of the leg to the ham, and from thence to the back, and in these paroxysms the limb would frequently be moved involuntarily. The pain was almost entirely confined to the peroneal nerve; for when I pressed it in the ham, it produced or aggravated the violent pain. Upon taking into consideration the size of the ulcer, the emaciated state of the patient's body, the excessive pain and profuse hemorrhage, I told him that I had a very unfavourable opinion of his case; that I was afraid I could not cure the ulcer, and that I saw very little prospect of saving his life, except by amputation of the limb. I found him resolved to make this sacrifice, as he felt he could not long survive the terrible anguish he endured: but as I knew that the branches of the peroneal nerve were the principal cause of the pain, from their connection with the ulcer, I determined first to give him the chance of saving his limb by cutting out a portion of the nerve.

In performing this operation I felt for the outer ham-string, and then made an incision about two inches long just at its inner edge. This divided the skin and fat, and brought to view a thin tendinous fascia, and immediately on dividing this the nerve was exposed.



A probe was passed under it, and after desiring that the limb might be held firmly by assistants, I passed under the nerve a probe-pointed bistoury, as near to the superior part of the wound as possible, by which I divided it; and then having separated it from the surrounding parts, I removed, as near as could be guessed, an inch of it. I then brought the edges of the wound together with adhesive plaster and a bandage, and had the patient removed to bed. When the nerve was divided, an artery bled very freely, and I was afraid this would have required the use of a ligature. After the nerve had been divided, the pain in the ulcer entirely ceased, and he had no feeling when the upper part of the foot was touched.

*Oct. 22.* He has had a good night, and has no pain in the ulcer, but has a little in the wound. No fever.

23. He has had a good night. The pain in the wound continues. He says he has perfect sensation in the upper part of the foot. No fever.

24. He had an indifferent night. He had pain in the ulcer, which he thought arose from the too tight application of the bandage: the pain went off at three in the morning, after which he slept. There has not been any discharge of pus from the ulcer, or any hemorrhage since the operation, but it has the same appearance.



25. He has had a good night, and has been entirely free from pain since the ulcer was dressed yesterday.

26, 27. He has had good nights.

28. He had an indifferent night. The granulations of the ulcer are not so high.

29. The wound was dressed for the first time, and was found to have united by the first intention.

The wound made by the removal of the nerve hardly caused any inconvenience. After the operation, he never had any of the spasms in the limb, or any of the violent pain which followed the course of the sciatic nerve, and caused so much suffering. His state was rendered much more comfortable by the operation, but he still at times suffered pain from the connection of the saphenus nerve with the ulcer. For some time he appeared to improve in his health. Several small particles of bone kept exfoliating; I afterwards removed two small portions; and one large piece, nearly the whole circumference of the tibia, having become loose, I extracted it. In about six weeks after the operation, he began to be troubled with a diarrhœa and night sweats; and as his health appeared to decline, and the ulcer was so large, and the bone still much diseased with caries, I amputated the limb above the knee, on the 25th of December, and he soon got quite well.

He continued in good health until the middle of March, when, on being too much exposed to the



caught cold, which brought on a disease of the lungs, of which he died about the middle of July.

On examining the limb the day after it was amputated, the tibia was found to be affected with necrosis quite through; and where the bone was alive, for some distance it appeared to be affected with caries, from which the spongy granulations grew.

The periosteum of the whole bone was thickened.

The saphenus nerve was very much enlarged, and was connected with the ulcer.

The sciatic nerve was enlarged. The peroneal nerve was also enlarged, and at the place where it had been divided was much thickened; and one new branch went from this part to the anterior tibial nerve. The junction of this branch with the anterior tibial was at the inner side of the nerve; and from the manner in which it is situated, I think it not improbable that some other branches, forming a medium of communication between the divided portions of nerve, might have been destroyed in the dissection. New branches went from the same portion of the divided nerve to the dorsal branch, and the surrounding parts. Both the anterior tibial nerve, and the dorsal branch were larger than in their natural state. The new branches that went to the dorsal branch and the surrounding parts, were flatter than nerves of the same size usually are, but as far as I can judge they were new nerves.



No inconvenience seemed to arise from the removal of the nerve. Whether the new branches had much power in conveying the nervous influence I cannot determine. About a fortnight before the amputation of the limb, I pressed on the part where the nerve was divided, and the patient said he felt it quite down his leg.

Though the operation in this instance did not prevent the necessity of amputation afterwards, yet it must be allowed to have answered so well, that under more favourable circumstances, as when the disease is confined to the soft parts only, or the bone is not much affected, it may be the means of preserving the limb. At all events, the operation is so simple, and attended with so little risk, that I think it deserves to be tried before amputation of the limb is determined on, as the latter operation can by no means be affected by it.

When much irritation has existed in a nerve and the surrounding parts, there is a greater disposition both towards the reunion of the divided nerve and the regeneration of a portion of one that has been removed, it therefore becomes necessary to cut out as much as will prevent its restoration from being too quickly effected. As far as I can judge, should there be an extensive ulcer, and the nerve be merely divided, it would, in all probability, become reunited before the ulcer could heal; and should this prove to be the case,



the same symptoms would be re-produced, and no benefit derived from the operation. Whether the restoration of the nerve be advisable or not, I am at present unable to determine; but should this be so, only a small portion should be removed.

It is not impossible that either too much or too little may be removed. In the first case, the cicatrix may be liable to ulcerate again, as parts are apt to do when deprived of the nervous influence; in the second case, the cicatrix may resume its irritable state, and on this account become again ulcerated.

In removing a portion of nerve, it is advisable to do it as far as possible from the ulcer, because there is then a much greater probability that the external wound will heal by the first intention, and consequently the cut ends of the nerve escape inflammation and ulceration. It is also advisable to divide the nerve as near to the upper part of the wound as possible, as the end of the nerve will thus retract from the wound, and consequently be less liable to become inflamed, should the external parts have assumed this disposition.

When a disease has existed in the hip joint a long time, do not the nerves become enlarged? If they do, is not this the cause of an issue keeping up the irritation, and nearly the same symptoms, when the disease or inflammation of the joint has gone off?

When the very painful ulcers exist, ointment made



with powdered opium, or lotions made by mixing well powdered opium with water or lime-water should be applied on lint to the sore, and then, a folded cloth moistened with water, or laudanum and water, over the surrounding skin, and attention should be paid to the digestive organs.

To show further how violent the pain is when the nerves are in a state of ulceration, I shall introduce the following extract from a case\* related by Morgagni, of an aneurism in the right groin, which extended backwards so much as to produce an ulceration of the sciatic nerve.

“In the last month the pains became most severe, not only in the tumour, but sometimes beneath the internal malleolus; in which place only, violent as the pains were, the foot was sensible, being in every other part deprived of feeling and motion. In all this month he neither had an interval of ease nor any sleep until his strength failed; then for some days he lay half asleep, and so died.

“On examining the limb, the nerve was so much eroded, that a few fibres hardly remained by which the superior and inferior parts were joined together.”

It is difficult to determine precisely the ways in which an ulcerated nerve produces pain, but I conceive

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\* Morgagni de Causis et Sedibus Morborum. Ep. 50, cap. 11.



it is principally in two; in the first, when it has been distended by a tumour or aneurism, and part of it has become eroded, pain is excited by the unequal contraction, as in partial divisions; in the second from the increased vascular action exalting its sensibility and rendering it susceptible of the slightest impressions.

In people advanced in life, the teeth of one jaw are sometimes entirely lost, so that those of the other are apt to press very much on the soft parts of the mouth, and produce slight ulcerations, which sometimes cause very violent pain, exactly resembling the *tic douloureux*; therefore in all cases which will not yield to the usual remedies, the mouth ought to be carefully examined, as the symptoms depending upon an ulcer produced in this manner can only be cured by extracting the tooth.

Sometimes small portions of the alveolar processes will exfoliate and remain attached to the gum, producing violent pain in the tongue, and rendering the act of deglutition very painful; therefore when the nerves of the tongue are affected it is right to feel along the inside of the gums with a finger, that any rough substance may be removed. In all other painful affections of the face, similar examinations should be made, as incrustations of tartar may, by pressure, produce ulcerations, and be the cause of unyielding symptoms.



## CHAPTER V.

## OF TUMOURS IN NERVES.

A TUMOUR seated in a nerve causes very violent pain. It is generally solid and formed by the interposition of adhesive matter between the fibrils; but sometimes it is a cyst containing a gelatinous matter, which has been generated in the substance of the nerve. It varies in size, from a grain of wheat to a substance of considerable magnitude. It may be distinguished from all other tumours by the excessive pain produced by pressure, and from the extension of this in the course of the affected nerve. It is generally moveable from side to side only as the upper and lower extremities are more or less confined by the nerve. If it be not removed the violent pain gradually wears away the strength of the sufferer, and he dies at last completely exhausted.

An attempt may be made to produce absorption of the interstitial deposit; but it will generally be found that relief can only be obtained by removing the



tumour with the knife, and it will be much better to cut off a portion of the nerve with the tumour, than to attempt to dissect this out of the nerve.

It is not unusual for epilepsy to be produced by a tumour in a nerve, and to be cured by its removal.

Sometimes an enlarged bursa, arising from a strain or other excitement, will press on a nerve, and cause great pain; if the swelling be large pressure may be made on some parts that will not affect the nerve, or it will have come on from some late exertion, and thus its nature may be in some measure known: and its base will generally be more adherent than that of a tumour seated in the nerve itself. When it is suspected that there is an enlarged bursa from over exertion, leeches and evaporating lotions may be used, and afterwards a blister may be applied, or some stimulating liniment or plaster.

Small tumours are frequently seated in the cutaneous branches of nerves, and are felt underneath the skin as in the following case.

#### CASE :

Mrs. H. had felt a pain in a small spot about the middle of the leg, for which no cause could be assigned. At the end of two years a very small tumour could be felt, which, when pressed, gave very great pain. At the end of seven years it had attained the size of a large



pea. The pain she suffered was very great, and was always brought on and aggravated by surprise, fear, or any affection of the mind, and likewise by cold. Keeping the whole body warm always relieved the pain. After she had suffered very much she consulted a surgeon, who divided the skin over it, and recommended the wound to be kept open, and caustic frequently applied to it. It was treated in this way for three months, but without any good effect. Some time after I saw her, and cut out the tumour, with the surrounding portion of skin. When divided it had a cartilaginous appearance, and a cutaneous nerve was seen passing between it and the skin, and an expansion of the nerve was spread over it.

After its removal all the distressing symptoms left her, and never returned.

M. Beclard\*, when a student, had a small and very painful tumour in the leg, about the size of a grain of wheat, which disappeared spontaneously some months after he had removed from a very unhealthy apartment he had for a long time previously occupied.

Small tumours or enlargements of various nerves are observed on dissection, but as the history of the subjects is not known, it can only be conjectured that these might have occasioned pains that could not be satisfac-

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\* Descot sur les Affections locales des Nerfs, page 211.



torily accounted for during the patient's life. In one subject there was a considerable enlargement of the digital nerve supplying the inner edge of each great toe; and at the outer side of each foot, at the junction of the metatarsal bone with the first phalanx, there was a ganglion or bursa the size of a horse-bean, which adhered to a digital nerve, and from this an enlarged branch was continued into its cavity. These diseases are the cause of very great inconvenience, and ought not to be roughly treated.

Sir Charles Bell, in his *Operative Surgery*, relates the case of a man, who had been bruised at the back of the thigh, and had apparently recovered; but some time after he began to be much troubled with a violent pain in his foot, which he suffered for two years. At the end of this time a tumour was discovered in the ham, which, when pressed on, did not give any particular pain, but rather, a sense of pricking numbness down the leg. He was then in a dying state, and only lived a few days after.

On dissection some nerves were found running over the tumour. The sciatic nerve entered into the substance of the tumour, but the fibular nerve, though close on it, was not incorporated with it.

Dr. Denmark, in the fourth volume of the *Medico-Chirurgical Transactions*, relates the case of a man who had a small tumour in the arm, which followed an



injury by a musket ball, and produced very violent symptoms, and was cured by amputation of the arm.

On dissecting the arm, Dr. Denmark observes, that the median nerve seemed to be blended with, and intimately attached to, the wounded parts for the space of an inch. It had been wounded, and at the place of the injury was thickened to twice its natural diameter, and seemed as if contracted in length. This contraction, he says, I thought partly accounted for the bent position of the arm, and the increased pain in attempting its extension ; but on further examination, he goes on to say, I was surprised to find on dividing the fibres in the posterior part of the wounded nerve, that there was a small portion of ball firmly embedded in it. The nerve was evidently thickened, both above and below the wound. At the conclusion of the case Dr. Denmark puts the following question :—Would the division of the nerve, and cutting a piece of it out, have been attended with success ?

From the experience of surgeons, cutting out a piece of a nerve does not seem to be attended with any bad symptoms, and therefore the extraneous substance might have been cut out, or the portion of nerve including this removed, but whenever any disease is seated in a nerve, as a tumour, &c., it would generally be much better to remove a portion of the nerve, with the disease, than to cause much disturbance in sepa-



rating the portions of nerve in order to extricate the tumour. The case\* related by Sir Everard Home, of the removal of a tumour from one of the axillary nerves, terminated fatally; and whether the result would have been different had a portion of nerve been removed with it, I will not venture to conjecture. Should, however, a disease be situated in the sciatic nerve, as a tumour, &c., and be confined to that part of it which eventually forms the posterior tibial nerve, and the peroneal be not implicated in the disease, it may be a question whether the latter should be separated and kept entire, whilst a portion of the larger trunk is removed, or whether amputation would be the best expedient. Cutting out a portion of the whole sciatic nerve would render a limb entirely useless, and expose it to serious injuries from cold, &c.; and would leave the patient in a worse state than if the limb had been amputated.

When a nerve has been divided, reunion in course of time generally becomes perfectly established, so that it performs its functions as well as if no division had ever taken place. When a portion of a nerve has been removed, and especially if a large portion, the breach is with the greatest difficulty, if ever, repaired. For instance, when a portion of the sciatic nerve has been

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\* Transactions of a Society for promoting Medical and Chirurgical Knowledge, vol. ii. p. 157.



removed, the separation of the divided extremities is very extensive, the superior portion prepares for the reunion by an increased vascularity; and although the inferior does so likewise, it is in a much less degree; and after a time this vascularity is very greatly diminished, and the restorative process appears at a stand. This backwardness of the inferior portion is owing to the want of that action, which the influence of the brain and spinal marrow usually imparts to the limb, below the division of the nerve, and shows in a marked degree the power the nerves have over the action of the blood vessels, and consequently over the secretion of coagulable lymph. In every simple division of a nerve, the inferior portion always exhibited a striking difference in the experiments I made on animals. Chasms in almost every other part of the body are generally filled up, when the surrounding blood vessels are perfect; but in this instance, though scarcely a vessel is wounded, the fact is otherwise, showing the great influence the nerves exercise in every part and action of the animal economy.

As far as any one can judge from experiments, and the few cases dispersed through the medical records, when there is a choice between simply dividing and removing a portion of a large nerve, the former ought always to be preferred. Although the removal of a portion of a nerve may be effected without injury



to the constitution, yet when it is considered how much inconvenience is thus occasioned in the parts to which its branches are distributed, it should never be attempted when there is a chance of relieving the patient by a simple division. But when the disease is in one of the smaller nerves, so much hesitation would not be required, as its removal would interfere so little with the functions of the part.

As, therefore, when a portion of a large nerve has been removed it is replaced with so much difficulty, whenever a nerve is diseased which supplies parts that are of much importance, it will deserve the most serious consideration of the surgeon to determine on the best method of proceeding. When a limb is supplied, or nearly so, by one nerve only, as the leg is by the sciatic, the removal of part of this would produce the greatest inconvenience. On the contrary, in the nerves of the upper extremity, the same doubts about the propriety of removing a part of one of them would not exist in the same degree, as the limb is supplied by so many nerves, and its general functions would not be so much impaired; but at the same time it must be observed, that the parts constituting the sense of touch, and producing the finer movements of the hand, would undoubtedly be much injured by the removal of a portion of the principal nerve, as the median. Whenever it is determined that a portion of a nerve shall be



removed, it ought to be as small as possible. Should, however, the disease, as a tumour, be such as to occupy a large portion of the sciatic nerve, and the peroneal could not be saved, if the tumour were so situated that it might be dissected out of the nerve, would its removal in this way be advisable? If not, what will be the most effectual method of relieving the patient, who is threatened with death from the continued violent pain. In the before-mentioned case of tumour in the axillary nerve, related by Sir Everard Home, the patient had the use of the parts after the operation, but he died. In one view, therefore, there were advantages gained over the removal of a portion of the nerve, though the operation seems to have been the cause of the patient's death. Sir Everard says "that in examining the parts after death, the tumour was found to have been incased in one of the large nerves which form the axillary plexus: the principal substance of the nerve passed along the posterior surface of the tumour. The cyst was now much contracted, and more than four times thicker than at the time of the operation. In consequence of having been inflamed, the cavity was lined with coagulated lymph, and almost filled with coagulated blood, as suppuration had not completely taken place. The inflammation and swelling had extended some way into the surrounding parts, which were also consolidated into one



mass, and with difficulty separated by dissection. The other parts of the body were found in a natural state, so that there was no evident cause of death, but what arose from a considerable degree of inflammation upon the substance of a large nerve, for three inches in length, which also affected the other nerves of the plexus.

“In the removal of such tumours we find, that so far as we are justified in drawing conclusions from two instances, the taking away three inches of a nerve is productive of less violent effects, than are occasioned by inflammation and suppuration in the substance of the nerve for an equal extent.”

But whether this would have been the same in a nerve in a different situation, I am not prepared to say. In this case there were several circumstances to produce more violent symptoms, in consequence of the inflammation which would succeed to such an operation, and which might not be expected to so great a degree in the nerves of another part. For, first of all, there was a tumour in another nerve, which would in all probability tend to make the parts more irritable than they otherwise would have been; and then the axilla is so much occupied by loose cellular membrane, and absorbent vessels and glands, so largely supplied with blood vessels, and the diseased part, in this case, so much surrounded by nerves, as to create such a difference in



the circumstances as can hardly exist in any other part of the body.

In some nerves the tumour is so intermixed with the nervous fibrils as to make its removal impossible, without at the same time cutting away a portion of the nerve, as must have been done in the case\* related by Sir Charles Bell; here, therefore, there is no alternative, but the portion of nerve must be removed along with it. I cannot conceive that a mere division of the nerve above the tumour would be ever advisable, for though it would most probably free the patient from suffering for a time, yet it would be only for a time, as I think the pain would most assuredly return when the reunion of the divided nerve had taken place, unless there were an absorption of the tumour, which I do not consider as by any means probable. But with regard to the case before supposed, where a tumour occupies several inches of the sciatic nerve, I should be inclined either to dissect it out, or amputate the limb, if the peroneal nerve could not be preserved entire. Mr. Guthrie† says, “if a cannon-shot strike the back of the thigh and carry away the muscular parts behind, and with it the great sciatic nerve, amputation is necessary, even if the bone be untouched; for although the wound might in some measure heal, the

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\* Operative Surgery, vol. ii. p. 161.

† Observations on Gun-shot Wounds, p. 185.



motion of the leg would be lost, and it would become an insupportable burthen to the patient."

I conceive that this would not be the only inconvenience attending a destruction of the nerve, but that the patient would be very liable to extensive mortifications from slight accidents, as has been very frequently experienced in horses that have been nerved, when the foot has mortified and come entirely off, and the horse has died in consequence.

A woman had a very large tumour on the leg; it was divided into cellular compartments, containing fluid, and was similar to many that have terminated in fungus hæmatodes. It produced very excruciating pain. It was punctured, but very little fluid escaped. A short time after, the limb was amputated. There was a small tumour in the substance of the sciatic nerve. The patient died on the seventeenth day after the amputation. The femoral and profunda veins were inflamed and ulcerated, and contained purulent matter. The ulcerations did not extend higher than Poupart's ligament; and in comparing the iliac vein with that of the opposite side, it could not be determined that it was diseased. The inferior cava and the cavities of the heart were sound, but there was much fluid in the pericardium. The femoral artery was much thickened, and appeared to have been inflamed as much as the vein.



Mr. Langstaff was so kind as to show me a preparation taken from a limb that had been amputated on account of a large swelling, resembling that of some malignant disease. It was, however, found to be produced by an enlargement of the sciatic nerve. Mr. Langstaff has very dexterously unravelled this tumour by taking out the interstitial deposit from between the fibrils of the nerve, and has thus shown a separate tumour formed in each fibril.

Much pain is sometimes occasioned by the pressure of aneurisms and tumours on nerves; the former produces pain at a distance, and is therefore sometimes overlooked; the latter is liable to be mistaken for a tumour formed in the substance of a nerve, but may generally be distinguished from this by the absence of pain on pressure, except in the particular direction of the nerve.

A very interesting case\* of a medullary tumour pressing on the nerves in the ham, is related by Mr. Travers; and another† by Mr. Lawrence, in which the ulnar nerve adhered to the tumour.

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\* Medico-Chirurgical Transactions, vol. xvii. p. 389.

† *Ib.*, vol. xvii. p. 33.



## CHAPTER VI.

## OF DIVIDED NERVES.

THE symptoms occasioned by injuries of the nerves are frequently very violent, but so various as to make it impossible for any one to foretel the result of an accident that has affected them, as sometimes a slight injury will bring on bad symptoms, whilst at another a more extensive one will not be attended by any untoward circumstance.

When a nerve has been divided, if the external wound become healed by the first intention, very little pain is felt in the nerve, in proof of which I shall relate the following case.

## CASE :

Mr. C. fell with his hands on a bottle, and cut both his thumbs. The wounds were made across the thumbs, and very near the junctions of the metacarpal bone with the first phalanx. In one of them the nerve, which I distinctly saw, was completely



divided. He felt much pain before the wounds were dressed. I examined them so as to be certain that no glass was in them, and then closed them with interrupted sutures, sticking plaster, and a bandage.

He suffered no pain in the wounds at any time after I dressed them, and they soon healed.

Both thumbs beyond the wounds were quite benumbed, and, for a length of time after, the cold had a very great effect on them ; sensation, however, kept gradually returning, and though it is now nearly a year since the accident, it is not quite perfect.

An open ulcer connected with a wounded nerve is generally very painful, and sometimes produces violent symptoms ; so that when a nerve has been divided, it is a matter of the greatest importance to produce union of the parts about it by the first intention, because then the divided extremities of the nerve escape many sources of irritation. It is necessary to remove as much as possible of the coagulated blood, and every thing that can act as an extraneous body. It seldom happened in any of the rabbits, on which I made the experiments hereinafter detailed, that inflammation was produced, and the wound, in almost every instance, healed by the first intention. But in one case, where much blood was effused, the external wound appeared more open, and the nerve inflamed to a greater extent than when coagulated blood was not present.



When a nerve has been divided, and the external wound has healed, and there are marks of inflammation about the cicatrix, as redness, tumefaction, and tenderness on pressure, it frequently happens that this state is communicated to the nerve, and causes great pain, which is generally aggravated by any motion of the part.

The best method of treatment will be to apply leeches near the parts, and evaporating lotions, and to keep them constantly at rest.

#### CASE :

A man had a fungous tumour on the lower lip, and suffered from it very excruciating pain, much more than is commonly experienced in cancer, and it very much resembled *tic douloureux*.

I cut out the diseased part, and brought the edges together by means of the interrupted suture, and in a week the wound was perfectly healed, and in every respect quite well.

About a week after this he came to me again, and said he was afraid the whole of the disease was not removed. On looking at the lip I observed that the upper part of the cicatrix was rather redder, and more swoln than it should be : but there was nothing in its appearance to account for the excruciating pain he suffered.



I ordered two or three leeches to be applied to the lip; and as he had evidently a disordered stomach, with a furred tongue, I ordered him such medicine as would correct this state.

The leeches very much relieved him, and in about a week his stomach was much better, and he did not again complain of the pain; and when I inquired of him several years after, he remained perfectly well.

It appeared to me that this was an inflammatory action in the part, and that the nerves had partaken of it more than they generally do under such circumstances.

That the fungous ulcer in this case affected the nerves of the lip was, I think, proved by the severity of the pain; and that the inflammatory disposition in the cicatrix afterwards produced the return of the pain is proved by other cases, where the nerves have become inflamed.

I need not say how necessary it is in all diseases to pay proper attention to the state of the digestive organs, and that it is so most especially in all diseases and injuries of the nerves, as will appear from the following case.

#### CASE :

Miss Carr, about thirty years of age, in cutting some bread, wounded the skin on the inner side of the thumb, as near as possible to its extremity. She said



there was very little bleeding at the time. When I first saw her the wound was quite healed. She could not put her hand behind her. She had numbness in the thumb, and occasionally pain in the outer side of the fore-finger; the pain extended as high as the elbow. She had pain in the head before the accident, and now her digestive organs are very much disordered. She had fomentations of poppies applied to the hand, and a poultice made of the same to the thumb. She took five grains of blue pill every other night, and an aperient mixture with magnesia. The pain began to abate in a few days, and gradually got less, until it entirely left her.

In this case the nerve had undoubtedly been wounded, and the pain was produced by the disordered state of the digestive organs; and I conceive the symptoms would have been much more troublesome, had not the injury been so near the end of the thumb as to prevent any undue stretching of the cicatrix.

Sir Everard Home, in the Philosophical Transactions, speaking of *tic douloureux*, says, "In one case of this disease in which the operation of dividing the nerve was performed with a view to remove the complaint, union by the first intention did not take place, and during the time the wound was open, the inflamed state of the cut end of the nerve made the patient liable to several attacks of the disease, similar to those



he experienced before the operation ; but there was no occurrence of them after the wound was completely healed."

When a nerve has been divided, and the wound does not heal by the first intention, but inflames, violent pain, and frequently spasms, are produced from a communication of the inflammation to the nerve.

If the patient has much fever, and is of a robust constitution, some blood should be taken from the arm. Sudorifics should then be given, with as much opium as will allay the irritation, and fomentations and poultices should be applied to the parts.

In this case the wound must in general heal by granulations, and until these have proceeded so far as to exclude the nerve from the external air, and the influence of the parts about it, it will be liable to produce much irritation.

It has been shown by Mr. Hunter that a wound or breach of any part made internally may heal by granulations without causing any secretion of pus. This process I have seen in the healing of a divided nerve in a dog, which did not seem to suffer pain.

From the experiments I have made, there appear to be two modes which nature employs for effecting the union of divided nerves ; one by the effusion of coagulable lymph, the other by granulations ; and of the latter there are two kinds, one where there is a secre-



tion of pus, the other where there is none. Neither the union by the effusion of coagulable lymph, nor that by granulations, so long as there is an exclusion from the air, and from every thing that can produce a greater action than is just necessary for the restorative process, causes much irritation or pain.

Nerves connected with external wounds granulate like other parts, as I once had the opportunity of observing in the leg of a boy that was amputated some time after a compound fracture, when the soft parts were in a state of ulceration. Although the result has been nearly the same in all the experiments I have made, yet in some few, nature has been backward in perfecting the restorative process. And even when experiments have been made on both the posterior extremities of the same rabbit, the divided nerves in the two limbs have now and then exhibited very different appearances; in one, the healing process has been going on properly; in the other, hardly any attempts have been made to begin it; the usual increased vascularity has been wanting, and consequently the deposit of coagulable lymph; and thus I conceive it may be in the human subject, for in some instances the union never properly takes place, as the patients are ever after either deprived of sensation, &c., or exposed to unpleasant effects from cold, &c., in the parts beyond the divided nerve.



When a nerve has been accidentally divided, if the external wound has healed, and there has not been any symptom of irritation for some time, in order to expedite the restoration of the nerve, it may be advisable to rub the part well daily with the hand, or a flesh brush, and some stimulating embrocation. Should this plan be ineffectual, galvanism might be used with the same view of increasing the action of the parts, and thereby enabling them to complete the union of the divided nerve.

Under these circumstances nature will be assisted by exercise, a generous diet, with a proper quantity of wine, and by doing every thing that can invigorate the constitution.

That this backwardness in nature to effect the union is owing to a want of action, is proved by its always happening when healthy nerves have been accidentally divided, and its seldom occurring in those affected by *tic douloureux*, in which the action of the parts is frequently increased.

In the following case the sciatic nerve was wounded by a fracture of the thigh bone, an accident, I think, not very unfrequently happening in consequence of fractures of the bones, though it has hitherto been very little noticed.

CASE :

John Wright, about seventy years of age, got a fall



about the beginning of May, and injured the left hip. I saw him for the first time on the first of June. The knee and foot were turned completely inwards; and if this position of the limb was changed it was always soon resumed; the thigh could be raised by an assistant towards the abdomen as high as usual, but could not be rotated much: the limb was shortened about an inch; the great trochanter was not far from its usual situation, but behind it there was a rounded tumour, which was apparent, and could be distinctly felt, so as to convey the exact resemblance of the head of the thigh bone. When the hand was placed above the trochanter, and the limb was moved, a crepitus could be felt; the limb had the exact appearance of the dislocation backwards. He complained of very violent pain for some time, much more than is usual; but for the last two or three weeks he lay in an almost insensible state. He was in a very debilitated state before the accident, but after it he never had any appetite, so that he sunk from complete exhaustion on the twenty-fourth of June.

The next morning I examined the part where the injury was received.

On dividing the integuments, a small quantity of a dark-coloured fluid escaped; all the parts, for some distance, appeared one confused mass, from the quantity of coagulated extravasated blood. The thigh bone



was broken through below the capsular ligament, and another portion was broken off below this, in an oblique direction, so as to leave the great trochanter nearly perfect; this portion lay behind the trochanter, and when covered by the integuments had a rounded feel, like the head of the bone; another small portion was likewise completely detached. All the portions of bone were surrounded by coagulated blood, which appeared to have become organized, for in several parts of it were found osseous deposits; the head of the bone appeared inflamed, and was coated with coagulable lymph. Nearly all the cartilage lining the acetabulum was absorbed.

The sciatic nerve was much enlarged, and likewise surrounded by coagulated blood; and in one place a portion of coagulum, about the size of a filbert, adhered very firmly to it; and when it was examined, portions of a whitish substance might very distinctly be seen in it, so as to convey the idea of this part having taken on the structure of newly-formed nerve: at this part some nervous fibrils had been lacerated.

The appearances of the limb in this case were different from what are usually presented in fractures of the neck of the thigh bone; and were such that, without great care, might have been mistaken for a dislocation of the bone backwards. The wound of the nerve sufficiently accounted for the violent pain.



Had this case been mistaken, how greatly must the patient's sufferings have been aggravated, as much extension of the limb would in all probability have inflicted another injury on the nerve, as well as all the other parts.



## CHAPTER VII.

## OF PARTIALLY DIVIDED NERVES.

It may always be concluded that a nerve has been injured, if, upon the infliction of the wound, very acute pain be complained of, and especially if it be in the situation of a nerve, and particularly if there be present convulsions, or other symptoms of great nervous irritation. Frequently the pain will be very acute only at the moment the wound is inflicted; sometimes it will continue for a while, and keep gradually abating, so that the patient will be easy for three or four days, and then it will return, and go on gradually increasing until it has become very distressing.

When a nerve has been wholly divided, each portion immediately retracts, so as to leave a considerable space between them. When only a partial division has taken place, the divided portions retract in the same manner, but not in so great a degree, and leave a space, whilst the undivided portion remains of the same length as before the division. Now a nerve is composed of different fibrils, and these, in most in-



stances, communicate together: should one complete fibril be divided, that had not any communications with the others of which the nerve is composed, it would retract, and leave its fellows in the same state as before the division, and it is most probable that there would be no more irritation than when the nerve is completely divided; but if a fibril be partially divided, or if it be wholly divided, and at the point of division it be connected with the adjoining fibril by filaments, the retraction of the divided parts will stretch these filaments, and thereby cause considerable pain.

But again, should the whole of a nerve, except one fibril, be divided, the great retraction of the divided parts will keep this very much on the stretch. Any one may be satisfied on this point by taking an animal soon after it is killed, and almost entirely dividing a nerve; the divided portions will be seen to retract in some degree, but immediately on cutting through the remaining part, each end will retract in the quickest possible manner to a much greater distance than it did before; thus clearly proving, that this small portion alone prevented the retraction, and must, therefore, have been kept very much on the stretch.

From the experiments I have made in partially dividing the nerves of animals, it does not appear to me that they suffer more than when a nerve has been wholly divided; nevertheless, in a partial division, the



nerve is under such circumstances, as to make it probable that the irritation would be greater than in a total division. I cannot help thinking, that from the variety of accidents which are perpetually happening, as well as in the performance of surgical operations, nerves must be frequently pricked or partially divided, and yet it seldom happens that we observe the symptoms characteristic of a wounded nerve.

Sir Astley Cooper\* says, "I removed a tumour from the median nerve of a gentleman, and cut away two-thirds of the thickness of the nerve, leaving one-third; tingling of the fingers with some partial numbness followed, but no constitutional irritation, and he did very well."

If there be really no difference between the functions of the nerves of man and animals, there seems no other way of accounting for the violent effects which follow the wound of a nerve in the human species, than by supposing either that the wound must have been inflicted in persons of peculiar constitutions, or those labouring under a disease of some organ with which the affected nerve sympathizes; and that after its infliction the parts must have undergone some particular change. I have endeavoured to show how a partial division of a nerve may produce the violent symptoms. Whilst the

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\* Lectures, by Tyrrell, vol. iii. p. 171.



nerve is free from inflammation, and just as much action as is necessary for its healing is present, this peculiar wound may not cause much irritation ; but when it has become inflamed, the fibres that are on the stretch may begin to feel acutely. We know that there is a very great difference between the sensations occasioned by the healing process when the external wound unites by the first intention, and no greater action is present than is just required for effecting the restoration of a divided nerve, and when, on the contrary, the external wound keeps open, and the ends of the nerve are exposed to inflammation ; and may not a nerve, when there has been a partial division, heal under the same unirritating action, if the form of the wound be not particularly unfavourable, and the patient not of a very irritable constitution ? The union of the divided nerve with the cicatrix is frequently a source of the violent symptoms, and particularly if the part be liable to much extension or motion.

But to show that the peculiar form of the wound of a nerve may be the entire and immediate cause of the symptoms, independent of inflammation, or any other irritating cause, I shall introduce the following case\*, in which this accident happened from bleeding in the foot.

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\* De la Médecine Operatoire, par M. Sabatier, tom. i. p. 253.



“ This slight operation,” he says, “ was very painful, and was soon followed by convulsive motions, which extended themselves through the whole of the wounded extremity, and then through the rest of the body : these symptoms were not accompanied by any tumefaction, and were very often renewed. The patient could neither walk, nor ride in a carriage. This state having continued a long time, notwithstanding the use of antispasmodics and quieting remedies, I advised a division of the saphenus nerve, but it was not consented to ; nevertheless the nervous symptoms gradually diminished, and the patient partly recovered her health, after five or six years of almost continual suffering.”

When a patient complains of pain immediately after bleeding, and this increases, it is to be feared that the symptoms will continue until the wound of the nerve has healed, and the cicatrix has become soft and yielding, so as to allow all the parts connected with it to be free and unstretched in motion ; but should acute pain be complained of at the time of bleeding, and not felt again for a few days, it may be presumed that inflammation has been excited by a premature use of the arm, and that it is therefore necessary to apply some leeches in the neighbourhood of the wound, and evaporating lotions, or if these disagree, fomentations of poppies, and poultices, and at the same time to keep the limb quiet, and in the most easy position.



I have very little doubt but by far the greatest number of injured nerves in venesection is made troublesome by using the arm too soon, and bringing on inflammation; for I have never seen any bad consequences in those patients who have been so ill as to be unable to do any thing.

Whenever a person has complained of very acute pain on the opening of a vein, great care ought to be taken to close the wound well with a linen compress and bandage, and to keep these continually on the orifice, and at the same time to confine the arm in a sling until the wound is perfectly healed.

I relate the following case to show that if a nerve be injured in bleeding, and the external wound heal by the first intention, that of the nerve may not be of any consequence.

CASE :

I bled Mrs. D. in the median cephalic vein; she complained of very acute pain at the time I made the puncture, and it continued for several hours.

As I was certain from the manner in which she complained that I had wounded a nerve, I was very careful in binding up the arm, so as to keep the lips of the wound in exact contact, and at the same time told her of the necessity there was for keeping her arm entirely at rest. The wound healed by the first intention, and the pain did not return.



Some have supposed that the injury of a nerve in venesection is always a partial division, and that in order to a cure, it is necessary to be wholly divided. That it is so sometimes, I shall relate cases to prove; but that it is not always so, will appear from the following

CASE :

A woman, about forty years of age, got a fall, which shook her head very much, and for which I bled her from the cephalic vein: she felt no inconvenience for two or three days, but after that her arm became painful from the shoulder to the wrist, and she seemed to suffer very much.

There was a little thickening about the cicatrix, and it was painful when touched. I ordered some extract of belladonna to be applied to it. Some days after when I saw her, the cicatrix was quite even and soft, and might be pinched without producing pain. The pain now only struck upwards to the neck whenever she attempted to straighten her arm. I ordered her arm and neck to be bathed with the following liniment, and the pain gradually wore off, although it was some weeks in doing so :

R. Linim. Carb. Amm. ʒvj.

Tinct. Opii. ʒij. M. Ft. Linim.



The following case\* shows that an injury of a nerve, under peculiar circumstances, may prove quickly fatal. "Immediately after opening a vein in the right arm of a woman, there came on the most excruciating pains, which could not be appeased by any remedies; violent inflammation followed, then spasms; at length being weakened by pains, watching, and want of food, she fell into epileptic fits, brought forth a dead fœtus, and died at the end of a week."

In the following case, for which I am obliged to my friend Dr. Wilson, of Grantham, the symptoms were the most violent that can happen from a wound of a nerve, except those of tetanus; and I think there is very little doubt, that if the nerve had not been divided above the place where the injury was received, the case would have terminated in the patient's death.

CASE :

I was desired to visit Mr. B.'s housekeeper, at ——. I found my patient in strong convulsions, and held upon the bed by several assistants; her hands were strongly clenched, and she was struggling greatly: she soon after became comatose. I was informed that she had been let blood two days before by a gardener; that she complained very much of the arm where she was

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\* Boneti Sepul., tom. 3.



bled, and of a pain shooting from thence to the shoulder. I examined the orifice of bleeding, which was in the median vein; it had not healed, was somewhat inflamed, and a thin liquor oozed from the lips of the wound. While I was making this examination she became again strongly convulsed, as I supposed, from the irritation I had caused. With a view to interrupt the communication from the diseased point to the sensorium, I applied a tourniquet above the part: a remission of the spasms soon followed, and I administered an anodyne; but the convulsions, after a short interval of ease, recurred as before, and the application of the tourniquet was again made without any good effect. As I had no doubt that the cause of the disorder was an injury of a cutaneous nerve in the operation of venesection, I determined to endeavour, by a transverse incision, to divide the nerve above the injured part, and to destroy its connexion with the sensorium; I therefore made an incision, while the convulsions were most violent, of about an inch in length and small depth just above the orifice: no mitigation of symptoms was perceived; but on making another incision above the former one, somewhat deeper and longer, she cried out immediately, to the astonishment of the attendants, "I am well, I am quite well, I can stir my arm;" which she began to move, and continued to do so with great delight for some time in various ways.



She had no return of the spasms, and very soon got well.

Mr. George Bell\* has related the case of a young woman, who had been bled ten days before in the median cephalic vein. The symptoms were very similar to those in the preceding case; but the operation he performed was very different.

On the 7th of July, 1802, "An incision about three inches in length was made through the skin along the course of the vein, commencing an inch and a half above, and terminating at the same distance below the wound which had been made by the lancet. The vein being laid bare and separated from the tendinous aponeurosis, two ligatures were thrown round it, at an inch and a half from each other, and equidistant from the wound of the vein. The ligatures were then tightened, and the intermediate portion of vein divided as close to them as possible, and removed. When the ligature was tightened in the upper part of the vein she complained of considerable uneasiness, much greater than that which she felt on tightening the ligature on the lower part."

"On the 12th, she remains easy and free from fever, the ligatures were removed this forenoon, and the pain, which the upper one seemed to have occasioned,

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\* Edinburgh Journal of Medical Science, page 326.



is gone. The wound is now dressed with adhesive plasters. From this time she continued quite well as to her general health, complaining occasionally of a sense of stiffness, and a numbness in her arm, though not to a greater extent than was reasonably to be referred to the wound made in the operation. The wound was healed on the 1st of August."

I cannot help thinking that in the wounds made in venesection it is frequently a very small filament that is disturbed, and that it may in some instances be connected with the edge of the wound, and that the unfavourable symptoms may be removed by nipping up the portion of skin forming the lips of the wound, and removing a very little with the blade of the knife held horizontally, as in the following case.

#### CASE :

John May, ætat. twenty-two, applied to me on the 5th of August, 1823, with a small wound in the forearm, close to the beginning and on the outer side of the median cephalic vein. It had been produced some days before by an eagle, which struck him with one of his talons. There was not any hæmorrhage at the time of the accident. He complained of much pain up the arm and neck, and very much of his back. He had an inability of moving the arm, except in a trifling degree, and it was so weak that he could not hold any weight in his



hand. There was not any inflammation about the wound, and very little swelling. The skin was separated from the fascia, a short distance round the wound.

August 11. He said the pain was increased, he felt very weak; he complained of much tenderness on pressure, to some distance round the wound; but when the bit of skin forming the edge of the wound was taken hold of by the thumb and finger, he complained of very great pain. The pain and tenderness were chiefly on the outside of the biceps muscle, and the external cutaneous nerve appeared to be the most affected, but the internal was also, but in a less degree. He could not sleep. He had leeches applied several times about the elbow, and an evaporating lotion constantly; as his complaints appeared to be increasing, and the edge of the wound so very painful, I took hold of the bit of skin with my thumb and finger nails, and holding the blade of the scalpel horizontally, removed the circumference of the wound.

13. He thought himself easier. He was ordered ten grains of the compound powder of ipecacuanha at bed-time.

15. The pain had not extended up the neck, but he had still much in the arm. The tenderness on pressure continued; the powder at bed-time was increased to fifteen grains.

18. He is much easier, and can move his arm more; but the tenderness about the wound continues.



20. He is easier ; the tenderness is still considerable in the direction of the outer edge of the biceps muscle in the course of the musculo-cutaneous nerve, but it is nearly removed from the course of the internal cutaneous. He is very weak, and his flesh is much reduced. He was ordered to take twenty grains of powdered bark, and the same quantity of subcarbonate of iron, three times a-day, and he soon after got quite well.

In the following case\* the patient recovered without any operation :

CASE :

“ A young man of a very healthy and robust constitution, received a stab near the knee at the inferior and inner part of the left thigh, in the course of the saphena vein and nerve. The bleeding from the wound was with difficulty stopped ; swelling came on, and fever ; the affected extremity was very painful. When these first symptoms had abated, a trembling of the leg and thigh was perceived, which was at first slight, but afterwards violent ; all attempts at remedying this were in vain ; the patient had not a moment's repose. I judged,” says M. Sabatier, “ that the saphena vein and nerve had been affected, and to prove this to the patient, I passed a sword across the inferior part of the thigh of a subject, at the place where the young man

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\* De la Médecine Opératoire, par M. Sabatier, tom. i. p. 254.



had been wounded, and, as much as I could, in the direction the one, with which he had been stabbed, had taken. The saphena vein was found entirely divided, and the nerve cut half through. I insisted on the use of the cautery, but the young man was too irresolute to consent to it. I did not see him again for more than six months after, when I met him walking in the street with the assistance of a stick; he said that he had used a milk diet, and that his complaint had almost entirely left him. There remained still sufficient sensibility to prevent his riding in a carriage without much pain. He was feeble, but endeavoured to use as much exercise as was possible. By degrees he recovered his good health, and has enjoyed a long time his accustomed strength."

The preceding case shows a great similarity of symptoms to several that have been related; and although the symptoms in this case spontaneously abated, and the patient got quite well, yet I think it would not be advisable to trust altogether to the natural efforts of the constitution in similar cases. Some of the cases show that, in all probability, if an operation had not been attempted, and the patients had survived the symptoms that threatened the destruction of life, they might have been undergoing continual sufferings for many months, or even years; and though, as in Sabatier's case, the violent symptoms might have sub-



sided, yet we cannot be certain that there will be this favourable event, as there are too many instances in which the state of suffering has been continued long after the time has elapsed that was necessary for the healing of the wounded nerve. Of this we have a strong instance in the following case :—

CASE :

Mrs. E., about forty years of age, received a cut on the inside of the first phalanx of the left thumb. Immediately after the accident she felt a numbness in the arm, and a sense of fulness, as if the skin would burst; these sensations continued for a fortnight, and the wound healed very well. At the end of this time violent pain came on, when a tremulous motion could be seen in the part which it occupied. The pain was termed startings, or spasms, by the patient, and was felt in different ways, but the muscles were not affected. These spasms were felt all over the body, though they were by far the most frequent in the upper half of it. She frequently felt a great heat in the chest and abdomen, but most particularly in the latter, and the same startings as in other parts of the body. The sensations were sometimes as if the flesh was pinched with hot irons; sometimes a great heat, as if hot water was poured down her back; sometimes she had frequent shakings of the whole body, which were unattended



by pain, and were most relieved by drinking hot water. The spasms were not confined to the left arm, but she had them at the same time in the right, and frequently in the right when she had none in the left. The forefinger was as painful as the thumb, and if any thing touched either of them the spasms were produced, which continued many days. She had a good appetite; her bowels were confined, and her tongue furred, but she had no thirst.

Electricity was tried, as were likewise several topical applications, but they gave no relief. She took a great variety of medicines, but none but the extractum cicutæ and the following mixture seemed to render her any material service.

R Camphoræ, ʒi.  
Mucilaginis Acaciæ, ʒss.  
Spir. Ætheris Sulph.  
Syrupi, āā ʒij.  
Aq. puræ, ʒvij.  
Tinct. Hyoscyami, ʒiss. M. f.  
Mist. cap. coch. iij. pro re natâ.

In the state I have described she continued about six months, after which the spasms were less frequent; but if the thumb or forefinger was touched or moved at any time, the spasms were reproduced. Every succeeding year brought a mitigation of her symptoms. Although nearly seven years have elapsed since the accident, and she is seldom affected by the spasms,



yet that extreme susceptibility of any impression still remains in the thumb; and although the feeling in the forefinger is much less acute than formerly, yet it has not entirely recovered its natural state.

In this case no operation was attempted, for the spasms were so general, and appeared so much blended with the constitution, that it was thought any fresh wound inflicted might produce more serious mischief, and it was very doubtful whether the division of the nerve could do any good.

During the greatest part of the time since the accident her appetite has continued good, and she has always been allowed a generous diet, which, indeed, in the generality of these cases, the great expenditure of the nervous power renders absolutely necessary.

To show how generally her constitution is still affected from slight causes, only a few weeks before I wrote this, the mere carrying of an umbrella two hours produced sensations all over the body, as if needles were running into her, also restlessness, pain at the stomach, and head-ache, and it was two or three days before these symptoms went off.

Lifting a weight, or using the right arm much, always produces sensations as if needles were running into it; and attempting to use the fingers of the left hand, as in knitting, produces giddiness.

She continued to be affected with the spasms, or



rather electric shocks, in every part of her body. She had been troubled with a cough, and several times had a copious purulent expectoration. For several weeks she had been unable to lie in bed, and appeared to die worn out, on the 28th of August, 1822, about nine years and six months after the accident. Every endeavour was used to obtain permission to examine the body, but without effect.

The following case \* is related by Mr. George Bell.

CASE :

“ In the month of June, 1805, a lady, about twenty-six years of age, the wife of a surgeon in Lincolnshire, applied to me when suffering under symptoms of violent nervous irritation, apparently connected with a wound which she had received two years before, when cutting a loaf of bread, the knife having slipped, and divided the artery, and probably injured the nerve of the thumb, on the radial side of it, halfway between the first and second joints. The pain was excruciating at the time, but the wound healed kindly ; yet the pain continued, and was accompanied by startings, twitchings of the flexors, bending of the thumb, and great general irritability. Various opiates, without large doses of which she had never slept since the reception of the injury, and every expedient, that

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\* Edinburgh Journal of Medical Science, p. 329.



could be thought of, were employed by her husband and the medical gentlemen who attended her; and on two different occasions, at a considerable intervening interval, an incision was made through the soft parts to the bone, in the neighbourhood of the wound, but with slight, and only temporary relief. When she came to Edinburgh, her general health had suffered much; and now the pain was sometimes so exquisite, and her mind had become so irritable, that I dreaded mental derangement would ensue. Before removing the thumb at the second joint, I requested Dr. Monro, secundus, and Mr. Russell to see her. Mercury was proposed, and tried; but the symptoms increased, and we were very glad to lay it aside. When the mercury seemed to have left the system, the thumb was removed. The twitchings and painful contractions were soon relieved; her mind became less irritable; and she returned home, in five or six weeks, restored to perfect health."

Mr. Wardrop has related a case\* in some respects similar to the preceding one, and in which he relieved the patient by an incision made beyond the wound. There was more febrile excitement in this case than is usually observed, and it is most probable that it was very much occasioned by intemperate living, which also produced inflammation of the injured nerve, and the other symptoms.

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\* Medico-Chirurgical Transactions, vol. xii. p. 205.



## CASE.

Miss Willson, æt. 23, on the 20th of December, 1822, wounded the ulnar side of the second finger of the left hand near the middle of the second phalanx, whilst she was attempting to cut an orange. She was immediately in great pain, which extended over the hand and up the arm, and after some days was continued to the centre of the left breast, and up the left side of the neck to the face, along the branches of the facial portion of the seventh nerve. On the 26th, which was the first day I saw her, the wound was nearly healed. The wounded part was very tender to the touch, and pain was produced on making pressure beyond the wound, or that part nearest to the tip of the finger. There was an insensibility and numbness of the opposite side of the finger, which was very great in the first few days, and then gradually diminished, but never went away. The arm could hardly be moved in any direction without pain, but this was frequently great when the hand was at rest. Opening the fingers, or stretching the wounded part in any way produced much pain, but this was excruciating when she attempted to move the limb with the hand in a state of pronation. Whenever she attempted to read, pain was produced in the superciliary nerves of the left side, so that she could not read longer than about five minutes. A poultice was



applied to the finger and afterwards the extract of belladonna, and opiates and antispasmodic medicines were given.

On the 11th of January, 1823, the symptoms continued nearly the same, and as her health appeared to be suffering, with the concurrence of my brother, I divided the nerve by making an incision across the side of the finger near the middle of the first phalanx. Immediately afterwards the cicatrix could be pressed without pain, and complete insensibility of that side of the finger was produced. She could move her hand and arm in any direction without pain, and in fact was immediately and completely relieved.

January 12th.—She has had a more comfortable night, and although she complains of her head, the pain is entirely different. She has had a little pain in the arm and neck, but none in the face. She complains of much pain in the joint between the first and second phalanx, but she can move her arm in any direction without pain, and her feelings are altogether totally different from what they were before the operation.

13th.—Last night violent pain came on in the joint between the first and second phalanx, and then went off, so that she had a tolerable night. A poultice was applied to the whole hand.

14th.—She has not had a good night, on account of



much pain in the hand. The poultice was left off at 6 P. M., when the pain gradually abated. When the arm is extended to the utmost, with the hand in a state of pronation, pain is felt along the finger, but it does not strike up the arm. The uninjured side of the finger has recovered very much of its sensation, but this is not perfect. She was able to read for a quarter of an hour yesterday. The wound looks well.

16th.—Last night she had pains in the neck, which struck chiefly to the back of the ear, but each attack only lasted about five minutes. The pain was different to what it was before the operation, as then it always felt as if it were connected with the finger. She has always some pain at the inner side of the arm. She has read for two hours this morning, with short intervals of rest. She has more feeling at the back of the finger on the injured than on the uninjured side. There is more sensation at the end of the finger than between the original wound and the one made at the division of the nerve.

18th.—She is in every respect much better. Her general health is improved. She has had a few paroxysms of pain in the last two days, which lasted a few minutes. She can hold out her arm to its full extent, with the hand in a state of pronation, without pain.

20th.—She had some pain in the face on the evening



of the 18th, but yesterday it was very severe and came on like the *tic douloureux*. The weather was intensely cold. The last wound is nearly healed. She was ordered to take half a drachm of subcarbonate of iron twice a day. This evening she had also violent pain for two hours.

23rd.—She is much better, and the wound is quite healed.

24th.—She has had a bad night, and cramp in her legs, which she supposed to arise from having walked too far on the preceding day.

25th.—She had a bad night, and much pain in the arm and the clavicle, but not so much in the face. She said the pain was not near so bad to bear as before the operation. The wound in the finger is perfectly healed, and the finger can be pressed or moved without pain. She was ordered to have her arm rubbed night and morning with the following liniment, and covered with flannel.

R Linim. Camphor. ℥j.  
Tinct. Opii,  
Liq. Ammon. āā ʒij. M.

27th.—She had very violent pain in the neck and face for several hours last evening. It affected the arm and shoulder to a little below the elbow, but neither the finger nor the hand. The dose of the subcarbonate of iron has been increased to two scruples.



February 2nd.—She has had pain and tenderness in her right side below the ribs. She had inflammatory affections of the liver before the accident. She was ordered to discontinue the iron, to have eight leeches applied to the side, and to take four grains of submuriate of mercury at bed-time, and aperient medicine in the morning.

4th.—Yesterday she was relieved, but the pain in the side is rather increased to day. She was ordered to repeat the leeches, submuriate of mercury, &c.

10th.—She is in every respect better, and has had very little of the *tic douloureux* for the last few days. She can move her arm in every direction when the hand is shut, but has pain when the fingers and hand are extended together.

17th.—The pain in the right side returned, but was again relieved by leeches, &c.

23rd.—On the evening of the 21st, the pain in the arm, neck, and face, was very severe, and continued until midnight. There is a small tumour in the cicatrix, which is very tender.

March 5th.—She has had bleeding several times from the left side of the nose, and the same pains. She has now much pain in the hand, and particularly in the finger, and the posterior part of this. When the arm is moved with the finger extended, there is pain all along this, but it did not strike up the arm. As



her health appeared to be suffering, and as she could not use her hand, and the functions of the nerves of the finger were altogether disordered, with the concurrence of my brother, the finger was amputated at the joint between the metacarpal bone and the first phalanx.

On examining the finger at the original wound a small fibril of the digital nerve was found divided; the end of this next the tip was incorporated with the cicatrix, the other was formed into a small bulb.

At the place of the division of the nerve at the first operation, both extremities of the divided nerve were incorporated with the cicatrix, and likewise those of the dorsal branch, which had also been divided.

6th.—She has had a good night, with the exception of a few slight paroxysms of pain in her face.

8th.—She has had a very good night, but had some pain in the neck this morning. She frequently feels the same pain in the finger she did before it was amputated.

17th. The pain in the neck and face has been very trifling the last few days. There is tenderness on the side of each finger next the stump. When she extends her arm and hand, there is the same pain in the finger as before the amputation. She has not had any pain in the arm. She gains flesh, and her health is much better.



21st.—Her general health continues to improve, but she has had pain in the hand, arm, and neck. The wound is quite healed, but there is still tenderness on each side the stump.

29th.—For the last few days she has, at different times, had pain in the hand, behind the ear, and in the face.

May 2nd.—Although she has suffered much less pain since the last report, she has not been altogether free from it. She has complained for the last few days of much pain in the side of the forefinger next the stump. After this period she had occasionally much pain in the hand and arm, especially after using it. In July, 1823, she went to the sea side and here first complained of her spine; she discontinued bathing, and appeared in better health. In the autumn the affection of the liver came on again. About the end of November she complained very much of pain in her back, and tingling in her arms, with a difficulty of supporting herself erect. On examining the spine percussion produced more uneasiness in every part than is usually manifested, and much pain about the lower dorsal vertebræ. She complained of pain in the left side of the chest. She began to keep altogether in the recumbent position.

1824, April 2nd.—She has, at various times, suffered much from spasms about the chest. Her appetite



has been generally bad. She has been obliged to take an opiate every night, for when she omitted it for a few nights the spasms were more frequent. She has taken occasionally a blue pill; and when the spasms were most troublesome, a dose of the submuriate of mercury relieved her. She has not complained of the tingling in her arms so much lately. She has not complained much of her left hand, and very little of the tic douloureux in her face. She occasionally complains of pain in her back, and especially if her hand be raised. She was seized with a violent pain in her left knee, which continued for two or three days. On making an examination of the spine, pressure on each side of the spinous processes of several of the vertebræ produced pain, and percussion with a key made it very severe. She had difficulty in voiding her urine. A blister was applied to the spine.

May 27th.—Since the application of the blister the spasms about the chest have been less severe, and her health has improved. A second blister was applied on the 24th. Her father had a paralytic stroke; this made her very uneasy, and brought on an attack of tic douloureux in the face. The difficulty of voiding her urine has gone off.

At the beginning of October she began to get up. During the summer the state of her health was various. Sometimes she had considerable pain in her back and



chest, and then her digestive organs were generally disordered. She took the sulphate of quinine for some time, and appeared to get strength; but she left it off again, as she thought it produced pain in her chest, in the same manner as almost all tonics have done. She does not now complain of her hand, but has numbness and want of feeling in the left hip and shoulder. She has pain at the back of the neck, and feels as if the neck could not support the head.

November 2nd.—About a week ago, on grasping a pole suspended from the top of her bed, she hurt her hand just where the finger was amputated, and she has complained of pain ever since, and feels the amputated finger very sore. This sensation, however, soon subsided. She continued to sit up several hours a day; she was then not so well, became weak, and was obliged to lie almost continually. She had much pain in her back, and great tenderness on each side of the spinous processes. At the latter end of the year 1825 and beginning of 1826, she was affected by dizziness, in fits of which she fell down, but never entirely lost her consciousness.

She used a liniment with cajeput oil for the back, which produced a rash, and appeared to relieve her. She began to get up again, and was by degrees able to sit up longer. She was carried out of doors almost daily for about two months, and since has gone



out in a carriage. When her tongue was more dry than usual, and her stomach disordered, she had a taste of copper in her mouth, and took four grains of submuriate of mercury. She was allowed a generous diet. She went to the sea-side on the 8th of August, 1825, and returned home about the end of September, very much improved in health. She can now walk a short distance, has a good appetite, and feels well, but weak. The left arm and leg are weaker than the right. She bathed first in tepid water and afterwards in the sea.

1826. August 30th.—She has been better than in the preceding year, but has been at times much subject to dyspeptic symptoms. She does not now complain of her hand, nor has she done so for a very long time. She has been again at the sea-side, and has received much benefit, and can now walk a considerable distance. She tried shampooing, when the left side was made very painful, and the left arm weakened for some days, but the right side was not affected. When the membrane lining the left external auditory meatus is touched, cough is produced.

I left Lincoln on the 30th of March, 1829, and to this time she had varying degrees of pain and weakness; soreness in the throat with an appearance of venous congestion, and disorder of the digestive organs, and at the pit of the stomach very great tenderness in a spot the size of half-a-crown; at the monthly periods



she had much pain, and passed a portion of coagulable lymph about the size of the cavity of the uterus; this organ began to be painful and enlarged, and had tenderness particularly on the left side of the vagina, and the evacuations from the bowels were voided with pain and difficulty.

She went to Sheffield to be under the care of Dr. Knight, and her state was improved by the means he recommended; but this amendment, as on almost every other occasion, was not of very long duration.

Since April, 1826, she has had a tumour, in form and size of a small pear, towards the right side of the abdomen, which appeared to be connected with the colon.

When sleeping on the left side she very frequently awakes with pain and great soreness in the amputated finger, and the sensation as if a thimble much too small pressed upon the cicatrix.

From within a few days of the accident she has suffered frequently from pain in the hand, extending in lines, as if it were produced by the great pressure of the teeth of a comb, and from a similar but more general pain in the bosom.

She frequently awakes with feverishness and excessive aching in the limbs, and especially the left. She has sensations of burning in the hands and feet, whilst the other parts of the limbs are very cold. After more than



ordinary exertion she has pain and spasms at the stomach and rejects her food. Cheerful society and conversation frequently bring on *tic douloureux*, but not so much as grief or any other depressing cause; exposure to a strong light will also bring this on, as well as paroxysms of sneezing, with which she is frequently troubled. There is now a very great sensitiveness of the throat and the Schneiderian membrane.

She is frequently troubled with strangury, and sometimes has then pains under the nails of the fingers, and in the teeth, and, in the most severe attacks, also under the toe-nails.

She appears to have been latterly more relieved by the use of the subcarbonate of iron than any other medicine, but if it be taken very long it brings on the affection of the liver. Sulphuric ether rubbed on the skin of the throat relieves the sneezing.

She had been bled from the arm several times before the accident, and had also used mercury freely for a complaint in the liver.

She had a steatomatous tumour removed from the left side of the back, by the late Mr. Cline, in the winter previous to that in which she met with the accident, but nothing unusual occurred from the operation.

It is worthy of remark, that the left half of the body seems to have suffered throughout by the accident, and the right very little; but parts of this have latterly been



affected with *tic douloureux*. The sensations of every part of the body are more acute than is consistent with health.

When I saw her on the 30th of October, 1833, she was nearly in the same state as she had been in for a long time.

From experiments on animals it appears, that in whatever way wounds of the nerves are made, they are repaired by nature alone. It becomes then necessary to inquire under what circumstances the interference of a surgeon is requisite, when the nerves have been injured in the human species.

In bleeding, it is undoubtedly proved that the nerves sometimes suffer from a wound by the lancet ; in many instances there have been violent symptoms, but in course of time these have subsided : it is therefore right when this accident has happened to wait for a while, and try by palliatives to assuage the violence of the pain and other symptoms that may occur. But if the irritation be so great that convulsions have come on, as in a preceding case, and threaten the patient's life, a similar operation should be attempted, in order to cut off the communication between the brain and wounded nerve.

When, however, the disease has lasted a long time, and nothing has afforded relief, and the constitution is suffering very much from the irritation, the division, or



the removal of a portion of the nerve ought to be tried, or the amputation of the part where the injury was received. Amputation of the thumb has proved successful in Mr. G. Bell's case, where the nervous symptoms proceeded from a wound: it has also been successful in Mr. Wardrop's case, where the disease originated in a prick of the finger. The loss of a thumb is a very serious one, but when we consider that it is of no use in its present state, and set against the loss the agony which the patient would otherwise continue to endure if the removal of part of the nerve has not succeeded, I think the probable advantage of being freed from pain, and consequent injury of the constitution, may reasonably be looked upon as fully compensating for the loss. Should the disease be in a finger, less hesitation about its amputation would be necessary. When it is in a large nerve of the upper or lower extremity, and a question arises whether the limb should be amputated, or a portion of the nerve removed, the latter, I think, ought always to be done, except under very particular circumstances.

From the consideration of the preceding cases it must be confessed that much remains to be desired in the treatment of these distressing accidents.

Mr. Pearson says \*, " When no deviation from the

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\* Medico-Chirurgical Transactions, vol. viii.



natural condition of the part can be detected by the most able and accurate examination, and when parts at a distance from the immediate seat of the pain sympathise on every accession of the paroxysm, there is ground for presuming that the source of the malady resides in some other portion of the nervous system, and that the division of the nerve in the part whence the pain seems to originate, may prove rather injurious than beneficial. This unfavourable issue of a successful operation is not an assumption founded on mere reasoning or analogy; cases have occurred where the patient has not only been disappointed of relief, but the irritation has been transferred subsequently to the spinal marrow and brain."

He further says, "During the course of many years' practice, several cases of the local affection of a nerve or nerves, accompanied by muscular spasms, had occurred, and had often proved very untractable. I was at length induced to attempt the cure of these painful complaints by inflicting a disease which should extend over a large portion of the surface of the body, and which, after exciting a series of actions in the skin, should finally cause an extensive eruption, attended with the usual concomitants of certain exanthemata." For this purpose he recommends the following liniment to be rubbed twice or three times a day on part of the skin, until an eruption is produced.



R Olei Olivæ, ʒijss.

— Terebinthinæ, ʒ iss.

Acidi Sulphurici, ʒi. M.

He further says, “ In one of these cases, where the arm and hand of a young lady had become nearly useless, and the symptoms had been combated by all the usual remedies in vain during twelve months, the patient was cured by the application of the liniment, which excited a considerable tumefaction of the whole arm, with a vesicular eruption. It was necessary in this case to produce the cutaneous disease three times, at intervals of about a week, and it never extended beyond the upper extremity.”



## CHAPTER VIII.

## OF THE EFFECTS OF LIGATURES ON NERVES.

WHEN a nerve has been included in a ligature, the parts to which it is distributed are deprived of sensation and motion in the same manner as if it had been divided. Immediately the vessels of the injured portion of the nerve begin to enlarge and become more numerous, and coagulable lymph to be effused. In an experiment, seventy-two hours after the application of the ligature, the separated portions had been united by lymph, and the vessels had anastomosed. The ligature becomes incased by the lymph, and soon after it is cast off, the separated portions of nerve unite, and the process of reparation goes on until the union is so complete as to enable the nerve to perform its functions. Two instances are related by Richerand \*, where the nerves performed their functions after having been included in ligatures. He says, “ by ways which are unknown, and in a manner

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\* Nosographie Chirurgicale, tom. ii. p. 206.



which it is very difficult to explain, nature suffers ligatures to be put on the largest nerves without danger. It is thus that the median has been tied in the operation of aneurism without the hand, which was immediately benumbed, losing the sense of touch. I have seen also the foot, immoveable after a ligature has been put on the internal portion of the popliteal nerve, to recover, by little and little, its movements."

When a ligature has been put on a nerve, the sooner it is cast off the greater is the probability of a speedy and perfect restoration. When it is known that a nerve has been tied, after a short time it will be better to pull the ligature gently every day to expedite its separation, as it may become so firmly confined to the surrounding parts by the coagulable lymph, as to make the reunion more difficult, when much time has elapsed before its separation has been effected; and so long as it remains, it forms so complete a barrier as to keep asunder the separated portions, except in a very slight degree.

"\* In the Comment. Acad. Bonon. vol. ii. part ii. there are related by Molinelli, the histories of two patients, who, though they had, in the operation for the aneurism in the arm, the nerve tied along with the artery, yet recovered, after about three months, the

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\* Whytt on the Vital Motions of Animals, p. 7.



entire use of that member; hence some have not scrupled to conclude, that the nerves are not necessary to motion and sensation. But in this they have been rather too hasty; for Galen informs us, that as often as a nerve has been quite cut through, the muscles to which it belonged were deprived both of sense and motion; and many later examples might be produced, where the same consequences attended the destroying of a nerve. I shall only mention one which is consistent with my own knowledge. J. F. who had the nerve tied along with the artery in the operation for the aneurism eighteen years ago, continues to this day to have a numbness and feebleness of the muscles of the thumb and fore-finger, which are also a good deal shrivelled. But further, it appears, even from the histories now mentioned, that the immediate consequence of a ligature made upon the nerves was a total loss of motion and sensation in the parts below; and this happened notwithstanding that the blood continued, by two pretty large arterial branches, to be distributed to them, which is such a direct proof of the necessity of the nerves to motion and sense, as is not to be overturned by the parts recovering afterwards their power of motion, since this might happen without any inconsistency to the former conclusion, and in a way unknown to us. In the history found by Morgagni among Valsalva's papers, and related in the same volume of the Com-



ment. Bonon. we are told the patient did not recover the full use of his arm till eight or nine months after the operation for aneurism was performed. When Molinelli dissected this arm, thirty years after, he found the nerve not wanting in the place where the ligature had been made, as were the artery and vein, but of a much greater thickness than usual, and not unlike a ganglion. From this observation I think we have reason to believe, that in Molinelli's two patients above mentioned, the nerve was not destroyed by the ligature, but perhaps acquired a greater thickness in that part, and so became, after some months, fit to perform its functions."

It has been ascertained that the effects of ligatures on the constitution are always hazardous. Although many cases have terminated favourably, yet more frequently death has been the consequence. With this knowledge it may be supposed that experiments made by applying ligatures on nerves would be unnecessary; but as these are sometimes put on accidentally, and frequently not found out until violent symptoms and even death have ensued, it appeared right to make such inquiries as would enable any one to know when this accident has happened and what ought to be done for mitigating the sufferings of the patient and preventing fatal consequences. When it is supposed, by the complaints of violent pain, a ligature has been applied on



a nerve, should the symptoms denoting tetanus, or a termination of life come on, the ligature must if possible be removed. Larrey \* has done this with advantage in cases threatened with tetanus, and he recommends the ligature to be cut away, when a nerve and artery have been included in it, by passing a grooved stilet carefully between the artery and the ligature, and a blade of a very fine and small pair of scissors in the groove of the stilet, and dividing the thread. Should one of the larger nerves have been tied by itself in a stump, and tetanic symptoms are coming on the ligature ought by all means to be removed.

To ascertain exactly whether a ligature has been put on a nerve will sometimes be difficult ; but if the following circumstances are attended to, I think it may be generally discovered.

When a nerve is much irritated, the pain is generally referred to the parts on which its branches are distributed. After amputation when patients refer the pain to parts which they did not complain of before the operation, it is most probable that the nerve which was distributed to them is in a great state of irritation, and that a ligature may have been fixed on it. If there is sufficient reason for supposing this to be the case, it may be further ascertained by taking hold of the several

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\* *Memoires de Chirurgie Militaire*, tom. iii. p. 294.



ligatures that have been used in the operation, and pulling them in the gentlest manner ; and if the doing of this to one in particular should aggravate the pain already complained of, and tetanus, or other very alarming symptoms are approaching, by which the patient is in danger of being destroyed, it ought to be removed at all hazards.

In my opinion ligatures ought not to be put on nerves for any purpose, as it can be very seldom necessary to employ them ; and if there be an apparent necessity, as was done by Mr. Hunter, in a case related by Sir Everard Home, after he had removed a tumour from the musculo-cutaneous nerve, still, I think, every other method should be tried, before so dangerous an expedient is resorted to. In any other case it never could be necessary, than when there is a profuse hæmorrhage, and then, I think, the vessel may generally be tied ; but should it happen as it did in the operation \* performed by Mr. Hunter, that the vessel cannot be secured without including the nerve in the ligature, would not the actual cautery be preferable ?

When, however, the application of a ligature is decided upon, it ought to be fine, and strong enough to allow of its being drawn so tight as to completely stran-

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\* Sir Everard Home's Paper in the Transactions of a Society for promoting Medical and Chirurgical Knowledge.



gulate the part of the nerve on which it is applied, for then the nerve is brought nearly to the same state as when it has been simply divided. On the contrary, if the ligature be coarse, it will not completely strangulate the nerve, consequently there will be great irritation and increase of danger to the patient. And unless the nerve be so firmly compressed by the ligature as to prevent all communication of sensation, and likewise circulation of blood between the two portions of nerve, the ligature would cause such an enlargement of both its extremities by the irritation it would create, and would be with such difficulty dislodged, that if the patient should not suffer extremely at the time, it would most probably cause the formation of a tumour, producing so much pain as gradually to wear out his strength.

The following\* case related by Dr. Hennen well describes the inconvenience arising from the application of ligatures on nerves.

“A General officer, of distinguished gallantry, was struck by a round shot during a very desperately fought action, which buffing along the breast in an oblique direction, destroyed the arm, and left only the head of the bone and a very small portion of the shaft remaining. He was carried to an adjoining hovel, where the common

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\* Military Surgery, page 191.



amputation was performed under very unfavourable circumstances ; the night was coming on, the supply of candles was scanty ; and the enemy's shot was flying in all directions. The General was placed under my care on the day after the operation. The variety of cross accidents from fever and extensive sloughing, it is not within my purpose at present to enlarge upon, but the first attempt at clearing the ligatures, and making gentle pressure on them was attended with pain so excruciating as to leave no doubt that each included nerve, or was in a certain degree connected with some large nervous filaments. This agonising sensation was not felt except the ligatures were pulled at, and then not in the stump itself, but referred to the finger, thumb, wrist, and elbow or even the external skin of the lost arm, as one or other ligature might be handled. I have sometimes been led to think, that the General uniformly felt the same sensations when the same ligature was touched, as I usually made my attempts to extricate them in a regulated succession, and his complaints were often of the same succession of parts. More attentive observation, however, convinced me that this was not the case, for if any one was pulled with more steadiness than another, he complained of all the parts suffering pain simultaneously. One small ligature, if pulled in an oblique direction inwards towards the axilla, always gave him imaginary pain about the elbow or in the



skin ; but if the same was pulled strongly and directly downwards, the fingers were complained of. He has, frequently, after the smarting of dressing was over, with great accuracy pointed out on my arm the course of the internal cutaneous nerve, as the site of his ideal pain ; often he has described that of the external, and on one occasion I, with utter astonishment, had the general neurology of my arm and fingers traced by him. But unless the ligatures were pulled at, he had no other uneasy sensations than those which usually occur in persons whose limbs have been amputated. Once only did I ever know him refer his pain to the sensorium itself. On that occasion, from using an artery forceps to the ligatures, on which the slide moved rather stiffly, I exerted a greater force than I had intended. He convulsively put his hand to his head, expressed a sense of exquisite pain in his brain, involuntary tears dropped from his eyes, a paralytic contraction momentarily affected his mouth, an universal paleness spread over the uncovered parts of his body ; and although unusually tolerant of pain, and of a most remarkable equanimity of temper, he uttered a piercing cry and exclaimed that the agony in his head and mouth was unsufferable. The state of collapse was so great, that I was obliged to send an aid-de-camp instantly for volatile alkali and a glass of madeira, by which he was



soon relieved; but the painful sensation, and the prostration of his strength continued through the day."

Larrey † relates the cases of two patients who died of tetanus; in one, where the arm was amputated, and the median nerve had been included in a ligature with the humeral artery, the portion of nerve below the ligature was swelled out like a mushroom, and that above was much enlarged and of a reddish colour. In the other, nineteen days after the amputation of the leg, the extremities of the nerves were swollen in the same manner, and adhering to the surrounding parts. Portal \* relates a case, where this tumour formed above a ligature that was put on the sciatic nerve after amputation of the leg. The patient had suffered horrible pains for more than two years, which he always referred to the end of the foot; and after death this tumour was found.

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\* *Memoires de Chirurgie Militaire*, tom. iii., p. 290.

† *Cours d' Anatomie Medicale*, tom. iv., page 289.



## CHAPTER IX.

## OF THE COMPRESSION OF NERVES.

A NERVE may be extended some way without giving pain or uneasiness, as I have frequently observed in making experiments, when I have passed a probe under the sciatic nerve and drawn this from its situation ; and as is shown in cases of popliteal aneurism, when the swelling may attain some size before much pain is produced.

But when a nerve is extended in any considerable degree, pain is excited ; and if the extension be increased, the pain is increased in proportion, till at length the nerve begins to ulcerate, and if the pressure be not removed it becomes almost destroyed by this process.

When a nerve is pressed against a bone for a short time, an uneasy sensation is produced, and the parts to which it is distributed feel benumbed. When the pressure is continued longer, these parts entirely lose the power both of sensation and motion ; but if it has not been very violent they will recover.



It is difficult to say precisely in what manner a nerve is affected by pressure, when its functions are destroyed without producing any altered appearance. When there is paralysis unattended by pain it is most probable that there is merely a functional disorder of the nerve. But when the paralysis continues, and particularly if there be pain and tenderness in the part of the nerve that has been pressed, it may be suspected that inflammation has been excited and coagulable lymph effused between the fibrils, so as to produce enlargement, as was done in the following instance\*.

In the case of an idiot, related by M. Pinel, the left arm and leg were paralytic. The right lobe of the brain was wasted and hard. The left sciatic nerve was redder and larger than that of the right side, in which the functions of the limb were perfect.

When the nerves have been injured from a continued pressure, the best remedy will be frequent frictions of the hand, and the use of a stimulating embrocation.

But if there be pain and tenderness in the part of the nerve that has been pressed, leeches and evaporating lotions should be applied and perfect rest enjoined. And if the symptoms continue after two or three weeks, counter irritation should be made by blisters or the ointment with tartarised antimony.

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\* Journal de Physiologie, tom ii. p. 191.



People frequently complain of pain in the lower extremities which is sometimes very excruciating. It is often occasioned by the use of tight garters, which press the nerves against the bones. In these cases it is generally absent in bed, and increases towards the latter part of the day, and has often been altogether relieved by discontinuing garters and whatever could make any undue pressure.

When pains in the limbs are complained of, the state of the feet ought to be examined, and particularly the nails. The following case shows how slight a pressure may give rise to the most distressing symptoms.

CASE :

1828. Nov. 10th.—Mr. John Ryal consulted me about a painful affection of the great toe and ankle of the left side. The pain came on violently at two A.M. for three weeks, and was always preceded by coldness of the parts, and lasted about an hour and a half. In the day it came on four or five times, was also preceded by coldness, but was soon relieved by warmth and friction. At the beginning of the complaint the toe turned cold, as if it had been asleep, and a few days after the pain came on. The whole limb was much less than the opposite one. I despaired of finding out the cause of these symptoms, as there was not any appearance of disease, and the patient could not give



any information that could lead to its discovery. I begged to examine the limb a second time. There seemed to be a little thickening at one corner of the nail, and on pressing this the pain was immediately produced. I cut off this portion of nail and found an indentation in the flesh about the size of a pin's point. This slight operation was very painful. He was very subject to disorders of the digestive organs.

He was ordered to take two grains of sulphate of quinine every three or four hours, an opiate draught at night, and to have the whole leg rubbed with camphorated liniment.

11th.—He has had a good night and has not had any pain to-day, and he can bear the toe to be pressed without producing the violent pain.

The pain soon almost entirely left him, but it was more than two years before the limb acquired its size and strength, and ever since it has been necessary to keep it warm.

Pain is frequently felt in a part and arises from some pressure made at a distance, as in the following case.

#### CASE :

John Fletcher, aged about 50, died very suddenly after eating a hearty dinner of beef and pickled cabbage. He had previously complained of much pain in the left leg. There was an encysted tumour on the



left side of the lumbar vertebræ, which had separated the fibres of the great psoas muscle, and put the small psoas muscle very much on the stretch. Some of the origin of the anterior crural nerve appeared as if incorporated with the walls of the tumour, and the whole of this nerve was also pressed by it. The anterior longitudinal ligament of the spine was thickened, and, on cutting through this, the body of the second lumbar vertebra was found ulcerated.

He had a disease of the right hip joint ten years before, and nearly sunk under the profuse suppuration. Some slight adhesions were found between the synovial membrane of the head of the bone and that lining the acetabulum, and the head of the bone was enlarged by cartilaginous deposits, which made this too large for the acetabulum, and in some degree constrained the motion of the limb.

The left kidney was entirely destroyed by suppuration. There were some red spots in the small intestines, and some fluid in the pericardium. There was some congestion of the blood-vessels of the brain, spinal marrow, and cauda equina, and some serum between the membranes. The stomach appeared quite sound, and was loaded with the beef and pickled cabbage.

\* Lobstein says, "I have seen lumbar abscesses, in the midst of which nerves, forming the crural plexus,

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\* De Nervi Sympathetici Fabricâ, Usu, et Morbis, p. 163.



remained uninjured. But in cold, steatomatous, encysted, and other tumours, I have seen the nerves wasted, too dry, and flattened, applied or agglutinated to the tumours; and in abscesses situated near the spine and arising from caries of the vertebræ I have found the nerves destroyed."

In a case of aneurism of the abdominal aorta related by Scarpa\*, the patient said he had been subject, for about six months, to almost constant pains in the lumbar region, stretching over the abdomen. The pains were more violent during the night than in the day time, and were accompanied by difficulty of breathing, languor, and ardor urinæ. A short time before his death he had a fixed pain extending to the left lumbar region; an almost continual restlessness; a regular pulse; no fever; no vomiting; the lower extremities sometimes quite cold, while the upper extremities, and especially the head, perspired copiously from the violence of the pains, which attacked him for the most part in the afternoon or during the night, and extended to the lower false ribs, to the loins, to the left thigh, and sometimes to the left testicle. These pains were more acute in rainy or windy days than in serene weather. Opium alone, in large doses, combined with assafoetida, and gentle friction with oil of amber, procured him

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\* Treatise on Aneurism, translated by Wishart, p. 99.



some relief. On dissection, I remarked that the effused blood had formed deep excavations in the substance of the left psoas muscles so as to disorganize the lumbar nerves and injure the anterior crural and obturator nerves."

Pain is frequently felt in a part from pressure made on the origin of the nerve that supplies it; this frequently takes place in the course of the sciatic nerve, and sometimes of the anterior crural. Purging has given great relief when the pain has arisen from a distension of the sigmoid flexure of the colon and the rectum.

A very curious case\* of this kind is related by Portal, the subject of which was a woman who had a very great curvature of the spine, and three or four hours after each meal complained of much pain in the great toe of the left foot; it was always increased by injections, but went off when she had a copious alvine evacuation. It was found to have been produced by pressure made by the last false ribs on the sigmoid flexure of the colon, which caused the fæces to have great difficulty in passing, and in consequence compressed the lumbar plexus of nerves.

In the following case the nerves of the axillary plexus appeared to have suffered from an injury of the shoulder.

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\* Cours d'Anatomie Médicale, tome iv. p. 276.



## CASE :

March 25th.—A lady, about sixty years of age, fell from some height and hurt her right shoulder, and was likewise bruised in other parts. I saw her the day after the accident, and found her complaining very much of her head and shoulder; no injury was perceived about the former part, but in the latter I discovered that the portion of the bone that forms the glenoid cavity of the scapula had been broken; she complained very much of pain, which struck up the neck and down to the fingers, and was very severe about the elbow; her fore-arm and hand were nearly paralytic. I bled her and gave her purging medicines, which entirely relieved her head; a plaster was applied to her shoulder, which was supported by a bandage and sling.

Any motion of the shoulder always gave her pain, and for a long time produced violent eructations of wind from the stomach; but every week seemed to restore it, and at the end of eleven, it was so much recovered that no grating could be felt in moving it, which was the case at first; and the arm could be moved freely backwards and forwards without pain, though it could not be lifted very far from the side without considerable pain. She was allowed to use it now as much as she pleased; and as the fore-arm and hand had very little sensation, friction of the whole limb was used, and likewise the following embrocation.



R Spirit. Vini tenuis. ʒijss.

Liquoris Ammonizæ, ʒss. M.

After this she continued to improve, having had much more use of her hand, and the whole arm could be raised much further from the side, and none of the eructations were produced by the motion as before.

I had hitherto supposed, that as she had always been subject to a pain in the head, and was rather of a full habit, she had fallen down in a slight fit of apoplexy, and the paralytic affection of the arm was the consequence; but on the 24th of July, on her arm being suddenly, and rather violently moved, very great pain was immediately produced: I examined the limb soon after, but could not discover that any injury had been done to the bone; but all her former symptoms returned, and the limb was thus brought back to the state it was in many weeks before, for the pain was much increased on moving it, and also the eructations; the power of raising it from the side was lessened, and the paralytic affection of the hand much increased. I had now no doubt but that at the first accident the nerves of the axillary plexus had been much injured, and that from this injury the paralysis proceeded, as all the same nervous symptoms were reproduced after the second injury, and without any affection of the head. After this last accident she continued the friction of



the arm, and the parts kept gradually recovering, but they were some time in arriving at the state they were in before it happened. At the end of September a blister was applied across the clavicle, so as to extend from the shoulder some way up the neck: this seemed to remove much of the pain, and the limb seemed to be gradually, though very slowly, recovering. From this time it continued in every respect to improve, and in May, 1820, the patient had the almost entirely perfect use of it.

A case is related by Mr. Earle, in which the injury to the nerves was much greater than in the preceding, and was accompanied by a fracture of the clavicle. About six months after the accident he states, that “this painful stage gradually abated, and the arm remained perfectly palsied and useless. From the history of the case it appeared most probable, that the same blow which had fractured the clavicle, had lacerated or crushed the axillary plexus of nerves, just as they pass under that bone.” He then states that the case continued to advance towards a perfect cure. The whole history is very interesting, and I beg to refer my readers to it\*.

I introduce the following case, because it shows that when there has been a paraplegia, that it is not merely

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\* Medico-Chirurgical Transactions, vol. vii. p. 175.



of consequence to draw off the urine on account of the safety of the bladder, but because its over-distension presses on the nerves, and tends to prevent their recovery. This idea forcibly struck me the first time I used the catheter for the patient who is the subject of the case. The bladder was very much distended, and urine kept constantly running from the penis. The distension of the bladder caused much uneasiness; but immediately after I had drawn off two quarts of urine, the lower extremities were more sensible, and that tingling was felt in them, which is known to every one who has been in a position to press the sciatic nerve, and has experienced the sensation that arises when the pressure is removed; and I conceive that such repeated pressure on the nerves, which are already very much enfeebled, must tend very materially to retard, if not to prevent, their restoration.

## CASE :

November 6th, 1819.—Mr. F. aged twenty-five, had the heartburn, after which he ate a hearty dinner of beef and apple dumpling, and the heartburn went off. Soon after he carried a weight of wood for some distance, which produced the heartburn again, and he was obliged to lie down on the damp ground as he felt so unwell. After he had lain a little while his legs



began to feel weak, and he had much difficulty in walking home, as the powers of the muscles kept diminishing, and at last entirely failed. The bladder, and also the sphincter ani, lost almost entirely their muscular power: the paralysis extended from the pit of the stomach downwards: he had no power of moving any of the muscles: he felt well, and had a good appetite, but was thirsty: when the bladder was very much distended he had pain, but it was not violent: the feeling of the skin was so far perfect as to render him sensible of the slightest touch; but moderately cold things applied to the skin did not feel cold, nor did hot things feel more than just warm: his sensations of heat and cold with the upper extremities were perfect, and very different from those experienced by the lower.

The catheter was generally used twice every day, from the seventh of November to the second of December; after this he expelled his urine without its assistance, but for several months he had not the power of holding it a moment after the inclination to make it came on.

As the secretions of the digestive organs were unhealthy, he took five grains of the blue pill every night for some time, and tonic medicines.

Large sloughs formed on the sacrum and hips, and the sores left by their separation were many months in



healing : and the discharge was so great, that he was in danger of sinking under it, notwithstanding he had a good appetite, and a very generous diet.

He began to have some little power over the muscles about a month after they became paralytic, but he was kept so weak by the discharge from the sores, that it was not till the beginning of March that he could exert them much ; he then began to walk by the help of crutches, and at the end of April he could walk with sticks, but his legs still continued weak. At the beginning of June he could walk for a short distance without any assistance, but he generally used one stick, and he got quite well, with the exception of a slight awkwardness in his gait.

#### CASE :

Joseph Key, aged three years and nine months, went to bed, apparently well, on the 17th of February, 1821. In the night he dreamt, and his sleep was very much disturbed. Towards morning he complained of pains in his legs, and was obliged to be taken out of bed by his mother very early. He was brought to me about eight o'clock. I found he had entirely lost the use of his lower extremities. I desired he might try to stand, but he had not the least power of doing so, neither could he move his legs when he was placed on his mother's knee. His pulse was quick, his tongue furred.



He said his head did not ache, nor did he complain of his back. I could not perceive any inflammation, or that there was any thing amiss with the appearance of the skin of the lower extremities.

I ordered six ounces of blood to be taken from the arm, which I found to be very florid, and a blister to be applied to the back: and two grains of submuriate of mercury to be taken every four hours. In the course of the day he moved his legs, and the next morning was able to walk. In a few days he appeared quite well, and has remained so ever since. The stools were at first quite black, but the blood on standing had not an unhealthy appearance.

In such cases as this there is a determination of blood to the spinal chord, which, if not removed, produces an effusion of serum. I think it not improbable that a disordered state of the digestive organs may give rise to this undue circulation.

It may be doubted whether a determination of blood to the spinal chord could, of itself, produce the paralysis; but recovery from hemiplegia, after bleeding and purging, has been so quick as to put almost entirely out of the question any pressure on the brain from extravasation.

Diseases of the nervous system are so obscure that I dare hardly hazard a conjecture respecting the cause of the symptoms in the preceding case; but those on record,



to which I thought this similar, led me to suppose that there was a great determination of blood to the spinal chord, which, if not immediately relieved, would have terminated either in extravasation, or an effusion of serum ; and that then it must have been a great length of time before the patient could have recovered much use of the lower extremities, even if the disease had not proved fatal.



## CHAPTER X.

## OF DISEASES OF THE PAR VAGUM.

THE Rev. Mr. Deacon, of Waddington, aged sixty-two years, had been attacked with gout when only seventeen years old. For many years he had very frequent fits of it, and was so much crippled in consequence, that the joints of his fingers were continually enlarged, and contained many chalk-stones. He took the eau medicinale for a long time, which never failed to relieve him; and for this he substituted Dr. Wilson's medicine, which he took for several years with the same effect. He was cautioned against taking these medicines so frequently, but to very little purpose, as by their use he was freed from a fit in a few days, when no other means restored him to an equal state of ease in several weeks. The functions of the stomach in the last seven years had frequently been impaired, but for the last eighteen months he generally had a great appetite, but never felt satisfied; and if he ate ever so much, he had no sense of fulness. On the 21st of



June, 1820, he was taken with great pain at the stomach, after eating a hearty dinner. He took an emetic, in consequence of which his stomach ejected a quantity of food, chiefly chicken, which though it was full four hours after dinner, was not in the least digested. Nov. 19, he began to have a difficulty of breathing, which was only perfectly relieved either by a fit of the gout, or the vinous infusion of the colchicum root. When the difficulty of breathing was the worst, he made a whistling noise, as though the glottis was contracted. For some time he was quite free from it. But in the summer of 1821 he had a violent attack of it, which was thought to have been produced by cold, when the gout came on and relieved him; he took the vinous infusion of colchicum, which removed the gout, but it purged him so violently, that an opiate was given him to restrain it. He began to sleep from this time, and continued so three weeks, except he was roused, when he seemed to know every one about him, but had neither recollection nor judgment beyond this. Leeches, blisters, &c. seemed to relieve him in some degree, but he was not materially better until he took the vinous infusion of colchicum again; after which he continued to mend gradually, but the difficulty of breathing soon returned; and though it yielded once or twice more to the vinous infusion of the colchicum, which always purged him, no lasting good effect was



produced. The difficulty of breathing continued, with different degrees of violence, till the time of his death. He never had pain in the chest. His stomach remained in the same craving and insensible state to the last. His body for months had been becoming more and more emaciated. His pulse was generally natural, but very strong. For several weeks he could not take opiates of any sort, or in any quantity, as they made him so uncomfortable. About ten days before he died, he had a teacupful of blood taken from the arm, which somewhat relieved his breathing. He, at this time, had much gouty inflammation in his hands. The blood was very much cupped, and had a strong buffy coat, but the next day he was so very faint, that he could with difficulty sit in his chair. He had a cough, which was occasionally troublesome. As nothing seemed to relieve him, and as his state appeared to me to be much approaching that of an animal whose eighth pair of nerves had been divided, he was galvanised. He thought the two first trials gave him some relief. A few nights before he died he was taken with difficulty of breathing to such a degree, and seemed so exhausted, that some wine was given him, and galvanism was again tried. After the first ten minutes, the noise in his breathing left him, and he kept breathing more and more easily, so that when the galvanism had been used for half an hour, he laid down and slept better for several



hours, than he had done for some time before. The galvanism was repeated the next day, and he thought himself relieved by it; but this relief was of short duration, for his breathing soon became as bad as ever, and he died a few days after, on the 22nd of September.

Within the last three weeks he had been obliged to rise in the night, and sit up a great part of it. Owing to this his legs swelled a little, as he was unable to have them in a horizontal position when he sat up, in consequence of his knees being much contracted. About ten days before he died, purple spots appeared on his feet, and then on the rest of his body; these, however, disappeared entirely in three or four days.

His symptoms never were those strongly marking hydrothorax; and his countenance had not the expression usual in this disease.

I cannot help concluding that the whole of the above symptoms were produced by the powerful action of strong medicines on the stomach. It always appeared to me that the par vagum suffered in consequence, and, I think, the craving for food, and the want of a sensation of fulness after eating ever so much, showed that the nerves, at least, had lost their sensitive qualities. Add to this, the difficulty of breathing, with the noise in the larynx when this was bad, and I think it must be concluded that these effects were produced by a



diminished energy of the nerves. As I have before observed, the symptoms never were those of hydrothorax; and though there was fluid in the chest, I conceive that it had only collected there a short time before he died, and that it was produced in consequence of the difficult transmission of blood through the lungs.

Hydrothorax frequently attacks dram drinkers, and may not this be the consequence of a deranged state of the eighth pair of nerves, in the same manner as I have supposed the disease to have been produced in the preceding case?

#### EXAMINATION.

September 24th.—On opening the abdomen every thing appeared sound. The outside of the stomach was covered with an unusual quantity of veins, but the inside of this viscus had nothing particular in its appearance.

On opening the chest there was much fat. The heart was enlarged and fat, but otherwise every thing about it had a healthy appearance. In the pulmonary artery one sesamoid body was larger than the rest; and in the aorta, one of these bodies was not situated at the edge of the valve, but about its middle.

Each side of the chest contained about two pints of a dark-coloured fluid. The lungs were not collapsed, but appeared otherwise healthy.

On tracing the par vagum from the middle of the



neck each nerve was flabby, and much smaller than natural, and felt like nerves removed from a putrid body after having been soaked in water. The branches distributed to the lungs appeared as usual, as well as the continuations of the nerves, nearly as far as the termination of the *œsophagus*, when they were found redder and thicker than usual, and had not a healthy appearance. The left nerve was smaller than the right.

A similar state of the lungs has been generally observed after a division of the par vagum in rabbits.

In order to be better satisfied with regard to the diminution of the size of the par vagum in the preceding case, I was led to compare it with that in other subjects; and in dissecting two destroyed by consumption, the left lungs were diseased in a much greater degree than the right; both trunks of the par vagum were smaller than usual, and especially when compared with those of a subject destroyed by empyema in which the lungs were sound; and the left trunk was smaller than the right. In both of these subjects, as well as in another, very considerable disease existed in the intestines. In one I examined the alimentary canal from one end to the other; and through its whole length beyond the stomach, very little space was left where the ulcerations of the mucous membrane did not exist, most of them varying in size from a pea to half-a-crown.



I have stated these facts respecting the par vagum, as they presented themselves to me. Whether they have been only accidental occurrences, or the usual concomitants of similar diseases, must be left for future observation to determine.

In examining the bodies of those who have died of consumption, I have often found the par vagum, and particularly the posterior pulmonary plexuses, encroached upon by enlarged absorbent glands. I have one preparation very much diseased from suppuration, and one branch of the par vagum has contracted adhesions with the gland, and appears so altered in structure as to have been incapable of performing any of its functions.

I believe that these glands have often been affected before the lungs have become diseased, and by their progressive enlargements have implicated the nerves and excited irritation in the lungs; whenever therefore enlarged absorbent glands are found in any part of the body, it is necessary to advise the patients to go to the sea-side, or some pure atmosphere, and by every attention to the general health to endeavour to remove this disordered state of the system.

In consumption I believe many of the distressing symptoms are frequently produced by the stretching of these nerves by enlarged glands. In these cases there have not been any decidedly inflammatory symptoms or much quickness of the pulse. There has been a



troublesome cough without much expectoration. The appetite has been whimsical. There have been frequent attacks of difficulty of breathing, sometimes of oppression with a sense of suffocation, and these symptoms have been relieved by some stimulus, as a small quantity of brandy and water, or ammoniated tincture of valerian, and brought on again by any thing that disagreed with the stomach. There has been a distressing nausea, which was relieved by opiates. In one of these cases, a gland as big as a pigeon's egg was found stretching the left trunk of the par vagum and the branches forming the posterior pulmonary plexus.

Lobstein describes the same stretching of the par vagum from absorbent glands, and further states\*, "I have often found stony concretions to adhere to the nerves and only to be separated by force. Besides the lung I have found the same thing in the solar plexus, where this approaches the supra-renal gland. I have found also a stone similar to the kernel of a cherry in the trunk itself of the par vagum, and its fibrils separated, the functions of the lungs and stomach being unimpaired† . . . .

"I examined a tumour extending towards the epigastric region and firmly adhering to the small curva-

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\* De Nervi Sympathetici Fabricâ, Usu et Morbis, page 154.

† The same, page 166.



ture of the stomach. Both trunks of the par vagum were broken, the right one formed a lengthened ganglion from which three tender branches went off. The patient, a man forty years old, was seized with sudden heartburn, and tormented with excruciating pains in the back and the interscapular region. To these symptoms were added an obstinate constipation and the most severe tormina, from which he died after a space of seven weeks. This disease was certainly of long standing and not marked by any symptoms, but from the time the par vagum was daily stretched and then torn through by the tumour, the most violent symptoms were manifested. It could not have happened otherwise, than that the twitchings, conveyed to the semilunar ganglion and the right trunk of the sympathetic nerve, should have produced the dreadful pain in the abdomen and back."

In the latter stages of consumption the mucous membrane of the intestines is generally ulcerated. How is this to be accounted for? If the par vagum conveyed the irritation from the lungs, it is reasonable to suppose that the stomach would be also found diseased, but this never happens. I do not think this effect of the diseased state of the body is produced by the nerves, but by the effusion of a poisonous exhalation from the mucous coat of the intestines, similar to that generated in the lungs.



There exists a poisonous secretion in diseases of the lungs, as I have myself experienced several times in wounds received during the examination of those who have died of consumption. Presuming that there exists a poisonous fluid in the body, and that the exhalants of the intestines are performing increased functions for relieving the lungs, it is very probable the mucous membrane of the lungs and intestines is of the same delicate conformation, and receives similar nerves, whose powers are weak or deficient, and therefore readily allow the parts supplied by them to become ulcerated.

Laennec\* has devoted a chapter in his work to affections of the nerves of the lungs, and although there appears to be a great want of precision in his account of the examinations of the particular nerves, I beg to refer my readers to it, as it may lead them to further investigations on this subject.

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\* *Traité de l'Auscultation Mediate*, tom. ii. p. 67.



## CHAPTER XI.

AN EXPERIMENTAL INQUIRY INTO THE PROCESS NATURE  
EMPLOYS FOR REPAIRING WOUNDS OF NERVES.

MANY experiments have been made by physiologists, to prove that when a nerve is divided, sensation and motion are lost by the parts supplied with its branches, and that after the re-union it performs its functions as well as before the division. I had always understood that this was a point generally agreed upon by physiologists ; and it has been so well illustrated, especially by the experiments of Dr. Haighton, that it is difficult to conceive, how, after an elucidation so satisfactory, any doubt should remain on the question ; but when it is contradicted by several very eminent men, so much hesitation is produced in the minds of those who are unbiassed by any favourite hypothesis, as to make an experimental inquiry into the subject absolutely necessary.

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## EXPERIMENT I.

1819, July 6th, in the left leg of a rabbit the sciatic nerve was exposed, one blade of a pair of scissors was carried under it, and it was divided at one cut.



July 7th, twenty-four hours after, that of the right leg was divided in the same way.

July 8th, the rabbit was killed twenty-four hours after the division of the last nerve. In the right leg the wound in the skin was perfectly united, that where the muscles were separated was quite open, and there was not any inflammation about the wound. On examining the nerve, the inferior portion was separated from the superior three-quarters of an inch, and a small portion of it was doubled down on itself: some coagulable lymph, which had very much the appearance of white of egg, was about it. The extremity was enlarged so as to form a bulb, which became very distinct when examined in a microscope, and appeared rather more vascular than the rest of the nerve. The extremity of the superior portion was covered with coagulable lymph for about a quarter of an inch; the very extremity itself was enlarged, so as to have the appearance of a bulb, or rather two bulbs, one for the sciatic nerve, and the other for the fibular nerve; and this extremity of the nerve was very vascular, much more so than the inferior portion, and the nerve was altogether more vascular than in its sound state.

On examining the nerve of the left leg, forty-eight hours after its division, the inferior part had a small portion doubled down, as in the right leg: it was covered with coagulable lymph for some distance.



The extremity of this portion was much more enlarged and more vascular than the corresponding one in the right leg; and, by the aid of a microscope, vessels were seen shooting into the coagulable lymph. This portion was separated from the superior a quarter of an inch.

The superior portion was much larger than in the corresponding portion of the right leg, and was covered with much more coagulable lymph, which had become very vascular. It was enlarged to only a very short distance, and had some slight adhesions to the muscles.

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#### EXPERIMENT II.

July 6th, the sciatic nerve in the left leg of another rabbit was divided, and on the 8th that of the right leg was divided, and the rabbit was killed on the 11th.

In the right leg, seventy-two hours after the division, the divided portions of the nerve were separated from each other half an inch. The inferior portion had no part doubled, as in the preceding experiment. More coagulable lymph was effused than in the preceding experiment, and it had become much more vascular. In the superior portion there was likewise much more coagulable lymph than in the preceding experiment; it was also much more vascular, and the vessels in the nerve for three-quarters of an inch were much increased in size, and the nerve itself enlarged.



In the left leg, one hundred and twenty hours after the nerve had been divided, the two portions were not separated more than a quarter of an inch from each other, and the space was entirely filled up with coagulable lymph, so as to join both portions together, so much so, that when the nerve was removed from the limb, and one end was taken hold of, the other seemed firmly united to it: the vessels in the nerve itself were less numerous, and not so large as in the right leg. The coagulable lymph throughout its whole extent was quite vascular. When the skin was separated, there was a very small portion of matter and some coagulable lymph between the skin and muscles; but the wound in the muscles was closed, and did not seem to have any mark of inflammation about it.

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#### EXPERIMENT III.

The sciatic nerve of the left leg of a rabbit was divided July 9th, that of the right was divided July 15th, and the rabbit was killed July 23rd.

In the left leg, fourteen days after the division, the extremities of both portions of nerve were enlarged, and were not separated more than a quarter of an inch; and this space was filled up with coagulable lymph, which had become organised, but had a browner appearance than is usual. The wound in the skin and muscles was perfectly healed.



In the right leg, eight days after the division of the nerve, the divided portions were separated six-and-a-half-twelfths of an inch; their extremities were somewhat enlarged, but not vascular, and a very little attempt at union seemed to have been made. The wound in the skin and muscles was perfectly healed.

The rabbit appeared in good health.

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#### EXPERIMENT IV.

July 16th, both sciatic nerves of the rabbit were divided, and it was killed on the 28th.

In the right leg, the divided portions of nerve were separated from each other four-and-a-half-twelfths of an inch, and the space was filled up with organised coagulable lymph. The extremity of the superior portion was much enlarged, and that of the inferior very little.

In the left leg, the divided portions were separated the same distance as in the right, and the extremities of both the portions were more enlarged than in the right leg, and the superior more than the inferior. The adhesions between the portions were firm, and the quantity of coagulable lymph was greater than in the other leg.

There was a considerable arterial hæmorrhage in both legs when the nerves were divided.

When the animal was killed, the wounds in the skin and muscles were perfectly healed, and there was no appearance of extravasated blood about the nerve.



## EXPERIMENT V.

The sciatic nerve was divided June 9th, and the rabbit was killed July 14th.

The extremities of the divided portions were perfectly united, but remained larger than the rest of the nerve. The bond of union was more transparent than the rest of the nerve, and was two-twelfths of an inch long; when held up to the light, the extremities of the nerve might be seen in it.

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## EXPERIMENT VI.

The sciatic nerve of one of the legs was divided July 9th, and the other on the 15th, and the rabbit was killed September 27th.

They were both perfectly re-united, and the rabbit was much improved in the use of its legs.

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## EXPERIMENT VII.

The sciatic nerve was divided July 16th, and the rabbit was killed August 10th.

The size of coagulable lymph was very large, and had a cavity, which contained a substance like brain.

I consider this as an accidental occurrence, having seen similar collections of this substance in cysts in different parts of several rabbits, and when there had not been any injury. The substance was very much



like what I have seen in fungus hæmatodes in the human subject, and very different from the pus I have seen usually secreted in rabbits.

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## EXPERIMENT VIII.

The sciatic nerve of the right leg of the rabbit was divided July 17th, and it was killed November 22nd.

Observations made on September 11th. It could make much use of its leg. From this time it kept gradually improving, and before it was killed it had nearly the perfect use of the limb.

On examination, the nerve was enlarged to some distance, where it had been divided, and appeared perfectly united. There had been a slight ulceration of the integuments of the heel soon after the division of the nerve, but it had healed, and the foot was in every respect perfect.

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## EXPERIMENT IX.

July 12th, the sciatic nerve was exposed, and partially divided with a pair of scissors, and the rabbit was killed twenty-four hours after.

On examination, it was found that a small portion of the nerve had been divided, and that the divided parts had retracted from each other to a short distance; their extremities were rather enlarged, and had the same



appearance as the nerve\* that was entirely divided twenty-four hours before it was examined, except that there was rather more vascularity in the nerve of this experiment.

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## EXPERIMENT X.

July 12th, the sciatic nerve was partially divided in the same way, and the rabbit killed forty-six hours after.

On examination, a branch, which lies close to the nerve, and arises from it high up in the thigh, was completely divided, and its extremities were separated two-twelfths of an inch, and each extremity was enlarged. Part of the trunk of the nerve was also divided, and the extremities of the divided portion were separated a very short distance, and were both enlarged, and there were the same appearances as in a total division of the nerve.

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## EXPERIMENT XI.

July 13th, the whole of the sciatic nerve was divided, except that part which forms the fibular nerve, and the rabbit was killed July 16th, seventy-two hours after.

On examination, the extremities of the divided portion were separated four-twelfths of an inch, and were

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\* See Experiment I.



enlarged; coagulable lymph was effused on them, and likewise on the undivided portion, and vessels were seen in it.

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## EXPERIMENT XII.

The sciatic nerve of the left leg was partially divided, and the rabbit was killed one hundred and thirty-four hours after.

On examining the nerve, it was found that one fasciculus of it had been divided, the extremities of the divided portion were separated one twenty-fourth part of an inch, and the space was filled up with coagulable lymph, some of which was likewise effused on the surrounding part of the nerve, and there was a greater vascularity there, than in the other parts of the nerve.

The sciatic nerve of the right leg of the same rabbit was punctured at the same time with a lancet.

On examination, a small vacuity was perceived, and about it there was a slight enlargement, and a greater vascularity than in the other parts; and some coagulable lymph was effused, both on the nerve, and in the vacuity made by the puncture.

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## EXPERIMENT XIII.

The sciatic nerve was partially divided on the eleventh of June, and the rabbit was killed on the sixteenth of July.



On examination, the wound in the nerve was perfectly healed, and at that part was very much enlarged for half an inch, and had the same appearance as when a nerve had been wholly divided, and allowed the same length of time for its reunion.

In all these experiments of partially dividing the nerve, the external wound was closed in the same way as when the nerve had been wholly divided ; and immediately after the experiments the rabbits seemed to have the least possible inconvenience in walking, even in that where the whole nerve, except the fibular portion, was divided ; and I could not perceive that they suffered more than those whose nerves had been wholly divided ; they always seemed in good health, and ate their food well.

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#### EXPERIMENT XIV.

All the above experiments were made on rabbits, as they are on every account the most convenient for the purpose ; but as the object of these experiments was important, and I thought it possible, as these animals lived entirely on farinaceous substances and vegetables, their nerves might on that account be affected by injuries in a different way from other animals, which at the same time eat flesh, I made the two following experiments on a dog, but did not find that there were any peculiar symptoms produced by them.



July 14th, I partially divided the left sciatic nerve of a dog, which was killed on the second of August.

Very little lameness was produced by it. Two-thirds of the wound in the skin were healed, and the wound in the muscles was quite healed; the wound in the nerve was likewise quite healed, having been filled up with coagulable lymph, which was completely organised. The extremities of the divided portions were enlarged.

After this experiment the dog did not appear to suffer much; he had always a good appetite, and certainly got fat during the time I had him.

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#### EXPERIMENT XV.

The sciatic nerve of the right leg of the same dog was completely divided on the twenty-sixth of July.

Part of the wound of the skin had healed by the first intention, the remainder continued open, and was filling up by granulations. The wound in the muscles was perfectly healed. The extremities of the divided portions of nerve were separated two-and-a-half-twelfths of an inch, and were both much enlarged. On the posterior part of the nerve, or that which lies nearest the bone, the space was filled up, and was white and transparent. On the anterior part it was quite uneven, and appeared as if healing by granulations, but there was no discharge of pus.



The cellular membrane about the nerve was thickened to some distance.

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## EXPERIMENT XVI.

June 10th, the sciatic nerve of the right leg was divided, and the rabbit killed on the twenty-first of August.

Both extremities of the divided portion were enlarged, and separated from each other five-twelfths of an inch : the attempts at union were very little.

Half an inch of the sciatic nerve of the left leg of the same rabbit was cut out on the 24th of July.

The extremities of the divided portions were separated nine-and-a-half-twelfths of an inch ; from the upper, four-twelfths of an inch had grown of the substance that becomes new nerve, and from the inferior, three-twelfths.

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## EXPERIMENT XVII.

Half an inch of the sciatic nerve of the right leg of a rabbit was cut out on the tenth of June, and it was killed on the twenty-sixth of July.

The extremities of the divided portions were separated, except by a membrane, seven-twelfths of an inch. From the superior a quarter of an inch of new



nerve had grown, and the inferior was very much enlarged.

The wound in the skin and muscles was perfectly healed.

Half an inch of the left sciatic nerve of the same rabbit was cut out on the twenty-fourth of July.

On examination forty-eight hours after, the extremities of the divided portions were separated eleven-twelfths of an inch. Much blood was effused about the nerve. Neither the external wound nor that of the muscles was closed. The extremity of the inferior portion was enlarged and vascular, and some coagulable lymph had been effused, as when there has been merely a division; that of the superior portion was very vascular, and more inflamed to a greater distance than is usual, and was covered with coagulable lymph, as in a total division. There was more inflammation about the wound than in any other experiment.

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#### EXPERIMENT XVIII.

Half an inch of the sciatic nerve of the left leg was cut out on the sixteenth of July, and the rabbit was killed on the twenty-second of November.

The extremities of the divided portions were separated from each other eight-twelfths of an inch. There appeared several small branches arising from the supe-



rior portion, but there were three very remarkable\*; one was continued down into the nerve passing to the outside of the heel, which in this case was larger than ordinary; the other two appeared to be newly-formed nerves; one went from the superior portion to the popliteal nerve, the other went from the same place to that which corresponds with the fibular nerve in the human subject.

The integuments of the heel were in an ulcerated state, and part of the os calcis was dead; but these diseased appearances had not I think increased in the last two months. The rabbit was certainly much improved in the use of the limb, which was however very far from being perfect.

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#### EXPERIMENT XIX.

August 7th, the sciatic nerve of the right leg of a rabbit was tied with a ligature of thread as tight as possible, and the rabbit was killed on the tenth, seventy-two hours after.

On examination, the wound in the skin and muscles was quite healed, except just at the place where the ligature came out.

Much coagulable lymph was effused about the nerve at the place where the ligature was fixed, and more than in the case of a simple division.

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\* See plate VII.



On removing the ligature the nerve appeared divided, but the portions were not at all separated, as when there had been a division made with a cutting instrument. The coagulable lymph effused by each portion appeared to have united, and to be very vascular, and the vessels of each portion to have communicated with each other. The nerve was rather more inflamed, and to a greater distance, than when there has been a division by a cutting instrument. The limb was more irritable than I had ever observed in any other experiment. Involuntary contractions of the muscles of the leg and thigh continued for a quarter of an hour after it was killed, and ten minutes after I removed the sciatic nerve from the limb.

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EXPERIMENT XX.

Both the sciatic nerves of a rabbit were tied with a thick ligature on the twelfth of August, and the rabbit was killed on the sixth of September.

That of the right leg was merely tied, and not divided. The wound in the skin and muscles was entirely healed; and though the ligature was not separated, and it came out at the skin, there was no discharge of matter. The ligature was completely encysted, and the cyst had adhesions to the neighbouring parts. The nerve above the ligature was enlarged to some distance; below it was much smaller



than natural. The communication between each portion of the nerve was completely intercepted, except by the cyst.

After the nerve of the left leg was tied, it was divided below the ligature. The inferior portion was separated from the superior to some distance, and the space was filled with the coagulable lymph that formed the cyst of the ligature : in every other respect the appearances in this leg corresponded with those of the other.

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#### EXPERIMENT XXI.

The sciatic nerves of both legs were tied on the twelfth of August with a thin ligature, and the rabbit was killed on the twenty-seventh of September.

In the left leg, in which the nerve was divided below the ligature immediately after it was tied, the ligature had been cast off, and the wound in the skin and muscles was perfectly healed. The extremities of the nerve were separated nine-and-one-third-twelfths of an inch, and no attempt at union seemed to have begun. Parts of the toes had mortified and come off, as had also part of the heel.

In the right leg, in which the nerve was tied and not divided, the ligature had separated, and the portions of nerve had united : the place where the union had taken place was much smaller than when a nerve had been divided with a knife and allowed to heal.



The foot was not in the least ulcerated, but looked as well as before the experiment.

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#### EXPERIMENT XXII.

The sciatic nerve of the right leg of the same rabbit, as in the eighteenth experiment, was tied with a ligature of thread on the seventh of August, and it was killed, as before stated, on the twenty-second of November, the ligature having been drawn out on the thirtieth of August.

The portions of nerve between the ligatures were completely united. At the place where the ligature was fixed the superior portion was enlarged; below this the nerve was smaller, but appeared perfectly united to the superior portion, and like nerve. The skin about the os calcis was ulcerated, and part of that bone was dead; but the animal had improved in the use of the limb, though it was by no means perfect.

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#### EXPERIMENT XXIII.

1819, September 29th, I tied a ligature tightly round the sciatic nerve of the right leg of a rabbit, and drew out the ligature on the 28th of October.

It was killed on the 28th of January 1823. It could walk very well again. The muscles of this limb were very little less than those of the opposite one. The sciatic nerve appeared to be perfectly restored, but was



rather larger where it had been tied, and adhered to the muscles.

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## EXPERIMENT XXIV.

I cut out half an inch of one sciatic nerve, in two rabbits on the 22nd of April. One died on the 27th; and the other on the 28th of September, from some improper food.

In one the divided portions were separated about seven-and-a-half-twelfths of an inch. There was a communication between these by new nerves, which had the appearance of a plexus.

In the other rabbit the communicating branches had not so much the appearance of a plexus, but there were two branches, which had the exact appearance of nerves.

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## EXPERIMENT XXV.

1827, June 6th.—I tied each trunk of the par vagum in a dog, with a ligature of silk. He immediately after attempted to vomit and was very restless. An hour after he was quiet and breathed with difficulty.

7th.—He breathed with difficulty, and was in a state of nervous agitation. He ate some meat, but vomited it up again. When water was offered, he shuddered, and was agitated for some minutes.

8th.—He was better than yesterday, inasmuch as he



had not the same nervous agitation. He took water freely, but would not eat.

9th.—At eight A. M., he appeared much weaker; he would not eat, but drank freely much water.

10th.—The same as yesterday. In the afternoon he took some water, and immediately vomited up part of it, and the whole body was then thrown into a state of spasm. He would not eat.

11th.—The same as yesterday. Died at half-past three P. M.

*Examination an hour and a half after death.*—The wound was very much contracted. There was a little pus in the right side of it; the nerve was nearly divided by the ligature, the neurilema was thickened and quite ulcerated through; also the greatest part of the medullary portion, or that forming the central part of the nerve was ulcerated through, so that the two ends just hung together. The two portions of this nerve were more vascular than usual to some distance, but this diminished gradually in both portions, with the distance from the ligature.

On the left side, the part at the separation of the muscles was more healed than in the right side, and there was not any appearance of pus. The portion of the nerve, included in the ligature, was more inclosed in coagulable lymph than that of the right side, and this lymph appeared vascular, so that the nerve seemed



enlarged at this part, and the ligature had not pressed it so completely as to entirely cut off the communication between the two ends. The vascularity of the divided extremities, and in the course of the nerve, was the same as in the other side.

There was a slight vascularity of the inferior cervical ganglia of the sympathetic nerve of each side, and also of the first dorsal, but it was much the greatest on the left side, and there was the slightest possible increased vascularity of the semi-lunar ganglia.

There was a turgidity of the vessels of the pia mater of the brain, but the brain itself was healthy.

The portion of the spinal chord examined was perfectly natural.

In the chest the pleura was inflamed, and smeared with purulent matter. The right lung was hepatised, but the left was so in a very slight degree. The inner portion of the pericardium was smeared with a thick glutinous matter, nearly the same as the pleura. The heart was sound. The membrane lining the larynx and trachea, had a slightly increased vascularity, and there was in these parts a little muco-purulent matter, and some portions of a substance like coagulable lymph.

The abdominal viscera had a healthy appearance. The stomach was very much contracted, and there was a dark vascular spot of the size of a shilling, on the villous



coat at its broad end. It contained a yellow mucus, which was principally bile; and the same was also contained in the intestines, but the villous coat of these was healthy.

In the preceding experiment, inflammation of the pleura had been produced, by placing ligatures on the par vagum; and as I conceived valuable information might have been derived from somewhat similar experiments, I passed a thread through one trunk in two other dogs, but without the result I anticipated.

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EXPERIMENT XXVI.

1829, September 22nd.—The right trunk of the par vagum in a dog of moderate size, had a ligature consisting of two threads, passed twice through it at the same spot; and the left trunk was treated in the same manner in a larger dog; in both, when a probe was passed between the nerve and the carotid artery, considerable pain was given, but not when the needle containing the ligature, was passed through the nerve.

24th.—The dogs have eaten well, and do not appear to be affected by the operation.

October 5th.—The dogs are the same, except that the one, whose left trunk was tied, is thinner.

13th.—The dog, whose left trunk was tied, is very dull, weak, and not disposed to stand much, or move, and is thinner.

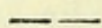


20th.—Emaciation rather increased, but he is more cheerful; the left eye is turned slightly upwards, and outwards, and is rather watery.

30th.—His eye remains the same. His appetite is good, and he is cheerful when spoken to, but continues to be as thin. He was killed by prussic acid.

On examination, the ligature had been thrown off, the nerve was thickened, and very firmly and rather extensively connected with the surrounding parts. The viscera of the chest were natural. The left thoracic ganglia of the sympathetic nerve were not so white as the right. The inner coat of the stomach was reddened as well as that of the intestines, but there were not any ulcers.

The other dog, whose right trunk had been pierced, was not affected to the 2nd of November, when he got away.



#### EXPERIMENT XXVII.

1829, September 26th.—The right trunk of the par vagum, in a common fowl, was divided. It did not appear to be much affected.

It was killed on the 29th. The cut ends of the nerve had a bulbous form, and were about the twentieth part of an inch asunder, and in a mass of lymph. The right lung was more expanded than the left, but every other part was healthy.



## EXPERIMENT XXVIII.

1829, September 26th.—I divided each trunk of the par vagum in a common fowl. It had, immediately, great difficulty of breathing, which continued all the day.

27th.—The difficulty of breathing was not so great. It ate some oats and appeared more alive than yesterday. It purged very much.

It was found dead on the 1st of October. It continued to be affected in the same way. It was fed the first three days on oats; the last three on barley, and boiled potatoes and bran.

On examination, the extremities of both nerves were very near each other, enlarged into little bulbs, and surrounded by adhesive matter. The lungs were expanded on both sides, and somewhat redder than in the preceding experiment. The lower part of the œsophagus contained a little food, and the crop was very full of barley, in a swoln state, and some potato. The passage to the gizzard contained the same food mixed with much bile, and some of this fluid was also in the lower part of the crop. In the gizzard there was a small quantity of semi-fluid matter, with much bile, which had a dark green colour. There were fluid fæces in the upper part of the intestines, but only mucus in the lower, except the cloaca. The gall bladder was



greatly distended with dark coloured bile. It may be remarked that no oats were found in the alimentary canal, but barley only.

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## EXPERIMENT XXIX.

1827, June 13th. I removed from a large terrier a portion of the left trunk of the par vagum, which measured five eighths of an inch. For some days he was very unwell. The principal symptoms he was for a long time troubled with, were sickness, an indistinctness of barking, and loss of flesh, but these gradually and very materially went off. A year after the operation he barked loudly, but not perfectly; he frequently vomited up his food and ate it again, but he was well fed, so that his body was sufficiently fleshy; and he breathed well.

1828, June 14th. At a quarter before five P. M., I divided the right trunk of the par vagum. A quarter of an hour after the operation he vomited. The conjunctiva of the right eye became more red than that of the left. He had an occasional heaving, something like hiccup.

15th.—He appeared to have a constant trembling. He drank water, and immediately attempted to vomit. He could not eat; he did not breathe with much difficulty. In the afternoon his breathing was rather short, and he did not appear quite so well as in the morning.



16th.—He is better, and does not breathe amiss. He will not eat, and always vomits after drinking water.

17th.—He breathes with great difficulty, and vomits a great quantity of mucus, and does not appear near so well as yesterday.

He continued to vomit throughout the day; his breathing got worse, and he died at half past seven P. M.

#### EXAMINATION.

There was a remarkable difference in the two sides of the chest. The left side was flat and small; but the right side was enlarged, so as to be much more capacious than the left.

The left trunk of the par vagum, from which the part was removed, was united by apparently new small nerves, and a twig went from the branch of the first cervical, which joins the descending branch of the ninth to the inferior portion.

The right trunk was united by a coagulum of blood. The right lung was not collapsed, and was very purple in patches, and more solid than natural. The left lung was more solid than the right, and much less, and had the same purple patches as the right. The heart was sound.

The stomach was contracted in the greatest degree. The intestines, and all the other abdominal viscera were healthy, except a few red spots on the mucous mem-



brane of the superior part of the intestines, which had the appearance of ecchymosis.

The left recurrent nerve was much less than the right.

The dog had much fat in different parts of the body, and seemed to have died from want of a proper change in the blood, which was quite black in the aorta.

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#### EXPERIMENT XXX.

June 23rd, 1827.—I cut out a portion of the right trunk of the par vagum in a white rabbit, which measured a quarter of an inch after it was removed.

It has hardly been affected by the operation, and has had many litters of young ones, and was fat and healthy in appearance.

February 19th, 1829.—At a quarter before one, P.M., I cut out a portion of the left trunk of the par vagum, and removed every nervous twig near the carotid. When the nerve was taken hold of with the forceps, pain was produced. Immediately after the operation, it breathed with difficulty, but with not near so much as when both nerves have been divided at once.

20th.—At eleven A. M., it breathed with great difficulty.

21st.—It continued very restless, and breathed with great difficulty the whole of yesterday. It vomited some mucus mixed with a little parsley.



22nd.—It breathes better to day, and very much like a person in apoplexy. It grinds its teeth, and eats very little.

23rd.—It continued better yesterday, and is still better to day. It makes some noise in breathing, but breathes with comparative ease. It ate some parsley this morning.

25th.—It breathes with more difficulty, and gets very thin, although it eats with a moderate appetite.

26th.—It breathes with very great difficulty.

27th.—It was found dead this morning, and was examined about 2 P. M.

The right side of the chest was flat, and the left side was considerably larger than the right. Both lungs were diseased, the upper two-thirds of each contained many tubercles, a few of which were in a state of supuration; the lower portion of each lung was free from tubercles. There were purple patches on the sound part of each lung. There were many hydatids in the abdomen, but all the other viscera were sound.

The right trunk of the par vagum had united, and although the bond of union was smaller than the original part, it had the appearance of nerve.

These experiments were made for the purpose of ascertaining whether the new substance, formed after the removal of a considerable portion of nerve, will perform the functions of nerve. In the last experiment I think the animal would have lived if the lungs had



been sound, as it survived the last operation much longer than is ever known when each trunk of the par vagum has been divided.

Nothing can more strikingly illustrate the connexion between the lungs and chest, than the alteration which takes place in the form and capacity of either cavity, when the functions of the corresponding lung have been impeded by the removal of a portion of the trunk of the par vagum, as was manifested in both of the last experiments.

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Soon after making experiments on the sciatic nerves of rabbits, I have been astonished to see how much they use the limbs. As this is a point which is apt to deceive, I think it proper to notice it. It is from the nervous influence not being cut off from the large muscles of the thigh, that the animal is enabled to make so much use of the limb: if it is observed during this time, it will be found that it always comes with a dead weight on the heel, and never on the toes; but when a nerve has been divided, and a sufficient length of time has elapsed for its reunion, the animal first goes occasionally on the toes, and as the powers of the nerve are restored, does so constantly.

It will be seen from these experiments, in the first place, that after a division of a nerve, the extremities



of the divided portions become enlarged and more vascular, but especially the upper portion; and coagulable lymph, having the appearance of white of egg, is effused, which soon becomes vascular. In a few days the coagulable lymph from each portion becomes united, and anastomoses form between the blood vessels; the coagulable lymph gradually assumes a firmer texture, and the number of the blood vessels diminishes, and the newly-formed substance appears to contract, like all other cicatrices, so as to bring the extremities of the divided portions nearer and nearer to each other. It is difficult to determine from an experiment on the limb of an animal the exact time at which the nerve again performs its functions. In eight weeks after the division of the sciatic nerve, I have observed a rabbit to be in some degree improved in the use of its leg, but at the end of eighteen weeks it was not perfect. When the nerves of the leg of a horse have been divided just above the foot, they are sufficiently restored to perform their functions in a very great degree in six or eight weeks; but it must be observed that these nerves are only formed for sensation, and it is very different with the nerves of voluntary motion.

I have stated that the usual way in which a divided nerve reunites is by the effusion and organization of coagulable lymph; but it will be seen from one of the



experiments, that the reunion is sometimes accomplished by granulations.

Secondly, I would observe, that punctures and partial divisions of nerves heal in the same way as when there has been a total division; and that, even on the first infliction of the wounds, the functions of the nerve are very little impaired.

Thirdly, it appears from the foregoing experiments that when a portion of a nerve has been removed, the restorative process is set up in the same way as when there has been merely a division of the nerve; but the extremities of the divided portions afterwards present such appearances, as to lead to a supposition that the nerve will never again be restored of the same size it was before. From the repeated experiments I have made, I had been led almost to conclude that a certain portion of a nerve is never restored after its removal, so as to be able to perform its functions; but that this is not always the case, the following circumstance will prove.

A horse had been lame for two years, at the end of which time an inch of each nerve going to the foot was cut out; after this he went very well for six months, when he again became lame, and continued so five months; at the end of this time he appeared to suffer such dreadful pain that he was killed. At the time he was operated on, it was supposed that the disease was



the same in both fore-legs, so that portions of the nerves of both of them were removed.

On examining the legs after he was killed, one was very much swelled, especially at the foot, where matter was discharged by several sinuses leading to the coffin bone, which was quite carious.

On further examination, the nerves of this leg were found to have reunited, and the new-formed substance was very large, and appeared to have the same structure as that which forms the bond of union when a nerve has been simply divided. The nerves, above the place where they were divided, were found to be much larger than those of the opposite leg in the same place. In the opposite leg, in which there did not appear to be much disease, the nerves had reunited, but the bond of union was not so large as in the other leg.

From these circumstances, it appears to me that the functions of the nerves were again performed, through the medium of the new-formed substance; but I am informed this is not usually the case when so large a portion as an inch of the nerve has been removed; and this circumstance shows that it must have been owing to the irritation occasioned by the disease in the foot.

So much depends on the subject, and a variety of circumstances, that it is impossible to make any accurate experiments to ascertain how large a portion of a



nerve can be restored after its removal. If this could be done, it would tend much to improve the treatment of diseases of the nerves, as we then might remove as large a portion of a nerve as would be necessary to prevent the recurrence of a very painful complaint; or, knowing how far a limb would suffer a permanent injury from the removal of a portion of a certain size, as in the case of a tumour being seated in it, we might at once determine, whether amputation of the limb would not be the best resource, when the patient is suffering so much as to lead to a supposition, that if he is not relieved, death must be the consequence.

It appears to me that a reproduction of a portion of a nerve is not accomplished without the greatest difficulty, except where there are very frequent communications with other nerves, or except a much increased action of the blood vessels exists in consequence of a diseased state of the part in which the nerve is situated, as in the case related by Mr. Abernethy, where a portion of one of the digital nerves was removed. When a portion of a nerve has been removed, if its reproduction were a desirable object, this circumstance of its growth in diseased limbs makes it probable that it might be much assisted by irritating frictions, electricity, &c.

Although a large portion of a nerve is seldom restored, yet in some instances new nerves are formed to keep up a communication with the brain. In the



eighteenth experiment I observed this for the first time. These new nerves had not that almost transparent appearance that the bond of union has, but were white, and exactly like nerves. It appears extraordinary that entirely new nerves should be formed, but it is not more so than that new arteries should be produced, as Dr. Parry has, I think, satisfactorily demonstrated.



## CHAPTER XII.

## OF DISEASED APPEARANCES IN THE SPINAL CANAL.

THE dissection of the parts contained within the spinal canal is attended with so much trouble, that, until within these few years, its diseases have been comparatively but little investigated. In some complaints, and especially tetanus, diseased appearances of the membranes of this part have been found; but it always seemed to me doubtful how far these might arise from accidental causes. As conclusions cannot satisfactorily be drawn from a few cases, and as numbers can only be supplied by many individuals, I conceive the following accounts may not be useless.

## CASE.

Cornelius Bishop's son, aged eight months, was brought to me on the tenth of August 1821. He was taken a few days before, with vomiting and fever, and when I saw him on this day his head was bent back so as to form a complete opisthotonos, and it could



not be moved forward, as the muscles appeared quite stiff. He appeared insensible. The pupils of the eyes were dilated. There were frequent convulsive motions of all the muscles of the body, but most particularly of those of the face. His head continued bent back until his death, which happened on the 25th of August. Immediately after death the head could be moved in any direction.

As the stools were black, some doses of submuriate of mercury were given him, and these had the effect of changing the secretions to a more healthy state. A blister was applied to the back of the neck.

#### EXAMINATION.

I examined the body twenty hours after death. On opening the head, the fontanelle was much wider than it should have been. There was a great quantity of fluid in the ventricles of the brain. In other respects the brain appeared healthy, and not redder than natural.

On opening the spinal canal, three patches of a reddish substance, about the surface of a horse bean, lay on the dura mater, about the beginning of the dorsal vertebræ, but I could not decide whether these were owing to disease. On dividing the dura mater, its inner surface appeared sound and healthy, and the arachnoid membrane was sound as far as about the first dorsal



vertebra; it then was thickened, and opaque, and had coagulable lymph effused on it as far as the beginning of the cauda equina. The pia mater appeared to have been involved in the disease. The morbid appearances were confined to the posterior part of the chord. The whole of the abdominal viscera were perfectly healthy.

## CASE.

James Cawthorn, aged twenty-five years, was hanged for murder on the 9th of August, 1821. On opening the spinal canal, the dura and pia mater were quite sound, but the arachnoid membrane had several patches of a cartilaginous substance on it.

On opening the abdomen, the stomach was contracted, and its villous coat was very red, and about the cardia appeared as if corroded by the gastric juice. The examination of the stomach took place about two hours after he was suspended.

The brain was sound, except the choroid plexuses, in each of which was a yellowish tumour, about the size of a large pea. There was much fluid in the ventricles.

On the pericardium of the heart there was a whitish appearance in several places, as if there had formerly been inflammation; and on the loose pericardium there were several whitish spots.

He was confined in the gaol for many weeks, and during all this time was in perfect health. He ate and



slept well, and got much stouter than when he was first committed. A strong instance this, to prove that similar appearances of the membranes of the spinal chord are certainly not the effect of tetanus, and ought not, without sufficient inquiry, to be considered as the cause of it.

#### CASE.

Benjamin West, forty-five years of age, was admitted into the county hospital on the 25th of March, 1822, on account of epileptic fits. He said he began to be troubled with them seven years ago; that they continued three years and then left him, and did not return until a year ago. He had no attack during the time he was in the hospital, but complained very much of his head.

He was seized with erysipelas on his right side on the 8th of April, which extended over the greatest part of the back; and terminated in mortification. He died on the fourteenth.

#### EXAMINATION.

I examined the contents of the cranium and spinal canal twenty hours after death.

The longitudinal sinus terminated in the left lateral sinus, and there was a communication between the two lateral sinuses very little larger than would admit the blunt end of a probe. The right lateral sinus appeared



to be a continuation of the torcular Herophili. This arrangement, as far as I could judge, must have tended to retard the return of the blood.

The whole arachnoid membrane covering the convolutions of the brain was very opaque, and much thickened, especially on each side the longitudinal sinus, where it had the granulated appearance in a very great degree, and I could not help thinking but that this was the effect of previous inflammatory action. Some small patches of cartilaginous matter were observed on it. At the base of the brain it was as little altered from its healthy state as possible. There were some small hydatids in the choroid plexus. The whole brain was sound. There was very little fluid in the ventricles, but some was contained between the dura mater and arachnoid membrane, and after the brain was removed, rather more than an ounce was collected about the great foramen.

The dura mater of the spinal chord on the outside was sound, but on its inner surface there was one small scale of cartilaginous matter. The arachnoid membrane adhered very much to the dura mater within the cervical vertebræ, and there were many adhesions through its whole extent, especially on the posterior part. There were several scales of cartilaginous matter on it, the same as in the preceding case. In other respects the contents of the spinal canal were sound.



## CASE.

In the dissection of Cornelius Bishop's son, I have described\* three patches of a reddish substance, which lay on the outside of the dura mater. I have frequently observed similar appearances in different parts of the spinal canal, but most particularly in the inferior portion, and therefore I cannot at present consider them as the effects of disease. But, in dissecting the body of a man whose lungs were very much diseased, I found such an appearance† covering all the posterior part of the dura mater of the spinal canal, and it was in a much greater degree than I had ever observed before. I did not find pus in the spinal canal, but there was a fluid very much like it at several of the inferior spinal holes. On opening the dura mater, many adhesions‡ were found between it and the arachnoid membrane, and especially as far as it is contained within the cervical vertebræ, and some of these, more particularly on the posterior part, were long, like threads. Some bloody

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\* See page 213.

† In the third volume of the Medical Observations and Inquiries, a case of paraplegia from injury is related, in which the symptoms seemed to arise from a similar disease.

‡ In a man supposed to be consumptive, but in whom all the viscera were sound, nothing remarkable was observed, except adhesions of the arachnoid membrane of the spinal chord to the dura mater. The dura mater of the head was thicker than usual, and the brain very soft. Morgagni, Ep. 49. obs. 16.



fluid was found in the inferior part of the sheath. The left lung was very much diseased, and adhered to the ribs, which formed the boundary of a large ulcerated cavity, and I thought it not improbable that diseased action might have been communicated from this to the spinal canal. On account of this disease, there was some difficulty in separating the branches of the sympathetic nerve on this side of the chest. The pleura was very much thickened, and the phrenic nerve of the left side was thickened, and with difficulty separated from it. I have known hiccup very troublesome in complaints of the chest, and I conceive it may be produced from disease communicated to this nerve. I did not know the history of the case.



## CHAPTER XIII.

## OF INJURIES OF THE SPINAL CHORD.

## CASE.

JOSEPH LARDER, of Scothern, thirty years of age, was admitted into the county hospital, on the 14th of May, 1821. About a week before his admission, he fell from a tree, and fractured the spine about the second dorsal vertebra. At first he complained of very great pain at the injured part. The spine had a curved appearance, and one spinous process projected much, and an indistinct crepitus could be perceived when an attempt was made to move it. There was a complete paralysis of all that part of the body below the fracture. The urine was drawn off with the catheter, and the stools came away involuntarily. At first he had much difficulty of breathing, and now and then vomited. The symptoms already enumerated continued till within two or three days of his death, with very little variation, except that the vomiting became almost continual and very distressing, and his lower extremities quite cold and purple.



He never complained of pain either in the chest or abdomen, and always expected he should recover until the day before he died.

After death, the purple appearance of the skin of the lower extremities went entirely away.

He died on the 31st of May.

#### EXAMINATION.

On dissecting away the integuments over the spine, coagulated blood was found, which had also insinuated itself amongst the muscles. I then removed the projecting spinous process, which was loose, and had the superior and right articulating process attached to it. Several small portions of bone were likewise detached. At this vertebra, viz. the second dorsal, the dislocation was such, that the spinal chord became firmly compressed against the inferior margin of the arch of the next vertebra; at this part the chord was nearly divided; but just below it was enlarged, and appeared as though the part above had been pressed towards it. Some coagulated blood was on the outside of the dura mater, and when this membrane was divided, a fluid escaped.

On opening the chest both lungs appeared diseased; in some parts as if thickened by inflammation, and coagulated blood that had been effused into their substance. Much bloody serum was in both cavities. The pericardium of the heart was inflamed, and adhered to the loose portion.



On opening the abdomen a great quantity of serum was found mixed with purulent matter. The peritoneal coat of the intestines was inflamed, and adhesions were formed between the convolutions. The sigmoid flexure of the colon adhered to the bladder; and, on separating these adhesions, an abscess was found to have formed between them, and the ulceration of this part had nearly extended into the gut, and likewise nearly through the posterior surface of the bladder. There might have been, and it is very probable there was a very small opening in the bladder, which allowed the urine to pass through at this part, though I could not find it.

When the bladder was cut into, its sides did not fall into contact, but remained separate, and appeared as though the cavity had not varied in size for some time. Much matter had long been discharged with the urine, and a great part of the urine passed off as it was secreted.

In this case, the nerves seemed to have retained their sympathetic power from the very distressing vomiting which came on before the patient died, in consequence of the disease within the abdomen, and which would have accompanied it in the same way, had the spinal chord been perfect. As pain did not attend the vomiting, we must suppose either that the sympathetic nerve has but little feeling, or that it is not prone to pain. Should this not be allowed, we must



suppose that its feeling or sensibility is derived from the spinal chord. The experiments made by Bichat seem to prove that it is not easily affected so as to become sensible of pain. Ulcers are frequently found in the bowels, without having produced that degree of pain we might have supposed. But on the contrary, the strangulation of a portion of bowel in a hernia, and other diseases, causes the greatest torments ; and though many diseased appearances have been found in the heart, which had not been attended by much pain, yet the reverse has been as often observed ; and this would lead us to conclude that such diseases being unattended by pain, is owing to some peculiarity in the disease itself.

When an infusion of tobacco is injected into the bowels, its effects, I conceive, are produced through the medium of the sympathetic nerves, for the parts which these supply seem to be always first affected, afterwards the nerves of voluntary motion, and lastly the brain. When its effects reach beyond the viscera, are they not conveyed through the spinal nerves to the spinal chord, and from thence to the brain ?

#### CASE.

Gilbert Clay, between fifty and sixty years of age fell down stairs. At first it was not known whether he was dead. I saw him half an hour after the accident. His



arms and legs were completely insensible and paralytic, and he had great difficulty of breathing. He could just speak in a whisper. His pulse was good. He complained of much pain when I pressed the cervical vertebrae. He died about two hours after the accident.

#### EXAMINATION.

A little blood was effused among the muscles near the spine. The bases of several of the spinous processes were fractured on the right side, and the body of the fifth was completely broken through, so as to allow of such a dislocation as to compress firmly the spinal chord. There was much fluid in the sheath of the dura mater, but there was no blood in the sheath and very little on its outside.

Violent blows on the back sometimes cause bad symptoms, though they are unattended by much apparent external injury, as in the following case.

#### CASE.

A man, about thirty years of age, fell from a waggon on his back: he immediately had violent pain in his back, with convulsions of its muscles, attended with most excruciating pain; for a minute or two he would be comparatively easy, and then the convulsions would return with great violence. He was bled, took a large dose of laudanum, and a mixture with sulphate of mag-



nesia dissolved in peppermint water, to which some ether was added : his back was frequently fomented and rubbed with anodyne liniment. The pain continued in this way violent for about twelve hours, and then gradually abated : at the end of twenty-four hours he had passed no urine, and as the bladder was very much distended, and he had much pain from it, his water was drawn off : he continued after this to expel his urine whenever he pleased : the pain kept gradually diminishing, and in about a week all symptoms of complaint, except general weakness, left him.

In this instance the accident could only have produced a violent irritation of the nerves, as the patient so soon got well, and never ailed any thing more.

Symptoms of the like kind, though more violent in degree, are sometimes produced by an accident of this sort, when a permanent injury either of the spinal chord or its nerves is inflicted, so as to paralyze all the parts below the place where the injury is done ; and though they will after a length of time recover, yet they are never perfectly restored to the state they were in before the accident.

#### CASE :

September 14, 1819. Joseph Morris, of Willough-ton, aged thirty-three, whilst on the ground had his head forced violently forward by three men ; he im-



mediately became insensible, and as it was supposed that his neck was dislocated, a man immediately held him fast between his knees, and having his hands fixed under the lower jaw, drew up the head forcibly, and the patient became immediately sensible; but a most serious injury was found to have been inflicted on the spinal chord, for all the parts below the neck were paralytic, but the right side was so the most completely; all sensation, as well as motion of that side was lost; and on the left side he could just tell when he was touched, but the feeling was imperfect.

The patient gave this account of himself: Mr. Barton of Market Raisin saw him the next day, but found it impossible to obtain any satisfactory information respecting the manner in which the accident happened from any of the persons about him. He found him lying with his head extended backwards beyond the pillow, which only supported the back of the neck; he placed the head in a more comfortable position, for the patient had not the power of moving it himself; this gave him some pain about the lowest cervical vertebra: there was then a considerable and extensive tumefaction about this part, and a paralytic state of the body, and fever. Venesection, and aperient medicines, very much relieved him. When the tumefaction had subsided, Mr. Barton examined the spine, without finding any distortion of it: pain and increased numbness were



occasioned by certain movements of the arms, and by deep lateral pressure on the vertebra, and it appeared to him that there was a fracture connected with the right transverse process.

At the end of January, 1820, he was admitted into the County Hospital. I saw him for the first time on the fifth of February; he then had the perfect feeling in every part of the body, except the extremities of the thumbs and fingers, which felt very numb: the muscles below the injury were as completely paralytic as they ever had been, but he could distinguish whatever touched him: he complained of a pain in his head, which had continued ever since the accident; he complained likewise of a very great pain in the right shoulder: there were some enlargement and tenderness on pressure about the last cervical vertebra: he appeared in good health as far as the functions of the viscera were concerned.

I despaired of rendering him any essential service; but as there was an enlargement of the vertebra, I made a seton on each side of it. Soon after the setons began to discharge he had some power over the muscles. At the end of the month he could just stand by himself, and walk when a person supported him, so as to keep him steady: he had some use of the left arm, but very little of the right.

April 1. The pain in the head has entirely left



him; he can walk tolerably well by himself, and can raise his left arm to some height, but he cannot raise his right, though he can move them both, backwards and forwards. When attempts are made to raise the arms, the soft parts appear stiff, and considerable pain is produced in them, and a numbness. The setons have been removed, as all the enlargement and tenderness about the vertebra have disappeared. He was ordered to have both his arms rubbed well daily with linimentum ammoniæ, and to have them frequently moved.

He was discharged from the hospital on the fifth of June, with the perfect use of the lower extremities, so much so as to be enabled to walk to a considerable distance. The use of his arms was much improved since the beginning of April, and he was entirely free from pain when they were moved. He was in perfect health; and I doubt not but that from the gradually progressive manner in which he has continued towards amendment from the time the setons began to discharge, that the use of the upper extremities will increase, so as to enable him to work again.

#### CASE :

Colonel Sibthorp, forty years of age, was overturned in his carriage about eleven o'clock in the evening of the twenty-third of February, 1821. I saw him with



Dr. Cookson about an hour after the accident ; he was cold and faint, and complaining of great pain between the scapulæ, but of none in his head. He could move his right leg and arm, but could not move his left leg at all, and his left arm only very little. He complained of a tingling in both arms, and very much of the cramp in his left leg ; indeed it came on so violent, that he was obliged to have it held. He was rather sick, and vomited a little. He had no difficulty in passing his urine \*. On examining the spine he experienced much pain when pressure was made on the left side of the spinous process of the first dorsal vertebra, but the same pressure did not produce pain on its right side. Two hours after the accident twelve ounces of blood were taken from the arm, but it flowed very slowly as the circulation was feeble. He took thirty drops of laudanum, and, as he vomited soon after, we gave him ten drops more, and left him at half-past three A. M.

February 24th. I saw him with Dr. Cookson and my brother at ten A. M. He had had some sleep towards morning. He had still some spasms in the left leg, and the tingling continued in both arms. The pulse was not much quicker than natural, but was rather full,

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\* Though there was no difficulty in voiding the urine, yet it did not flow so freely as it should, and for some time when the inclination came on, there was an immediate necessity for voiding it.



He complained of pain towards the left side of the lower part of the abdomen. Twelve ounces more of blood were taken from the arm, and he was ordered to take two drachms of sulphate of magnesia dissolved in an infusion of roses every four hours.

Eight P. M. The spasms in the left leg are less frequent, and the tingling in the arms rather less. He has more feeling in the left leg, and has less pain between the scapulæ, and in the abdomen. He feels more comfortable, and has had some broth and pudding. Pulse 72, quiet and good. He took only one draught as it produced sickness. He was ordered a draught with thirty drops of laudanum, and a pill with four grains of submuriate of mercury, to be taken at bedtime.

25th, ten o'clock A. M. He has not had an evacuation from the bowels since the accident. Pulse 66. He has had much sleep in the night, and less pain between the scapulæ, but still has the same tingling in the arms. He can move the left arm better, but has not the least power of moving the left leg; he has, however, perfect sensation in it, as far as touch is concerned, and when I put a glass to it containing cold water, he said it felt cold.

He was ordered to have twelve leeches applied to the injured part of the spine, and to take another draught with sulphate of magnesia.



Eight P. M. Symptoms the same, the draught was vomited up, and he has not had a stool. He was ordered pills composed of submuriate of mercury, and compound extract of colocynth.

26th, ten A. M. He has had a tolerable night, but no stool. Pulse rather quicker. He was ordered an enema.

In the evening pulse 70 and quiet. He has had two plentiful stools, and in consequence is much more comfortable. His left leg feels rather more like itself, but the tingling in the arms is the same. He does not complain of pain between the scapulæ except on pressure.

27th.—Symptoms the same. In the evening he thought the tingling in the right arm rather less, but the same in the left. He could move the left foot a very little. He had six leeches applied to the spine in the morning, and was ordered to take some purging pills at bedtime.

28th.—He has not had a motion, and was therefore ordered to take more pills; in other respects he is the same as yesterday. In the evening he had a motion. The tingling in both arms continues the same, but he can move his left arm and leg rather more.

March 1st.—Symptoms the same, except that he complains of pain in both arms, and at the short ribs on the left side.



2nd.—He had six leeches applied to the spine ; in the evening he was very faint, but his other symptoms were the same.

3rd.—Symptoms the same. Hitherto he had lived on a very low diet, but this day he had a little fish.

4th.—The tingling in the arms continues, but he has more use of his left leg. He had broth and chicken to-day for dinner ; in the evening his pulse was 80, and rather full.

After this he improved daily. He had not sensation of the right hand so perfect in the little and inner side of the ring finger, as in the other parts. In the left this distinction was not so perceptible. He began to have his left arm and hand rubbed with a flesh brush and a spirituous embrocation. The tingling appeared to be greatest at the inside of the arm and in the fingers.

April 1st.—He walked a few steps without assistance, and from this time kept gradually improving in walking.

In May \* he complained of a numbness in his right side, but not in the left, and this continued for some time. At this time I again examined the spine, but could not perceive any irregularity in the bones, and

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\* At this time I thought a seton made near the seat of the injury might have been useful, but it was not consented to.



indeed I never could, though I had examined it frequently with the greatest care. When the accident first happened, I could never perceive any crepitus or other symptom that could induce me to suppose that the vertebra was fractured, unless the pain on pressure of its left side would lead to such a supposition.

It appeared most probable that the symptoms in this case were chiefly produced by an effusion of blood, and that a coagulum pressed very much on the left side, and only slightly on the right, and on the right principally on the portion of the chord that gives origin to the seventh cervical and first dorsal nerves; and the circumstances of the ring and little finger being most affected, and the tingling being greatest in those parts, and in the inside of the arm, in the direction of the internal cutaneous nerve, seem to favour this opinion. From this also it is probable that each nerve has its origin from a certain portion of the spinal chord, which is a centre or source of influence from which and to which the nerves propagate their actions. On the right side none of the parts below the injury suffered the slightest alteration in their functions. The portion of the chord, from which each axillary plexus arises, was affected, but the injury was very slight on the right side, for extensive motions of the right superior extremity could be easily made, though the finer movements of the hand could not be executed with the



precision they were previously to the accident. Writing that was made a few days after the accident was very imperfect, and could be only just recognised as the writing of the patient; but this daily improved, and in about three weeks was as good as before the accident.

The left leg improved much faster than the left arm, though at first it was entirely deprived of motion.

If each nerve did not receive its powers from the corresponding portion of the medulla, we can hardly conceive that the parts furthest below the injury should first recover, and afterwards those immediately interested. It must appear from this also, that the communication between the brain and spinal chord, for the production of sensation and voluntary motion, can be carried on if the chord is only injured to a certain extent, and before the nerves, immediately arising from it, are sufficiently recovered for performing their functions. From the nature of the accident, the patient's amendment was greater in the time than might have been expected. I met him very frequently walking in the streets at Lincoln, at the latter end of the summer, and though his left arm continued in a considerable degree paralytic, I felt confident that time would gradually restore him the use of it; and in this opinion Dr. Cookson and my brother concurred with me.

About the middle of September he went to London,



and was advised by the medical man he there consulted to submit to a peculiar mode of treatment, in consequence of being told by him that several of the vertebræ were dislocated, or compressed inwards, and that the paralysis of the arm depended on this dislocation; that by the peculiar process recommended, and the use of lubricating liniments, the bones might be restored to their proper places, and that then the paralysis would cease.

As part of this mode of treatment the patient was pulled and pressed for about an hour, almost daily, for several weeks. And such was the violence of the pressure, that on one occasion in particular something cracked, and it was believed at the time that a rib was broken, for immediate pain was produced, which continued several days. My medical readers will form their own judgment as to the effects likely to be produced by such a process as this. For myself, I have no hesitation in thus publicly avowing, that I all along expressed to those who asked me, that in my opinion it was utterly impossible thus to have restored the parts to their proper position, supposing any dislocation had really taken place, which, however, I was confident was not the fact; and further than this, that, in an operation attended with so much violence, there was great risk of injury to the general system, in a case where, from the nature of the accident, the parts were rendered more



susceptible of morbid changes. But whatever the opinions of others might be, in the judgment of the medical gentleman himself, the process adopted was completely successful; all the bones were said to be put into their proper places, and the patient almost, if not entirely, cured; debility alone remaining, which, as the cause was stated to be removed, it was expected would soon cease also.

He reached home on the 28th of November, and I visited him on the 7th of December. He at that time complained of vomiting, headach, impaired vision, and constipation of the bowels. He said his left arm was nearly in the same state as when he went to London, and if it was improved at all, it was not in a greater degree than he thought it would have been in the same time provided nothing had been done.

He seemed desirous of trusting himself to the *vis medicatrix naturæ*, as in consequence of what had recently occurred, he had; with very good reason, a great aversion to the interference of art. He continued nearly in the same state until the twenty-fifth of January; the alvine evacuations were then black, and common aperient medicines being of little use to him, he took submuriate of mercury until his mouth became sore, when the colour of the evacuations changed, but his other symptoms did not abate. His sight had become gradually worse. He had continual sensations



in his eyes, as if flashes of light were always before them, but the pupils contracted and dilated properly. He said he felt a general weakness. He made water with difficulty, and experienced the same want of power in expelling the fæces. It was feared that disease was going on in the membranes of the spinal chord and brain; and leeches, blisters, and setons were recommended to him, but their application was not consented to.

February 2nd.—He complained of great pain, which began at the back of the neck, and extended over the head; he had difficulty of swallowing, which he said was greatest on the left side, and when he took any thing solid into his throat, he could not get it down without the aid of liquid. Had there been no affection of the nervous system, this difficulty of swallowing might have been attributed to the soreness produced by the mercury, but I could not perceive either inflammation or ulceration in the throat, and only a slight excoriation on the left side of the anterior arch of the palate. The articulation was imperfect for a short time. Under these circumstances, and coupling therewith the previous imperfection of sight, I could not but consider him to be in a very alarming state. Blisters were applied behind the ears. Deglutition and speech became better in the evening.

February 3rd.—He was better, and appeared to mend



for some days, but still complained of headach and his left arm was much weaker. He continued to experience the same flashes of light before his eyes I have already mentioned. Blisters were applied to the temples on the tenth, which produced much swelling of the eyelids. From this time he seemed to improve in his health, and expressed himself to his friends as feeling more comfortable. Though he never admitted that his sight was better, yet his friends believed it to be so, as he read much more, and observed things at a distance which he had not done before. He could see best in a very strong light, and only very indifferently by candle-light. He went out two or three times in his carriage, and appeared to continue to mend in every respect, except that the difficulty of keeping his bowels open, which had been removed by the mercury, had returned.

February 26th.—He was taken in the night with violent headach and vomiting, and experienced so much difficulty of breathing, that he could not lie in bed on the night of the twenty-seventh; and on the twenty-eighth, his legs, which had shown a disposition to swell for some time, were now much enlarged. He had pain in the upper part of the back, and the left shoulder, and increased numbness in the arm, with involuntary motions of the left arm and leg. A blister had been applied to the back of the neck, and discharged well.



March 1st.—He was rather better, and had been able to lie much more in bed. The difficulty of breathing appeared to me to arise from a deficient nervous energy. He continued much the same till the fifth, when he became exceedingly restless; he had throbbing in the temples, was drowsy, and unable to see distinctly; he had increasing numbness of the left side, and could not remain in the same posture for more than a few minutes; his breathing was much oppressed; he was unable to lie in bed longer than half an hour at a time, but could lie on either side, and had very little cough; his urine, which before had been in proper quantity, was now scanty.

In the evening the restlessness was extreme; six leeches were applied to the back of the neck, and a mixture with camphor and castor was given him.

March 6th.—He was more composed. He said he had no pain, but his head felt confused, and it was all he could do to keep his recollection. The leeches were repeated, and four grains of James's powder and a saline draught were ordered to be taken every four hours. In the evening he continued more composed.

March 7th.—From this time to the ninth, on which day he died, he remained in the same state. In the last twenty-four hours he complained of very distressing pain at the bottom of his back.

He could hardly be said to have ever lost his perfect



understanding. He became nearly blind, and for the last few hours was much convulsed. His tongue was always much furred. He never had what could be called fever, and his pulse was hardly affected. Nearly the whole nervous system seemed to be gradually prevented from performing its functions, so that there never was any opportunity of using very active treatment; indeed, I feel confident, that had any quantity of blood been abstracted, the consequence would have been fatal, as on two or three occasions after being purged, he was so much exhausted as to cause great alarm. For some time, he felt he could not recover, and on that account was unwilling to submit to such treatment as we thought might hold out a prospect of relief.

He was attended, after his return from London, by Dr. Cookson, my brother, and myself.

#### EXAMINATION.

On attempting to remove the scalp, the tendon of the occipito-frontal muscle and the pericranium adhered so firmly together, that they could not be separated, so that nearly the whole of the bone was completely denuded\*.

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\* Several years ago the patient frequently complained of very bad headaches, and he then told me he thought some disease would be found in his head. J. S.



After having completely sawed through the skull, the dura mater adhered so firmly to it, that it was with the utmost difficulty it could be separated from the bone. There appeared some marks of previous inflammation over the longitudinal sinus, and particularly on the left side.

On opening the longitudinal sinus, there was a coagulum of a whitish colour, exactly like what is observed very frequently in the heart, especially when death takes place very slowly; the same extended into some of the veins, but in these it was streaked with a black coagulum. On cutting into the dura mater, it was observed to be very much thickened in various places, but its internal surface had a particularly healthy appearance. The whole arachnoid membrane had an opaque appearance. The pia mater looked healthy. The whole brain had a healthy appearance. There was no fluid in either ventricle. Each choroid plexus was rather larger than usual, and in that of the left side was a very small tumour. The infundibulum was enlarged, and had the appearance of being thickened. There was fluid like water in the inside of the pineal gland, which, otherwise, had not an unhealthy appearance. Neither the optic nerves nor their thalami had any unhealthy appearance. The cerebellum, and all the nerves going both from it and the brain, appeared healthy.



The cellular membrane on the back was much loaded with serum. The posterior parts of the vertebræ were denuded both of muscle and periosteum, and no vestige either of dislocation or fracture could be perceived. The spinal canal was laid open from the atlas to about the last dorsal vertebra, before the dura mater was opened. The spinal canal was perfectly natural in every part, and no pressure could have been made on the chord by any part of it. There was an appearance on the outside of the dura mater, forming the part of the sheath within the cervical vertebræ like coagulable lymph, but I am not aware that this is a diseased appearance, for I have frequently observed it before. The whole dura mater, on both sides, had a very healthy appearance. The whole arachnoid membrane was thickened and very opaque. At the fifth cervical vertebra, there was a very firm adhesion between the dura mater and arachnoid membrane on the left side, it was much broader, and very unlike the process of the denticulated ligament. Three inches and a half from the termination of the chord, there were several small eminences, nearly of the size of pins' heads, which had the appearance of pearls\*. They

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\* If the subject be kept long, or the spinal chord be softer than usual, this appearance may be produced by the concussion in removing the spinous processes with a chisel and mallet.



consisted of a substance like cream, and were contained under the arachnoid membrane. From the manner in which the canal was opened, it was not possible for these eminences to have been produced by the parts being wounded; but, to be satisfied that they were not, I punctured a part of the chord higher up with a needle, and though some portion escaped through the membranes, it could be rubbed off immediately, but this could not be done in the other parts. This appearance was more or less distinct nearly to the termination of the chord; all this portion, viz., three inches and a half, was firmer than natural, and appeared thickened, and very near its termination in the substance of it was a small solid tumour, of a semi-transparent appearance, and about the size of a very small pea.

The cartilages of the ribs were for the most part ossified. About four ounces of fluid were in each side of the chest. There were a few adhesions of the lungs to the pleura costalis; the substance of the lungs appeared sound, but they were in an inflated state, so as almost completely to fill the chest.

The heart was larger than usual, but was perfectly sound, except that there was a small ossification in one of the semilunar valves of the aorta. There was a small quantity of fluid in the pericardium.

All the abdominal viscera were sound except the spleen, which was not enlarged, but contained some



tubercles. There was a little thickening of the anterior portion of the pylorus, but it had not the appearance of disease. The inside of the stomach was perfectly sound.

After the viscera were examined, the bodies of the vertebræ were found to be exactly in their places. All the ligaments of the spine, as well as the inter-vertebral substances, had a perfectly healthy appearance.

The body was examined by Mr. Boot, the senior surgeon of the County Hospital, and myself, in the presence of Dr. Cookson, Mr. W. Cookson, and some of the late Colonel's domestics.

To observe the gradual diminution of the energy of the nervous system, and at last its almost total extinction, and to find after death no materially diseased part, except the arachnoid membrane, and that only changed from its healthy appearance by being a little thickened and opaque, would naturally lead to one or other of these two suppositions; either that this membrane is in itself a very important agent in the nervous system, or that it is an index to shew the state of the parts with which it is connected, and which, in point of fact, are labouring under the same disease, though so constructed as to escape observation. Now, with regard to the former of these suppositions, if it were true that the arachnoid membrane was spread only loosely over the chord, as on a superficial examination



it appears to be; and yet the change of appearance in it, which I have described, had naturally produced the violent symptoms stated in the preceding case, undoubtedly it must be looked upon as of such importance from its extreme sensibility of morbid changes, as to render it impossible for any one to have the nervous system perfect, when this membrane is in any way diseased. But in direct opposition to this, in the instance of James Cawthorn\*, where we might reasonably suppose this must have been the case from the number of cartilaginous deposits in the arachnoid membrane, we know that no impaired functions were the consequence, I am, therefore, strongly inclined to favour the latter of the two suppositions I have stated. And, indeed, I am much disposed to believe, that the arachnoid is not merely a loose covering of the chord, but that it is reflected over both the inside of the dura mater, and the exterior surface of the pia mater. It appears to invest the pia mater closely, and to be reflected from its posterior surface to form the loose covering.

To account, therefore, for the symptoms in Colonel Sibthorp's case, I should say, that the diseased appearances of the arachnoid membrane, were merely indicative of a similar disease in the more vital parts of

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\* See page 215.



the chord, with which it is connected. I think it most probable, that when the arachnoid membrane becomes changed from inflammation, whether chronic as in this case, or acute as in the case of Cornelius Bishop's\* son, that the pia mater partakes more or less of the same action. The pia mater is so closely connected with the chord, and contains so many blood vessels, as to be very unfavourable for marking those delicate changes observable in the arachnoid membrane; but which, even in this latter membrane, would be frequently overlooked, were it not for its natural thinness and transparency. The chord is composed of a very beautiful and delicate cellular texture, within the cells of which the medullary matter is contained. The cells are attached to, and indeed are, I apprehend, a continuation of, the pia mater or at least have their origin from it. From hence, should the same change of structure take place in the pia mater as in the arachnoid membrane, we may readily conceive how it might be communicated to the cellular structure, containing the medullary matter, and thus impair its natural powers; and that this might go on in the same degree as in the loose arachnoid membrane, and yet be so little marked in its appearance in the pia mater and the delicate cellular structure, as to escape the utmost penetration of the anatomist.

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\* See page 213.



Dr. Maty has related the case of Count de Lordat, who was overturned in his carriage from a pretty high and steep bank. At first he felt a good deal of pain along the left side of his neck, but after a few days he did not experience the least inconvenience from the accident. Some months after, he began to find a small impediment in uttering some words, and his left arm appeared weaker; and though the paralytic affection continued to increase, he lived nearly four years after the accident. On dissection, "we found the medulla oblongata greatly enlarged, and surpassing the usual size by more than one third; it was likewise more compact. The membranes, which in their continuation inclose the spinal marrow, were so tough that we found great difficulty in cutting through them; and we observed this to be the cause of the tendinous texture of the cervical nerves. The marrow itself had acquired such solidity as to elude the pressure of our fingers; it resisted as a callous body, and could not be bruised. This hardness was observed all along the vertebræ of the neck, but lessened by degrees, and was not near so considerable in the vertebræ of the thorax."

It will be seen from the foregoing account, that the membranes were first affected, and the disease spread from these to the chord; and I conceive that the cellular tissue of the chord became thickened from its



being a continuation of the diseased membranes in the manner I have just been describing.

CASE :

Solomon Lanes, of Scotter, aged twenty-two years, was admitted into the hospital on the 6th of August, 1821. He was digging gravel in a pit on the 24th of July, when a great quantity of gravel fell in upon him, and injured the spine about the tenth dorsal vertebra. He had some use of the right leg, but the left was nearly paralytic; he had a tingling in it, and sensation was imperfect. He had a numbness about the anus. The spine was more curved than natural, and on the left side at the curvature, the transverse process appeared to be dislocated, and he had pain when this part was pressed. This transverse process was situated much higher up than the opposite one. He was obliged to have his urine drawn off twice a day, and the stools passed involuntarily. He had a cough and some difficulty of breathing, but these were left some time before by the small pox. There appeared to have been a fracture about the head of the radius. On his admission into the hospital, the bladder was greatly distended, causing great pain. There was so much thick ropy mucus in it that the catheter was obliged to be withdrawn several time before the urine would flow freely, and I am fully persuaded, that if his bladder had not



been carefully emptied twice or three times a day, it would have become diseased, as in the case of Joseph Larder\*.

The use of his limbs gradually improved, so that at the beginning of October he could get up, and by the end of the month was able to walk. The bladder and anus still continued paralytic.

At the end of December his urine was drawn off only once in twenty-four hours; much of it passed away in the night. In the day he had pain in the bladder, after which it expelled some urine. He knew when he was going to have a solid stool; but thin fæces passed off involuntarily. He said he had much more feeling both in the bladder and anus.

He was discharged from the hospital at the beginning of February. The use of the catheter had been discontinued for some time. He was in good health and could walk well, but the bladder and anus continued to perform their functions imperfectly, for though the bladder emptied itself, yet much of the urine passed off involuntarily.

It is an opinion too commonly received, that serious injuries of the spine very seldom admit of relief, and it is for this reason I think that so few patients of this description recover.

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\* See page 220.



There are three occurrences always to be feared after an injury of the spine, any one of which sooner or later is destructive of life, and therefore their prevention ought to occupy seriously the mind of every surgeon. The occurrences I allude to are inflammation spreading to the medulla or its membranes; disease of the bladder; and mortification of the lower part of the back and nates.

When the spine is injured the same changes take place as in injuries of other parts of the body. Inflammation, in a greater or less degree, is set up, and if the injury is below the part that supplies nerves to organs immediately necessary for the maintenance of life, it is the inflammation, I believe, which causes death, when it happens very soon after the accident. It becomes, therefore, necessary to prevent inflammation of the chord and its membranes, by general and topical bleeding; indeed the same care ought to be taken as in injuries of the head. The diet should be of the mildest kind, and an absolute state of rest in a recumbent position should be enjoined. It is not enough for the symptoms immediately ensuing on the accident to be removed, but attention to diet ought for some time to be adhered to, and every exertion of the body avoided, and especially riding in a carriage over rough roads. Should pain arise in the injured part, blood should be taken from it by leeches or cupping; or



should numbness or any other symptom denoting impaired functions of the chord be complained of, blood may be taken away in the same manner; and if the patient is not relieved, setons or issues should be made near the part. In mentioning setons and issues I would by no means recommend their being made immediately over a fractured vertebra, unless some weeks have elapsed since the accident, as issues especially may communicate with the fracture, and make it a compound one, thus causing irreparable injury.

The urine should be drawn off twice or three times in twenty-four hours; and if the bladder be insensible, so much greater ought to be the care taken in using the catheter, for an injury may be easily done; and when ulceration has begun in a part deprived of the influence of the brain, nature seems to have but little power in controlling it.

Mortification of the parts below the injury must be prevented by keeping them very clean and dry, and washing them with a spirituous embrocation, as brandy, &c.

The palsied parts may be stimulated by friction, as with a flesh-brush.

When the vertebræ themselves are injured, they are, in my opinion, best left to nature.

It has been proposed to remove the portion of the



bone pressing on the chord, but, as far as I can judge, it is very difficult, even when it is known that the bone is fractured, to determine that the pressure is produced by the bone.

In the case of Joseph Larder\* the chord appeared to have suffered so much injury it is hardly probable it could have recovered from it under any circumstances ; and had the pressure been removed, the vertebræ were so much dislocated as to leave very little probability of their continuing in such a situation as not to cause fresh pressure. There would be inflammation to contend with, and if the dura mater was wounded, very probably a sloughing of the chord, as this does not seem to resist well the effects of exposure to the air. Under all these circumstances very little encouragement is held out for performing any operation. Should a portion of a vertebra, to which the spinous process is attached, be merely pushed into the canal, there might be some probability of success from extracting it ; but even this must be attended with much difficulty and hazard.

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\* See page 220.



## CHAPTER XIV.

### OF DISEASES OF THE NERVES OF THE SENSES.

NONE of the nerves of the senses, except those of touch, seem to suffer much pain from injuries and diseases, and do not excite any constitutional disturbance; when, however, they have once become affected, they seem less liable to undergo the restorative process than the other nerves, at least as far as regards their peculiar functions.

### OF DISEASES OF THE OLFACTORY NERVES.

The power of the nerves, constituting the sense of smell, may be diminished or destroyed by the frequent application of strong odours to the nose, or from an inflammation of the Schneiderian membrane. The same thing may likewise happen from pressure on the origins of the nerves by hydatids, or an accumulation of water in the lateral ventricles of the brain, or from



their being involved in a diseased action going on at the under surface of the anterior lobes of the brain, or from a diminution of the foramina of the cribriform plate of the ethmoid bone. When there is inflammation of the Schneiderian membrane, which takes away this sense, leeches may be applied to the outside of the nose; and the inside may be anointed by means of a feather with some cooling ointment, and purging medicines may be given. All the other diseases are generally beyond the reach of art.

In the following case the sense of smell of the right nostril appeared to have been suspended by an inflammatory action going on about the crista galli.

#### CASE :

J. S. about thirty years of age, had complained of a very violent pain in the forehead for many days, especially towards the right side of the crista galli of the ethmoid bone, as far as I could understand from the description he gave of his complaints. He entirely lost the sense of smell of the right nostril, but that of the left remained perfect. He was bled copiously from the arm and from the temples with leeches, and he took antimonial powder, with submuriate of mercury and sulphate of magnesia, and was put on a strict antiphlogistic regimen. By these means the pain kept



gradually wearing away, and the sense of smell returned.

In a similar case related by Morgagni, which terminated fatally, there were evident marks of an inflammatory action having subsisted, for he says, “ On opening the head nothing unnatural was found, except at the anterior part of the brain, when on the left side some quantity of blood was effused, but on the right, towards the crista galli, the brain itself was hard and callous, and very firmly connected with the dura mater\*.”

The functions of the olfactory nerves are sometimes so diseased as to produce a sense of unpleasant odours. In some cases this is owing to ulcers, &c., about the nose and throat, but frequently there is neither a disease in the nose nor neighbouring parts, that can account for it. We know that when morbid impressions are made on the optic nerve, spots of various shapes and colours are seen, as though they were really what they appear to be. Also when the auditory nerve is morbidly affected, various sorts of noises are complained of by the patient when he is in the stillest place; and may not this perception of unpleasant odours be likewise occasioned by a morbid action of the olfactory nerves? When this is the case, the functions of the

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\* Morgagni de Causis et Sedibus Morborum. Epist. ix. cap. 25.



stomach and viscera connected with it are frequently deranged, and if these are restored to a healthy state, the disorder will generally cease.

#### OF DISEASES OF THE OPTIC NERVE.

Diseases and injuries of this nerve, and its expansion, the retina, are almost always attended with a destruction of its functions; and although every other tunic of the eye and its humours are perfectly sound, and capable of transmitting freely the rays of light, no impression is made on the retina, and this state constitutes the disease termed amaurosis.

Amaurosis generally comes on with a gradually increasing dimness of sight, and very often with a sensation as if specks of different shapes and colours were floating before the eyes. In many cases there is more or less pain in the head.

Generally the pupils are dilated, but if only one eye be affected, it retains the sympathetic power of contracting and dilating with the sound eye, so that it is necessary to keep the sound eye shut when the diseased one is examined; sometimes, however, the pupil is contracted and irregular. When the disease is coming on, many complain of a great sensibility of the eye, and an intolerance of light. In this state a slow inflammatory action is going forward in the retina, and



if its progress be uninterrupted, this tunic becomes gradually more and more insensible of light. Sometimes the disease comes on suddenly. It may be produced by a blow on the eye itself, or on the eyebrow, or below the lower eye-lid. It may be caused too by syphilitic inflammation, and by a too sudden exposure of the eye to an intense light.

It is sometimes owing to a disease of the retina, and this has in some rare instances been found ossified. Sometimes the optic nerve is wasted. It may be caused by water in the ventricles of the brain, or a tumour pressing on the origin of the nerves. Sometimes the nerves are injured by a disease altering the foramina, through which they pass from the cranium.

When this disease is the consequence of a blow on the eye, or eyebrow, it is almost always incurable, and also when it is the effect of an organic disease of the retina: in this latter case, instead of the eye looking black through the pupil, it has a pearly appearance, which is sometimes inclining to green. When it is connected with cataracts it is always incurable, and also when the humours are cloudy, and the pupil is contracted and irregular, and will not dilate.

When the disease is coming on, if there be flushings of the cheeks, or other symptoms of a determination of blood to the head, blood ought to be taken from the arm, and by leeches from the temples, and mercurial



purges given ; and when the inflammatory symptoms are gone off, a blister may be applied to the back of the neck and the temples, five grains of the blue pill should be given every night for a length of time, and at the same time a strict antiphlogistic regimen should be enforced.

When it comes on with a disorder of the digestive organs, remedies must be used to restore these to their proper functions. If pain in the head be much complained of, and the patient be debilitated, some blood may be taken from the back of the neck by cupping, or by the application of leeches to the temples, and then blisters may be applied to these parts. If there be no marks of an inflammatory action in the constitution, but, on the contrary, those of debility, tonic medicines should be given. The vapour of æther or ammonia may be applied to the eye, and if these remedies do not succeed, electricity may be tried.

Great caution is necessary in taking away blood in affections of the retina. I saw a man, who was totally blind ; he had complained of dimness of sight, when he was recommended by a physician to have some blood taken from the arm ; he almost immediately became blind and continued so. Such cases are, I believe, not very uncommon.

With respect to the appearances of the eye exhibited by amaurosis difficulties sometimes occur. I extracted



an opaque cataract from the left eye of a man, the right eye did not admit the least light, and the part behind the pupil was quite black, so that there was the exact appearance exhibited by amaurosis. I, however, introduced a needle through the cornea, and just opened the capsule, and the patient soon recovered his sight of both eyes. I presume the cataract in the right eye was black.

Of all the milder complaints to which man is liable, there is no one more troublesome than dizziness. The sensation it produces is not only very disagreeable, but it often comes on so unexpectedly as entirely to incapacitate the patient from proceeding with any business in which he may happen to be engaged.

When it comes on frequently, I have found it very difficult to cure by the means usually employed for that purpose. As I have in several obstinate cases removed it, I think it may not be useless to relate what has occurred to me on the subject.

When a person has become subject to dizziness, though he may in the first instance have been relieved by bleeding, yet should the complaint soon return, and especially if the body is much debilitated, a farther loss of blood will not only not relieve it, but will, on the contrary, increase it. In many cases the usual remedies may be employed with advantage; but there are others in which the complaint is continued from habit,



which must be interrupted by every thing that can improve the general health; and, with this view, I have several times given, with success, from half a drachm to a drachm of powdered bark every four hours; at the same time allowing a generous diet, with the use of wine. I have often thought malt liquor prejudicial.

Instead of dizziness, or accompanied by it, some people will have a very confused sensation in the head, attended with debility of body, restlessness, palpitations of the heart, and mental irritation, almost amounting to insanity; which I have known to be cured by the same means as in the following case, for many particulars of which I am indebted to Mr. Franklyn, with whom I attended the patient.

#### CASE :

Mr. W., about forty years of age, had been troubled with palpitatio of the heart for some time, so much so indeed, as to lead to a supposition that this organ was diseased. He was affected suddenly with fainting, so as to be obliged to keep in a recumbent position. His head felt generally uncomfortable, and he was sometimes dizzy, and sometimes complained of pain in his face and a painful tightness and soreness of the forehead and top of the head, and inconvenience when he brought the occipito-frontal muscle into action. The eyes felt stiff in their sockets, and as though the globes were too



large. He was very irritable, so that the mention of any calamity, though it did not in the least concern him, rendered him highly uncomfortable. The sound of any musical instrument irritated him exceedingly; and indeed his mind was nearly bordering on insanity. He seemed debilitated, but in other respects his body was healthy. When most affected, he was always relieved by lying on the right side, and admitting the cold air. He frequently had a sensation as though the lungs were elevating, and occasionally complained of a spasmodic stricture of the throat, similar to what is experienced in the globus hystericus. His bowels were regular.

He was at first ordered to take half a drachm of powdered bark every four hours, and this dose was increased to two scruples. He was advised to take as much nourishment as possible, and several glasses of wine daily. This plan seemed immediately to relieve him. Some months after, he made use of sea-bathing, which was of great service to him, and he is now quite well.

I could relate other cases where complaints in the head, which had rendered the patients uncomfortable for a great length of time, were cured by the same means.

When children are affected with a disordered state of the digestive organs, or worms, squinting is fre-



quently produced, in consequence of the impaired action of the abductor muscle, through an affection of its nerve produced by its communication with the sympathetic.

The third nerve is sometimes affected so that it cannot perform its functions ; and there is a paralytic state of the muscles it supplies, as may be known, not only by the inability to direct the usual motions of the eye, but also by the falling of the upper lid ; the motions of the iris are at the same time so affected, that the pupil becomes dilated, and cannot contract. These circumstances show that the ciliary ganglion is not an independent part, but that it receives its power of causing contraction from the third. In this case, the sight need not be destroyed, but the functions of the optic nerve may continue perfect ; so that I conceive the powers of the fifth may remain also in the ganglion, notwithstanding the functions of the third are impaired. Complete blindness may exist with a perfect appearance of the eyes and free motions of the iris ; and this proves that the iris is not moved through the retina, but that the ciliary ganglion gives the power of feeling light to the iris.

As the iris has the same properties as other muscular contrivances, and as its action is necessary for the perfect functions of the eye, but as it is required to have peculiar qualities, and not much dissimilar from those



of the involuntary muscles in general, the lenticular ganglion is found to be capable of imparting that mixed nervous excitement, which makes the actions of the iris independent of the ordinary functions of the third nerve, but at the same time sufficiently assimilated with them for producing a harmonious co-operation. As the fifth supplies the exterior apparatus of the eye in a considerable degree, so it would reasonably be expected that its interior should be associated with it by contributions from the same nerves, but as these are principally for sensation, and the muscles of the eye receive nerves, which are entirely for exciting muscular action, it becomes necessary to associate nerves from both sources by means of this ganglion; and as the actions of the iris are principally controlled by light, so it is requisite it should be composed of nerves both of sensation and motion. This is the only example of an external agent immediately exciting muscular contraction without the interposition of another part. Cold, indeed, affects the skin, and then by connected agency, muscular parts, as the bladder, &c. I conceive the lenticular ganglion exists for exciting the peculiar actions of the iris, and that it should not be considered as part of the sympathetic, as the communication with this nerve is very indirect, and does not correspond with the general order of its ganglia.

I have stated that the lenticular ganglion may exist



for uniting together nerves of sensation and motion ; but when the lenticular ganglion is entirely formed by a branch of the third, it may only be for making the motions of the iris sufficiently independent of the actions of the third in general. When it is formed of the third alone, the sensibility of the iris must either be produced by it, or through sympathy with the retina ; but as no communication is particularly formed between these nerves, it may be presumed that the third can produce sensation as well as motion.

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#### OF DISEASES OF THE GUSTATORY NERVES.

THE gustatory nerves are sometimes injured by being violently bruised between the teeth, and though there is no apparent injury of the tongue, the powers of the nerve, producing the sense of taste, will be destroyed, as in the following case related by Sir Everard Home in the Philosophical Transactions.

“ A gentleman, by an accident which it is unnecessary to describe, had his tongue bitten with great violence. The immediate effect of the injury was great local pain, but it was not attended with much swelling of the tongue, or any other symptom, except that the point of the tongue entirely lost its sensibility, which deprived it of the power of taste.

“ Whatever substance the patient ate was equally



insipid. This alarmed him very much, and induced him to state to me the circumstances of his case, and request my opinion. I examined the tongue a fortnight after the accident, it had the natural appearance, but the tip was completely insensible, and was like a piece of board in his mouth, rendering the act of eating a very unpleasant operation. I saw him three months afterwards, and it was then nearly in the same state."

A woman was stung by a wasp on the tip of the tongue, which became slightly swoln and very painful. For a week she could not taste any thing, but after this period her taste returned.

If there be a considerable obstruction to the passage of air by the nose, the sense of taste is rendered very imperfect. It is necessary for the perfection of taste to have the surface of the tongue brought into close contact with the palate, and even the slightest impediment to this takes away the exquisiteness of the sense. If breathing cannot be carried on by the nose during the time of taking very pungent liquors into the mouth no sense of taste is produced, as many people know by having nipped the nose at that moment. This is prevented by the air, which must then pass between the tongue and palate on account of the stoppage in the nose, and keep these parts too much asunder.

The gustatory nerves are disordered in their functions, when things that are at other times sapid make no im-



pression on the tongue, or a very different one from what they are accustomed to do; or, again, when various unpleasant tastes are continually in the mouth. All these affections are generally symptomatic of a disordered state of the stomach, which must be corrected in order to restore the proper functions of the gustatory nerves.

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#### OF DISEASES OF THE AUDITORY NERVES.

IN the following case I had every reason to suppose that the base of the skull was fractured, that the petrous portion of the left temporal bone was very much injured, and that the auditory nerve was destroyed, or so much injured, as to be incapable of performing its functions, as the patient never heard again with that ear.

#### CASE :

A man fell from a loaded waggon, and pitched on his head on the left parietal bone. A small wound was made, but this bone was not injured. Much blood flowed from the left ear, and a little from the right, and he became insensible. On being bled he became more sensible, but the next day was again insensible. His pulse was eighty, and weak. Four grains of submuriate of mercury and purging medicines were given him. The third day he kept sleeping, but when roused appeared more sensible. The purging medicines had



operated, and his pulse was seventy-two, and weak. Four grains of the antimonial powder and a saline draught were given every four hours. On the fifth day he became quite sensible, but had pain in his head and was entirely deaf. On the seventh day the pain in his head had increased, his pulse was fifty-four, and his cheeks flushed. Six ounces of blood were taken from the arm, which relieved him. On the eighth day he continued better, though his pulse was only fifty-four. On the tenth day he kept mending, but when he attempted to walk, his legs appeared very weak. He continued entirely deaf. A great quantity of an aqueous fluid had kept constantly discharging from his left ear, and some from his right.

On the second day after the accident the fluid was very much tinged with blood, but after that it became gradually paler. On the tenth day it was quite pale, I collected some in a tea-spoon, and made it boil over a candle, but it did not coagulate, and it was salt to the taste.

Some months after when I saw him he could hear tolerably with the right ear, but remained perfectly deaf of the left.

The functions of the auditory nerves may be impaired so as to produce deafness. When this is the case, the patient finds he cannot hear sounds that he was ac-



customed to, and is at the same time tormented with various noises, which are compared to the undulations of the sounds of bells, humming of bees, waterfalls, &c; and, if the complaint increases, he becomes so deaf as not to hear at all without the greatest difficulty.

When the functions of the nerves are entirely destroyed, the patient does not complain of any noises. One case of this kind I have seen in a man about sixty years of age. He could not hear the loudest sound in the least degree; and as this usual characteristic symptom of nervous deafness was wanting, I thought the complaint might arise from imperforate Eustachian tubes. I therefore punctured the membrane of the tympanum of each ear, but it did not make the slightest difference.

The noises, attending nervous deafness, likewise attend diseases of the external auditory meatus, as when it is filled with hardened cerumen, and likewise when there is a diseased state of the membrane lining the meatus. When there are noises with a loss of the sense, and the external auditory meatus and the membrane of the tympanum have every appearance of being in a healthy state, if the patient stops his nose and mouth and blows downwards, and feels that peculiar sensation which every one does when the Eustachian tubes are perfect, and if a watch cannot be heard,



except very faintly, when it is in contact with the head, face, neck, or teeth, we may be certain that the disease is in the nerve.

The peculiar noises attending deafness arising from a complaint in the external auditory meatus, and those arising from an affection of the nerves, have been supposed to be characteristic of one or other of these diseases, according to the sound it is compared to, but this distinction cannot be relied upon.

Too hasty decisions have been sometimes made in cases where the patient has complained of noises attended with deafness; some of these have been decided upon as proceeding from nervous affection, when it has been afterwards clearly ascertained that they have depended upon hardened cerumen, the removal of which has immediately cured the patient.

When this disease first comes on, submuriate of mercury should be given every night, and as much sulphate of magnesia or jalap in the day-time as will purge the patient. Blisters should be applied behind the ears once a week, and abstinence from fermented liquors and animal food enforced.

When it comes on, attended by symptoms of a great determination of blood to the head, the patient should be bled, otherwise he may be seized with a fit of apoplexy.

When the remedies I have just advised are used in



the beginning of the disease, they will very frequently remove it; but when it has continued long, their efficacy is so doubtful as to deter a surgeon from urging a patient to their employment.

In tracing the tympanine branch of the glosso-pharyngeal nerve, which has been so particularly described by Jacobson, much of its distribution may be seen on the transparent membrane lining the tympanum when this part is perfectly sound, but when it is diseased a very considerable difficulty is experienced. In an attempt to trace this nerve in the head of an old woman, the membrane lining the tympanum was not only thickened, but there was at the same time some roughness of the bone. In the head of a man, who had a suppurating node on the forehead, and whose posterior nostrils were stopped up by adhesions of the soft palate, this membrane was also thickened; the spheno-palatine ganglion was very considerably enlarged. In the dissection of the head of a very young woman the Schneiderian membrane, covering the inferior turbinated bone of the left nostril, adhered very considerably to that of the septum, so that a very little passage was left for the air; there was a perforation in the membrane of the tympanum of the same side, and purulent matter was contained in each tympanum. The membrane lining the tympanum was so much thickened that the nerves could not be observed.



I believe deafness does not so often depend on a disease of the auditory nerve as has been supposed, but much more frequently on an inflammatory action attacking the membrane lining the tympanum, and involving these small branches of the tympanine nerve. There are very few deaf people who cannot hear music or singing, or who cannot hear conversation, whilst they are in a carriage in motion. But it is not so with those who are nearly blind, for when the optic nerve is paralysed, no light, or any modification of it, can produce perfect sight, and it must be the same with the auditory nerves with respect to sound. I will not deny that a very strong light may enable a person who has a slight degree of vision to see some objects almost in the same manner as a very deaf person hears with a speaking trumpet. I believe, therefore, that deafness depends very frequently on the inflammatory action which has impaired these minute branches of the glosso-pharyngeal nerve, distributed on the tympanum; and although many of the noises may depend on the disordered functions of the auditory nerve, I nevertheless think they may arise, too, from these small branches of the glosso-pharyngeal, and their communication with the sympathetic in the carotic canal. It may be asked how music, &c., dispose the ear for receiving the fainter sounds, as those of the voice. I conceive these excite the parts about the tympanum in



the same way that stimulating things would any other organ; and that by this excitement such a degree of action is imparted to the whole as is present in a healthy state of the organ. When the functions of the gustatory nerves are impaired, people cannot taste properly; but when these have been stimulated with a little wine, the taste again becomes exquisite. This may not be thought a fair argument; but I conceive the wine becomes a local stimulus, although it may, at the same time, be a general one, and by both means effect the same purpose.

The consideration of the distribution of the tympanine branch of the glosso-pharyngeal nerve, leads to the conclusion that the tympanum performs more important functions in the production of hearing, than have been usually ascribed to it; and that the failure of remedies in cases of deafness, which have been termed nervous, may have proceeded very much, not only from the obscure situation of the tympanum, but from the misapplication of the remedies themselves. And I conceive, therefore, as a thickening of the membrane lining the tympanum, and involving such delicate nerves, can be so often observed, that many of the diseases of the ear may be more within the reach of art than has been contemplated: and that by subduing the inflammatory action at its very onset, before the structure of the delicate parts has become so much



changed as permanently to impair their functions, many of the worst cases might be prevented.

It is not an unfrequent occurrence for deafness to be produced by very loud sounds, when the ear is unprepared for receiving them ; but it is difficult to determine which part of the organ of hearing particularly suffers. I have thought that the injury was done principally to the tympanum, and this opinion is rendered very probable by the following case. I had seen the gentleman who is the subject of it ; but as the facts are important, I prefer giving them in his own words :—

“ In reply to Mr. Swan’s questions, Captain Norton begs to state, that blood only came from the left ear being in a right line towards the percussion ; yet the singing or intense buzzing was equal in both ears—sometimes like the chirping of ten thousand sparrows, and at others a monstrous hissing. The first day Captain Norton could not hear any thing, and the second day could only hear a person who placed his mouth close to the ear, and spoke in a modulated tone ; could not hear the high notes of a fife ; could not distinguish the tune ; he could not hear the boatswain’s call (whistle).

“ Some four or five weeks afterwards Captain Norton was again in action, and was close to the muzzle of a



gun when fired, and the report most completely restored his hearing for two days, when the singing again commenced. Captain Norton is of opinion that his hearing is as acute as ever, and it is only the singing which confuses sounds ; for when one person only is speaking, he can hear him tolerably well ; but when three or four are speaking at the same time, he cannot distinguish any one : he can hear a distant gun or bell as well as any one.

*“ Portsmouth, August 10th, 1829.”*

It must, I conceive, be admitted that the membrane of the tympanum was ruptured in the preceding case to have permitted the flow of blood from the left ear, and that the injury was almost entirely confined to the tympanum. Particular sounds could be heard, but words could not be sufficiently distinguished in a conversation carried on by several persons. These occurrences are very common in deafness, and arise very probably from the membrane of the tympanum and the membrane of the round fenestra not acting in unison. Hearing in the mammalia is, I presume, produced both through an impulse given to the labyrinth by the ossicula, and a modified one to the membrane covering the round fenestra, so that particular sounds are heard through one of these parts and not through the other ; for I cannot conceive that the



membrane of the round fenestra exists only for modifying the undulations conveyed through the labyrinth from the ossicula.

The membrane covering the interior of the tympanum, as well as that of the round fenestra, may not be in a state for receiving properly the undulations from sound, as it may be thickened, and therefore incapable; or the functions of its nerves may have become impaired, so that its action cannot correspond with that of the membrane of the tympanum; or the latter may alone be affected, whilst the other parts of the ear are healthy.

The membrane of the oval fenestra receives the undulations from the membrane of the tympanum through the ossicula, and continues them through the semicircular canals and the scale of the vestibule, as far as the apex of the cochlea, where they meet those imparted by the membrane of the round fenestra to the scala of the tympanum; therefore, unless the membrane of the tympanum and that covering the round fenestra, are in an equally perfect state, confusion of sounds must be the consequence, as the nerves spread on the whole labyrinth are so intimately connected, that all the mechanical impressions made on them at the same instant must be in unison, or in such proportions as the original conformation of the labyrinth requires from its respective parts of the tympanum.



Some deaf persons cannot hear sounds that are either too high or too low, but only those that are moderate. I conceive that the several parts of the tympanum are in different states of activity in deafness, and presuming that some of the notes of music pass both through the oval and round fenestræ, in modified degrees, and these two parts may be so influenced by any morbid changes as to prevent the production of motion corresponding with the degree of impression required in each of them for unison, the one must confuse or destroy the power of the other; and, therefore, if the voice or music be so managed as either to excite an equable action in both these parts, or be so adapted to one of them as quite to overpower or make no impression on the other, distinct hearing will be the consequence; and perhaps the motion of a carriage, by stimulating all the parts at the same time, produces that equable action which is necessary for fitting the deaf ear for hearing.

In the preceding case, on the restoration of the hearing for two days, the sound from the discharge of the gun acted as a stimulus to the membrane of the tympanum and the nerves distributed on it and the tympanum. Whether the auditory nerves themselves were affected, must admit of some doubt. I have stated in a former paper, that these are not so often implicated as has been supposed; but that deafness,



and the noises which accompany it, very often depended on the state of the nerves distributed on the membrane lining the tympanum. The auditory nerves themselves have very seldom been found defective or diseased, yet they may suffer either at their connection with the brain, as when deafness is accompanied with epilepsy; or in their distribution in the labyrinth, in the same manner the optic nerves and retina do in amaurosis. But I wish to establish that, in a great proportion of habitually deaf people, these nerves are not affected. If such conclusions lead to no improvement in the cure of deafness, it may appear a useless waste of time to enter into any discussion on the subject; but if a knowledge of the true seat of deafness be gained, a better mode of treating it will follow. If it be proved that deafness is most commonly seated in the tympanum, it is bringing the disease not only to a part more within our knowledge and nearer to the surface, through which remedies may be more efficaciously administered, but the very circumstance of its being within our reach, of its not being primarily seated in the brain and the delicate auditory nerves, may give reasonable ground for presuming that, although the nerves of the tympanum may be implicated, the diseases which involve them may be removed, and, by sufficient care, permanent deafness



prevented. I conceive that the foundation of deafness is most frequently laid in childhood, and the inflammatory action, which is its origin, is not attended to, because it is merely ear-ache, discharge from the ear, &c.; but when this has once begun, exposure to cold, disorders of the digestive organs, &c. renew it, and in time the functions of the affected part become permanently impaired. It is an undoubted fact that modern surgery has prevented not only numerous operations, but deformities; because more care has been taken of incipient complaints, and a rational method of treatment has been adopted for their removal. Why should not this same care extend to one of the most exquisitely formed organs in the body—one on which so much of the comfort of man depends, and the loss of which is so deeply lamented by those who have experienced it? If when inflammation has been set up in the tympanum from any cause, means were taken to counteract its tendency to change of structure, and these were persevered in until the restoration of the organ became perfect, and a repetition of its exciting cause then obviated, why should not deafness be rendered less frequent, as well as blindness, and deformity from diseased joints?

Although the following papers belong in a considerable degree to physiology, yet as they also relate to



disorders of the nerves connected with the organ of hearing, I shall take this opportunity of republishing them.

Of all the comforts enjoyed by man, none is greater than that of perfect hearing; and when we reflect on the numbers that are deprived of it, and of the little good that can be done for diseases of the ear, this question naturally arises, whether it is owing to our ignorance, or to an impossibility, that we cannot cure them?

Insulated facts may at first be apparently trifling, yet when taken into the general account may produce something of the greatest importance. These considerations have induced me to bring this paper before the public; for as I have discovered an anatomical fact which I cannot find any where taken notice of, and as it will account for some part of the physiology of the ear not before generally understood, it may lead to a perseverance in trying to supply some of the defects of that organ, and thereby render a great service to many labouring under its infirmities.

When the ears are stopped, and a watch is brought in contact with any part of the head, face, teeth, or neck; or if a stick, water, &c. be interposed between any of these parts and the watch, the sound will be heard as well as when the ears are open.

It has been supposed that the sound is mechanically conveyed through the flesh and bone in the same way



it is through a macerated bone, piece of wood, &c.; but if it were so, it must be heard always when the auditory nerve is perfect, at whatever part of the head, face, &c. the watch is applied, but this is not the case. When the hearing through the external meatus has been perfect, and there has been no apparent alteration in the structure of the head, face, &c., I have seen many who could hear from only one of these parts, and several who could not hear from any of them.

If I stop my ears and rest my chin on the petrous portion of the temporal bone in a macerated skull, and place my watch in contact with any part of the skull, I can hear the sound perfectly. I saw a boy who was born deaf and dumb, but had been taught to speak, and when a watch touched the left side of his face he could hear it, but when it touched any part of the right side he could not in the least.

A man who was recovering from an illness had become so deaf of the left ear that he could just hear my watch when put very near it: he heard perfectly of the right ear. I desired he would stop his ears until he could not hear my watch when put nearly in contact with them; I then let it touch the left side of the face, &c: he just heard it, but when I let it touch the right side, he heard it distinctly.

If sound is conveyed mechanically through the flesh and bone, what in these two cases should hinder it from



being heard distinctly, when the watch touched either side of the face, any more than in the macerated skull?

If sound is not conveyed mechanically through the head, face, &c., it must be through some other medium, and that I believe to be the facial nerve of the seventh pair and some other nerves connected with it.

On dissecting the seventh pair of nerves in man, I find at the bottom of the internal auditory meatus a communication between the auditory and facial nerves.

In sheep I have observed the same communication.

In fishes several nerves, that have a communication with the auditory nerve, are spread on the skin over the whole head.

If we consider how the facial nerve is connected by nervous substance with the auditory, its extraordinary course, its receiving the branch of the vidian nerve and the chord of the tympanum and, when it has got out of the stylo-mastoid foramen, its great expansion, I think we may conclude that it was made to serve some greater purpose than has hitherto been ascribed to it.

That this provision of nature has been useful to deaf people, the following case, which may be found in Haller's *Prælectiones Academicæ*, will prove. 'Musicus fuit in aulâ, ex morbo factus surdaster, prehendebat vestibulum mordicùs, et tum omnino chelyn ex arte pulsabat.'



That it might be useful to many, could proper instruments be made to increase the effect of sound, and especially to those who are deaf and dumb, if properly persevered in, is, I think, probable ; but it must be remembered that, when the disease is in the nerve, no good can be derived from it, which may be ascertained after a few trials by the expression of the child, if a sounding body is applied to the head, face, neck, or teeth, and that many deaf and dumb can hear in this way, I am myself, from experiment, well convinced.

If from what has been said it should appear probable that sound is conveyed by the facial nerve to the auditory in man, it will, I think, be reasonable to conclude, that the nerves, which are spread on the soft parts of the heads of fishes, answer, in a great measure, the same purpose the tympanum does in man ; and though in man this provision is not necessary when the tympanum is perfect, yet when that is imperfect, it becomes the means of conveying sound to the auditory nerve, and thus answers one of the most important purposes in the animal economy.

In the preceding pages I have endeavoured to prove that when the external auditory meatus is stopped, sound is not mechanically conveyed to the auditory nerve, I have likewise stated it was probable that it was from the nerves spread on the external parts of the head receiving the impressions of sound, and conveying



them to the auditory nerves, that the sense of hearing was produced in fishes: and that man might hear well in this way, when the mechanism, by which sound is usually conveyed to the auditory nerves, was imperfect. I supposed, in consequence, that people born deaf and dumb, and who had no defect in the auditory nerves, might be made to hear through the medium of the facial nerves, and thus have their unfortunate condition in some measure ameliorated.

I judged that this might be done from having observed that dumb people could hear a watch when in contact with the face, and likewise from a case then related of a musician, who was enabled to play by having part of the instrument between his teeth. With respect to making the dumb understand various sounds, and thereby enabling them to speak, I could then urge nothing more than a probability, but I now, in the following case, have the power of proving how sensible the facial nerves are of the impressions of sounds, and that what I thought probable is really practicable.

Elizabeth Nobles, aged thirty-six years, was born with the external auditory meatus of each ear imperforate. In the right auricle there is a very slight trace of the external auditory meatus, and there appears to be no other part of the auricle but part of the helix and the lobe. In the left there is a slight trace of the



meatus, but it is only about one-sixteenth of an inch deep; there is the form of the auricle, but the different eminences are not distinct, and the communication between the external air and the membrane of the tympanum of each ear, if these exist, is as completely obstructed as is possible. She did not begin to talk at all intelligibly till she was seven years old, and she did not talk tolerably well before she was about twelve: she can now talk to be perfectly understood. She can hear perfectly when a person addresses her at the distance of six or seven yards. She cannot hear so well, when the person speaking is behind her. She cannot hear a watch unless it is in contact with her face, and not if it is in her mouth, unless it is in contact with some part of this. She herself, as well as others who have known her, supposes that she hears through her mouth and nose, and from observing the motions of the lips. To prove that this is not the case, the circumstance I have related with respect to the watch might suffice, but I made her shut her eyes, and she heard distinctly what I said, as likewise when both her mouth and nose were quite closed. Putting a cloth over her mouth, and nipping her nose, have made a slight difference now and then; but nothing more than I could suppose would happen from the extent of the face the sound was thus kept from. I have pressed my fingers on the parts where the external auditory meatus should



be, but she heard just as well as before. I have put a thick cloth over them, and at the same time pressed this as close as I could, but it made no difference. I stood four feet from her after having put a linen cloth over her face, and when I addressed her, she heard distinctly. I then put over the linen a piece of flannel, and she still heard me. I then put over the flannel a large woollen cloth coat, and asked her several questions, but she could not hear any of them. I removed all the coverings, and used the same words in the same tone, which she told me immediately. I made the same experiment another day, but she heard all the questions I asked, though more faintly, according to the covering put on her face. Some variation will always exist in these experiments, for it is impossible always to remember the exact tone of voice made use of in them, and some little difference may likewise exist in the coverings. She could hear distinctly tunes played on the pianoforte at the distance of seven or eight feet, and I covered her face, as in the other experiments, and the sounds were fainter. I pressed on her ears with a cloth, but she heard the tunes just as well. I placed her in a chair near the piano, and covered her face so as to hinder her from hearing so well: I then placed her hand on the piano, and she heard much better: I then tied a silk handkerchief tight round the arm, and she did not hear so well, and she heard better again when



I loosened it. She cannot hear the sounds of bells at a distance ; nor hear the cathedral clock strike unless she is very near, though the hammer strikes on a bell, which is one of the largest in the kingdom, and can be heard at different times at the distance of several miles.

When her face or teeth are in contact with the piano, on which any one is playing, the sound is very loud to her.

I made the first experiment at her own house when no one else was present, and the second at my house, after she had walked fast, and before company.

In the case I have related no means were employed beyond those that are made use of for the instruction of children in general, and no pains were taken to make her understand, as is very generally done in the education of dumb children : it therefore may not be uninteresting to inquire, why this faculty of hearing, in dumb people, is not even occasionally perfected in those who have had much trouble bestowed on them for their instruction.

May not the reason be—I speak only of those whose auditory nerves are perfect, and who have the facial nerve capable of receiving impressions of sounds,—because their whole attention has been taken up with signs, &c., and no methods have been used to increase the power of the provision really made by nature, for supplying the defects occasioned by imperfections of the



tympanum? I think this may be the case, because we find that the sensibility of the nerves, as far as the performance of their particular functions is concerned in the production of the senses, is increased by proper use. This I apprehend is the case with all the senses, but I will instance only one with regard to that of hearing. Many young people, it is said, have no ear for music; and perhaps, if no attention were paid to it, they would never have it as long as they live: but, I believe, in almost every instance of this kind, by proper instruction from a master, and proper attention from the pupil, music may be taught, so that the learner may have as correct a judgment respecting every part of it, and be made to play and sing as well as many people who have ever so good an ear for it naturally. Do we not find this argument supported by anatomical facts? Many of the nerves, like the muscles, enlarge by constant use. When much irritation has existed in a limb, the nerves of that limb may be found much enlarged far beyond the place where the disease existed, and the nerves will have a healthy appearance, exactly as muscles have that are enlarged from use, compared with those that have been more inactive. Do we not find in subjects where the different features of the face are the most marked, that the facial nerves are much larger, and apparently more numerous, than in those where the expression has been less? And is it not the



case in very old people where sensation is almost lost, and the nerves have been but little exercised, that the facial nerves are so small and fine as to be with difficulty dissected? If this is true, may we not suppose that in dumb people the facial nerves would have much more power of receiving the impressions of sounds, if they were properly exercised, than when no exertion of this sort is used? I doubt not but that many people have the power of hearing sounds with the face when the mechanism of the ear is perfect, for I have frequently stopped up the external ear as close as possible, yet the human voice has been heard.

Presuming that what I have said is well founded, it is not reasonable to expect that the powers of the facial nerves will ever be fully developed in dumb children, if their instructors do not direct by far the greatest part of their attention to the proper exercise of these nerves. And if this is to be done effectually, it must probably first be by the assistance of instruments to increase the effect of sound; and when these have been properly used, and have answered the intended purpose, then to gradually lessen their power until common sounds can be heard.



## CHAPTER XV.

## OF DISEASES OF THE SYMPATHETIC NERVE.

THERE is a peculiar perceptibility in the sympathetic nerve, which is well suited for the functions of the different organs to which its branches are distributed. It would be unreasonable to expect that it should have the same sort of sensibility as the nerves of the skin, as the parts it supplies are of a more delicate structure, and generally covered with matters, that would irritate the skin, and therefore produce pain and destructive inflammation.

It is almost unnecessary to state that this nerve is susceptible of pain in many forms of disease.

Bichat has not considered the sympathetic nerve to be so devoid of the properties of other nerves as the current opinion has tended to inculcate, and that he was not satisfied with the knowledge he had acquired may be learnt from the regret he expresses on account of the great difficulty of making experiments.



He says \*, “ I laid bare the semilunar ganglion ; I irritated it very much ; the animal remained unmoved ; but when I irritated a cerebro-lumbar nerve by way of comparison, he cried out, raised himself up, and struggled.”

Again †, “ I am still far from believing in the absolute insensibility of the nerves of ganglions, but certainly under the circumstances I have just now related, the cerebral nerves would have caused much more pain. I think that in the diseased state this sensibility is susceptible of being much increased ; no one can deny that the solar plexus does not take a considerable share in the different sensations experienced in the epigastrium, &c.”

Again ‡, “ But in knowing the uses they do not fill, we are ignorant of those for which they are really destined. I have already observed, that the difficulty of making experiments on the ganglions and plexuses will retard very much the progress of science. We have scarcely any branches at the exterior of the body on which we can act.”

In the following case part of the sympathetic nerve had been destroyed by ulceration, in the exfoliation or rather destruction of the temporal bone.

\* Anatomie Générale, tome i. page 227.

† Page 241.

‡ Page 242.



## CASE.

William Sharpe, eleven years of age, had a purulent discharge from the left ear, which began in the spring of 1824, kept gradually increasing, and became very offensive. Blisters were applied many times behind the ears, and tonic medicines administered without producing any good effect on the local disease, although his general health was improved by them. About the end of March, 1825, the integuments around the ear became swoln and painful, and the whole side of the face was enlarged. At this time the discharge was very copious and offensive; he had frequent pains in the head and over the left eye. On passing a probe into the meatus the bone was found to be denuded; his health had declined, and tonic medicines were of no use. In December it was observed that the left side of his face was nearly paralytic; he had violent pains in the head and face, which were much aggravated at night, and for which he took an opiate with some relief. He was frequently drowsy, and sometimes nearly comatose. In February, 1826, there was some inflammation of the conjunctiva of the left eye, which went off in a few days. On the 12th of October the left temporal bone appeared to be quite loose in the wound, and was easily extracted. About a week before this time his right eye became amaurotic, the pupil was dilated and the lids closed. On the 14th he became



insensible, but cried out when touched. On the 16th a large vesicle formed at the inferior part of the left cornea, and the greatest part of the cornea had become opaque. The right cornea was not altered. He had slight convulsions, and when the left side of his face was touched he flinched. He died in the night.

He walked about until the last few days. He had generally a good appetite. His food appeared to digest properly, and indeed all the functions of the viscera of the chest and abdomen were perfectly performed. He could talk distinctly. The left side of his face was nearly paralytic, and the left side of the nose was completely drawn to the right side. When he cried out, so as to exert the muscles of the face much, it was observed that those of the right side had very great power over those of the left ; but the mouth, when shut, appeared even, and would not then have been supposed to be paralytic. From the end of last March the pain in the right side was very severe, he shrieked very much, and the opiate did not relieve him. His manner became altered, and he was unwilling to answer questions. He was generally easier in the day, and spent much of it sleeping in the sun.

#### EXAMINATION.

This took place on the 17th of October, at eleven A.M.

The dura mater was rather more vascular than is



usual. The arachnoid membrane was much thickened, and especially on the right side, and there was much fluid between it and the pia mater. The pia mater was very vascular. There was much fluid in the lateral ventricles. The portion of brain which lay over the part from which the temporal bone was separated, was protruded into a hernia, and the inferior cornu of the lateral ventricle was thereby drawn out of its course; the brain at this part was softer than natural, but the rest of it was sound. The origins of the nerves were distinct.

The third branch of the fifth pair was in a state of ulceration, near its beginning from the Gasserian ganglion; the gustatory, dental, and buccal nerves were however quite attached to it, and indeed did not appear to have suffered.

The auditory and facial nerves terminated in a bulbous mass on the dura mater. The facial nerve could with difficulty be traced in the face near the edge of the jaw, on account of the inflammatory process which had been going on there. It could, however, be distinctly seen to communicate with the dental nerve, and then terminate in a confused mass, which formed the walls of the cavity containing the exfoliating bone.

The par vagum, the glosso-pharyngeal, and the accessory nerves were sound, and passed just behind the walls of the same cavity.



The internal carotid artery, from above and below, could be traced as far as the walls of the cavity, and was then lost. It was reduced to a small size, however, before it reached the walls of the cavity, and was impervious.

The superior cervical ganglion of the sympathetic nerve terminated in the walls of the cavity. The branches given off from the sixth, which usually go to the superior cervical ganglion, were very small, and terminated with the internal carotid; the superior cervical ganglion itself appeared natural.

The vidian nerve was perfect from its connexion with the spheno-palatine ganglion. The superior branch could be traced a short distance, but soon became much smaller than usual; the inferior branch could be traced a little way, it then became very small, and the branches from the sixth could be traced the same distance, and both of these terminated with the internal carotid artery, in the walls of the cavity.

The condyloid process of the lower jaw was exfoliating. The whole of the temporal bone had exfoliated, and to compensate for it, the orbital plate of the frontal bone had become unusually thick, and all the bone in the neighbourhood of the disease had a firmer texture than is observed at his age. The pericranium round the opening at which the hernia protruded, was much more vascular than in the other parts.



A considerable portion of the brain had protruded like a fungus, into the cavity left by the exfoliated bone; it had been forming gradually, and was, no doubt, the cause of his death.

The quantity of fluid contained in each ventricle was the same, and therefore, the blindness of the right eye did not depend on this as its cause, for vision remained in the left after the right one was blind.

In the examination, a black pin was found in the cavity, which had contained the exfoliated bone. Pins had not been used to confine the dressings, the question therefore is, whether it had been forcibly introduced into the ear, and occasioned the disease, but this could not be ascertained.

It will be seen from this very curious case, that the sympathetic may be partly destroyed, and the general health remain unimpaired, as we have a right to presume after a due consideration of all the circumstances which have been related. We may conclude, therefore, that although the sympathetic nerve produces a general sympathy in the body, yet that each ganglion has a somewhat local influence, inasmuch as it more particularly connects the parts giving and receiving branches from it, so as to associate them in complicated operations. Both the sphenopalatine ganglion, and the vidian nerve, were first of their usual size, then each



branch of the vidian was diminished. Can it be presumed from this, that the branches of the vidian are going to, and not coming from, the sympathetic nerve?

The functions of the facial nerve must have been entirely suspended, and, from the evenness of the mouth when at rest, and from his ability to speak so well, I cannot help concluding that the branches of the fifth had very considerable power in exciting the action of the muscular structure of the lips.

#### EXPERIMENT.

July 3rd, 1827.—I cut out a portion of the sympathetic nerve of each side in the neck of a rabbit, which was nearly full grown. I also removed a portion of the left trunk of the par vagum. It ailed very little after the operation, and in a few days appeared quite well, and has remained so ever since. It ate with a good appetite, and was always lively and playful. It was killed October 1st.

The right sympathetic had united by very minute filaments.

The upper extremity of the divided trunk of the par vagum had a bulbous enlargement, and this and its lower extremity, and the extremities of the left sympathetic, were united together by a considerable plexus of small branches.



All the parts of the body were well grown, and in every respect perfectly healthy in appearance.

#### EXPERIMENT.

July 3rd, 1827.—I cut out a portion of the sympathetic nerve in the neck of a rabbit, exactly like the one which was the subject of the preceding experiment. In the evening he appeared well, and ate with a good appetite. He never ailed any thing after the operation, and did not appear to suffer the slightest inconvenience. He was killed September 17th, and was well fed and perfectly healthy.

The right sympathetic was united by some small filaments, and the superior portion was also united to the trunk of the par vagum; the left was also united by several filaments, which formed a plexus. Every part of the body appeared quite sound.

Dr. Monro\* had made similar experiments, the results of which correspond with mine, but as he had not given the appearances after death, I repeated them.

These experiments confirm the opinions that the different parts of the sympathetic nerves have, in a very considerable degree, a local influence, for the animals, which were the subjects of them, continued to thrive, to eat well, and be playful; and as far as could be

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\*Elements of Anatomy, vol. ii. page 496.



decided by observation, none of the general functions of the system were in the least influenced by the injury to the nerves. No doubt, some particular functions were disturbed, but in what degree is very difficult to determine ; but I think it not improbable that if we could be sufficiently acquainted with the habits of the animal, to be enabled to watch the effects of stimuli applied to the nose, or other parts above the division, and which were connected by it with different organs below the division, we might learn, that at the same time the ganglia are exerting a local influence, and are convenient for uniting several parts together, we should also discover that they can transmit particular impressions to a distance.

Lobstein\* relates the following cases in which part of the sympathetic nerve was destroyed.

“ A girl ten years old with paralysis of the lower extremities, laboured under a diarrhoea for three months, with gripes and tenesmus that could not be appeased. On examination I found nothing in the course of the intestines, but there was a large abscess extending from the sixth to the tenth dorsal vertebra on the left side. Connected with this was the great splanchnic nerve, unchanged in structure. The semi-lunar ganglia were sound and none of the branches

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\* *De Nervi Sympathetici Fabricâ, Usu et Morbis*, page 163.



arising from the solar plexus exhibited any change. On opening the abscess I found a caries which had destroyed the sixth and seventh vertebræ, whilst the intervertebral cartilages and the covering of the spinal chord were uninjured. The trunk of the sympathetic nerve from the sixth to the twelfth vertebra was evidently destroyed and its lumbar portion inflamed. The spinal chord in the course of the carious bones for sixteen lines was too white and wasted\*.”

In a large tumour formed behind the peritoneum and placed on the lumbar vertebræ I have seen the origin of the hypogastric plexus divided or broken into a superior and inferior portion; the former terminated in a ganglionic tumour similar to that in stumps; the latter, although separated from the former the breadth of a finger, was neither extended nor wasted.

Many experiments were made by exciting inflammation in various parts of the body, for the purpose of ascertaining the manner in which the irritation was conveyed to the internal parts, and constitutional fever and irritation were produced, but I shall relate only the following.

#### EXPERIMENT.

1825, January 11th.—At a quarter before 10 A. M.,

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\* De Nervi Sympathetici Fabricâ, Usu et Morbis, page 165.



a piece of gamboge weighing seventy-six grains, was inserted in a wound between the shoulders in the back of a very large dog. He soon after began to be very uneasy. In the evening he lapped much water, and afterwards vomited. He purged in the night.

12th, at seven A. M. He lies as if he were almost dead. He sometimes moves and howls, and then appears in a state of stupor. He cannot stand. At half past nine he was in the same state. Whilst I was observing him, there was a violent spasm of all the muscles of the body, which lasted about a minute; he vomited at the same time. He died about eleven.

#### EXAMINATION.

This took place at one P. M.

All the ganglia of the sympathetic nerves were very highly inflamed.

The pia mater of the brain was rather more vascular than natural, but the other membranes were healthy. The substance of the brain was healthy. There was a small quantity of serous fluid about its base.

The spinal chord and its membranes were healthy. There was a very small quantity of serous fluid in the sheath formed by the dura mater. The axillary nerves and the par vagum were more vascular than usual. The sciatic nerves had a natural appearance.



On opening the abdomen all the viscera looked healthy, except the liver and spleen, which had an increased vascularity.

The stomach contained some half digested food which had been eaten before the experiment was made. Its villous coat near the pylorus was very red; in the other parts there were numerous black spots, at each of which there was an ulcer and the black part appeared to be coagulated blood. The villous coat of the small intestines had a very high degree of redness, and was ulcerated in many places. The mucous coat of the large intestines was more red than usual.

The thoracic viscera were sound.

The wound in the back was closed; when its lips were separated, a quantity of gamboge, dissolved in the serum, flowed out, but some of it had insinuated itself amongst the cellular membrane, nearly as far as the elbow. There was a most violent and extensive inflammation of the cellular membrane, and a corresponding effusion of serum.

When a slight injury has been inflicted in any part of the body no constitutional irritation is produced, as the part is of itself fully capable of making a reparation.

When a severe injury has been received, the whole body sympathises, and the functions of every part be-



come more or less disturbed, especially those of the digestive organs, and the heart and arteries.

There is not only a disordered state of the functions of important parts at a distance from the seat of injury, but a great change in their appearance is discovered on dissection, as in the following case.

#### CASE :

Susanna Graham, a stout-looking girl, æt. seven years, was burnt by her clothes catching fire on the 20th of August 1823, at noon. The thighs, and arms and back were the parts affected ; but some of them appeared to be burnt deep. The skin of the abdomen was not burnt. She did not appear to suffer much pain. Mild ointment was applied to the affected part.

21st. At ten A. M. she complained of pain in her belly. She had vomited several times. She wandered a little and was cold, and her face was death-like. She said she remembered me. The pulse could not be felt in either arm. Purging medicines were given her, but they did not remain in the stomach.

In the evening the pulse was perceptible, but she appeared weaker and was quite insensible ; the pupils of the eyes were much dilated, and did not contract on the approach of light, but she could see, for she attempted to blow out the candle. Six leeches were



applied to the temples. She died at one A. M. on the 22nd.

#### EXAMINATION.

The lungs were very purple and loaded with blood. There were spots of ecchymosis behind the posterior mediastinum on the left side; there was a great vascularity on the outside of the aorta; there was some fluid in the pericardium.

There was an increased redness on some parts of the omentum, but the peritoneum appeared healthy. The liver was generally pale, and especially on its concave surface. There were some spots of redness on the villous coat of the stomach, but I could not decide that they amounted to disease. About six inches of the jejunum were highly inflamed.

All the ganglia of the sympathetic nerves in the chest were vascular. On the right side, the semilunar ganglion and all the rest of the ganglia in the abdomen were very vascular. On the left side, the semilunar ganglion and the first in the abdomen formed by the continuation of the sympathetic nerve, were very vascular, but the others were not. The nerves of each axillary plexus were very vascular. The sciatic nerves within the pelvis and the anterior crural nerves were vascular, but not near so much so as the axillary plexus.

After every accident in which the constitution sym-



pathises with the injured part, I believe, the ganglia of the sympathetic nerves become irritated, and the functions of the parts supplied by their branches are disturbed in consequence. The action of the heart is increased in proportion to this degree of irritation in them, so long as it continues moderate.

Although an injury in the first instance has been slight, or such as does not usually occasion much disturbance; yet if the constitution be irritable, or the body exposed to cold or other causes of disorder, it will produce a very considerable disturbance, not unlike that arising from a more serious injury, as in the following case.

#### CASE :

Mrs. Powel, æt. above 80 years, fell down in the afternoon of the 14th of November 1824. I saw her soon after, and found her complaining very much of pain in the left hip; the limb could be moved in every direction, but this motion produced excessive pain; she lay on her back, with the limb extended, and nothing was ever done except the application of fomentations for the first few days. I believed there was a fracture of the neck of the thigh bone, although the limb remained quite as long as the other, and I could neither perceive any crepitus nor any altered appearance in its position, except a slight inclination of the toes out-



wards. She had more constitutional irritation than I ever observed from a similar accident. She suffered much pain in the hip, and was in consequence obliged to take an opiate, but she got very little rest. She generally had much thirst; there was the utmost difficulty in keeping her bowels open, and she had great pain and difficulty in making water. She had no appetite for common food, and for about three weeks appeared so weak that she was under the necessity of taking wine and brandy. For some time all her urine and stools were passed in bed, but not involuntarily, and only because she could not be persuaded to use proper means; in consequence, her back became rather sore. Latterly, she complained of pain in the abdomen, which was very tender on pressure, and made even the weight of the bed-clothes inconvenient. Her tongue became very dry and brown, and in the last twenty-four hours she was insensible. She died on the morning of the 19th December, about five.

#### EXAMINATION.

This took place at seven in the evening.

There was some ecchymosis amongst the muscles about the injured part, and in the cellular membrane about the sciatic and anterior crural nerves. The greatest part of the fracture of the neck of the thigh bone, which was entirely within the capsular ligament,



was firmly united. A section was made through the fractured part, and a faint white line was perceived in one portion of the union, but the rest appeared to be entirely bone.

The viscera of the chest were sound. The outside of the aorta was very vascular. All the intestines were very vascular, as if a state of excitement bordering on inflammation had existed in them.

There was violent inflammation of the semilunar ganglia of the sympathetic nerves.

The bladder was very large, and contained some urine. The uterus was very hard, and had a small ossific tumour in the fundus. The labia were excoriated, and there was nearly the same appearance on the buttock of one side.

This case beautifully shows the principle, which Sir Astley Cooper has advocated, viz., that when the reflected ligament remains whole, and the bones are not drawn asunder, the nourishment to the head of the bone continues, and union will be produced even in the short space of five weeks, by only placing the knee over a pillow, and in other respects leaving the case to nature.

It may be here remarked, that the head of the thigh bone was enlarged in the case\* of John Wright, who

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\* Page 106.



had a fracture externally to the capsular ligament; it was very similar in appearance to that of John Fletcher\*, who had, several years before his death, a disease of the hip-joint. If, therefore, the necessary action for the consolidation of the neck of the thigh-bone, were generally excited after a considerable degree of separation, might not this enlargement of the head frequently take place, prevent its free motion in the socket, and thus leave the patient with a limb infinitely less useful than is done by the more passive process of ligamentous union?

When a very serious accident has happened, and particularly if any of the vital organs have been injured, there is frequently no reaction in the system, and especially if venesection has been much employed for the purpose of diminishing the quantity of circulating fluid, and then no alteration is found in the appearance of the nerves, as was exemplified in the following case.

#### CASE :

William Howard, æt. fifty years, received a kick from a horse on the left side of the chest, on the 15th of April, 1824, at one P. M. The greatest violence appeared to have been inflicted on the seventh, eighth, and ninth ribs, and the skin covering them was very

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\* Page 158.



much discoloured. A great crepitus was felt by just placing the hand on the side. There was emphysema. He was very faint. At four he was bled to about twelve ounces, he then appeared very faint and almost sinking. A bandage was put on the side, but it increased the pain so much, that it was very soon removed. At eight he appeared so sinking and had so much difficulty in breathing, as to induce me to make an incision through the integuments and muscles at the lower part of the side, when I readily discovered an opening which communicated with the chest. Bloody serum and air escaped, and he soon after appeared much relieved.

16th, at nine A. M.—I was informed he had passed a more comfortable night than was expected. He has much pain. Sixteen ounces of blood were taken from the arm. In the evening he was rather better.

17th.—Early in the morning he continued to be better, but about eleven he trembled and had much pain, and a death-like appearance. The abdomen was tender. He complained of a most oppressive pain about the ensiform cartilage. Eight ounces of blood were taken from the arm, which afforded him some relief.

At nine P. M. He appears worse. Opening medicines, which he had taken, have not operated. He purged several times in the night. He continued nearly



in the same state until five A. M. on the 17th, when he died rather suddenly.

#### EXAMINATION.

This took place at noon on the same day.

On removing the skin from the left side nothing remarkable was observed, but ecchymosis and the opening into the chest at a short distance from the wound made in the operation. The sternum was removed, and the inferior lobe of the left lung was found adhering at the opening in the chest just mentioned. The lung had been torn at this part. The whole pleura of the left side had a thin coating of coagulable lymph. No fluid was contained in the chest, except a small quantity amongst the adhesions of the lung to the side. All the ribs of the left side were broken, except the two first and the twelfth; and the broken points projected through the pleura into the chest.

On opening the abdomen, a quantity of fluid blood was found in every part of it. On the left side there was much coagulated blood, and the spleen was found to have been extensively lacerated. There did not appear to be any distinct opening through the diaphragm, but it had the appearance of having been lacerated in several places. There was some fluid in the pericardium, but the heart was sound. In the right lung there was a considerable thickening, the



result, I suppose, of some former disease, and there were likewise some earthy concretions.

All the ganglia of the sympathetic nerves in the chest and abdomen were examined, but they had a pearly appearance, and were entirely free from any appearance of vascularity.

#### CASE :

Charles Shepherd, æt. 28, was working in a stone pit on the 7th of Nov. 1825, when some stones fell upon him and produced a compound dislocation of the left ankle, with a fracture of the inner malleolus and the fibula. He complained of pain in the right breast, but in no other part. Sixteen ounces of blood were taken from the arm.

6th.—The pain in the breast is nearly gone, the ankle is very little swoln. The penis and scrotum are black from ecchymosis.

10th.—He is going on well, pulse 90.

11th.—There was rather more constitutional disturbance.

12th.—Pulse 100, with a slight jerk and very weak. Dimness of sight. He wandered a little and appeared very weak. Belly rather tender; he had always made water properly. Ordered four leeches to each temple. In the evening he was the same, he had made water very well, but as there was some fulness about the



bladder a catheter was passed, and about two pints of urine drawn off.

13th.—Quite delirious, much weaker : catheter again passed and half a pint of water drawn off : the water had always been clear, and his tongue always moist. In the night he became convulsed, and died on the 14th, about noon.

The ankle was going on well, and there did not appear to be any good reason for his sinking, as no other injury could be detected, and pressure on the pelvis did not produce any crepitus ; on examination however, the right bone of the pubes was found to be fractured. Blood was extravasated behind the peritoneum and particularly about the bladder ; and on cutting open this viscus spots of ecchymosis appeared through the mucous membrane. All the other viscera were sound.

The semilunar ganglia were not vascular.

In consumptions and complaints attended by hectic fever, I have not found an increased vascularity of the ganglia of the sympathetic nerves ; but if any thing happens to bring on acute inflammation, the symptoms change, and an increased action in the ganglia is produced, as in the following case.

#### CASE :

Robert Norris, æt. ten years, began to be unwell at Midsummer, 1822, and kept gradually declining. For



some time before he died, his pulse was 120. He had a purging, but no cough, and his tongue was red. He made much urine. He ate voraciously, and always vomited after. He had profuse perspiration. He complained of much pain in his head, which began ten days before he died. For the last three or four days he was quite insensible. He died on the 25th of April, 1823.

#### EXAMINATION.

The arachnoid membrane over the whole surface of the brain was opaque, and fluid was contained between it and the dura mater. At the base of the brain the arachnoid membrane was much thickened, and especially about the infundibulum. Much fluid was in each ventricle.

The lungs felt quite solid, and when cut into were found to be full of tubercles in a state of suppuration. The glands at the roots of the lungs were much enlarged, and one behind the right trunk of the par vagum, just where this nerve passes behind the lung, was in a state of suppuration, and to this the nerve was firmly attached, and was very vascular.

There were several white spots like the pustules of small pox behind the pleura in each cavity of the chest, and these contained purulent matter.

The ganglia of the sympathetic nerves in the chest



were very vascular, and the semilunar were vascular, but not so much so as those in the chest, and the others in the abdomen were less so than the semilunar. Each trunk of the par vagum, where it gives off the recurrent, was vascular.

The stomach was healthy. The liver was enlarged and contained many yellow substances of the size and appearance of mustard seed ; one of them was particularly examined, and was found to contain bile. There were some small white spots in the spleen. Several ulcerations existed in the intestines, and the mesenteric glands were enlarged.

In the following case the patient had hectic fever, and although the sympathetic nerve was connected with the walls of an abscess, it had not any vascularity, nor did it produce any symptoms that could be particularly recognised.

#### CASE :

John Wilson, æt. 15 years, had a disease of the spine with a projection of the spinous processes of the first and second dorsal vertebræ. The lower extremities were nearly paralytic, and the arms weak. At the beginning of March he had hectic fever, and large sloughs formed on the nates and back ; his urine and stools passed involuntarily.

#### EXAMINATION.

There was not any change worthy of notice in the



abdomen. There was some serum in the chest, and the pleura covering the right lung was much thickened; that covering the left was little altered. There was a large abscess in front of the spine which pressed very much on the contents of the posterior mediastinum. Several loose portions of bone were found in the abscess.

The sympathetic nerve on each side was attached to the walls of the abscess, and put rather out of its course; it was tender at this part and easily broken; the ganglia were quite white and free from vessels; the right semilunar was unusually small.

Each trunk of the par vagum was connected with the walls of the abscess; that of the right side had a natural appearance, but on the left it was unusually vascular, just before it passed behind the lung. The axillary plexus was natural. The spinal canal was opened at its posterior part; the dura mater was healthy, but contained much serum; the arachnoid membrane was thickened. The spinal chord was diminished in size at the diseased part of the vertebræ, but in the other parts was healthy. The matter of the abscess had extended itself between the dura mater and the posterior part of the bodies of the vertebræ.

On the right side the sloughs had extended so deep, that the sciatic nerve was mortified.

Examinations by dissection prove that irritation can be conveyed by the nerves of an injured part to those



of the ganglia of the sympathetic. It can also be conveyed to the ganglia from any other parts, as the viscera, &c. A boy, who died with a calculus in the bladder, and disease of the kidneys, had all the ganglia in the abdomen much more vascular than those in the chest. A man, who had an inguinal hernia of the left side, and was not operated on, died at the end of five days; about three feet of the jejunum, and very highly inflamed, were contained in the sac, and the intestines above the protruded portion were also inflamed, but not in so great a degree; there was the least possible vascularity in the right semilunar ganglion, but there was a much greater degree of it in the left. A gentleman died with inflammation of the liver, and pleura of the right side, and the right lung was very dark and congested; the pleura of the left side, and the left lung were almost natural; the semilunar ganglion of the right side was very vascular, and that of the left was vascular, but not near so much so as the right. A child died of hydrocephalus internus; the semilunar ganglia and the right superior thoracic were very vascular, but the left superior thoracic was not near so much so; the right trunk of the par vagum was stretched by very large absorbent glands at the root of the lung, and was very vascular at this part; on the left side, the glands, and also the trunk of the par vagum, were natural. The mother of this child died with an enlarged liver,



and ulcerations of the intestines, without any marked symptoms of disease of the chest: for the last ten days of her life, she had fever, with a furred and brown tongue; and in the last few days, her cheeks became flushed, which had always before been pale. The right semilunar ganglion was quite pale, and free from vessels, and also the left, except about one third of it at the termination of the splanchnic nerve. The superior thoracic ganglia of each side were very vascular, or inflamed. The lungs were tuberculated; and there was active inflammation, and an effusion of coagulable lymph on the pleura, but most particularly on the right side; and these appearances of the ganglia were, no doubt, produced by the inflammation of the pleura, which had come on in the last ten days.

All these circumstances, as well as others, show that each branch of the sympathetic nerve has its peculiar and specific uses, and influences, and is influenced by the precise part with which it is connected, and that the sympathetic cannot be considered as a whole, so as to be separated from the other parts of the nervous system. Although we cannot demonstrate the precise point at which each fibril of a nerve communicates with the filament of the sympathetic, we may nevertheless, from pathological observations in particular, rest assured, that this takes place.

At the same time, that I am fully persuaded the



sympathetic nerve exists principally for the purposes of supplying parts with a peculiar excitement; it also exists for connecting one part of the nervous system with another; that whilst it makes the organs supplied by it sufficiently independent, it also produces that concert which is necessary for the maintenance of the general accommodation of the whole. It can also through its union with the other nerves, call into action the parts these are given to, either through the stimulus imparted to it by the motion of the heart and arteries, or by morbid changes, such as inflammation or irritation from various causes. I also believe it is intended for maintaining such a sympathetic communication as appears necessary for producing those simultaneous actions, and their consequent harmonious sensations throughout the system, which constitute a state of health; and on the contrary, that it performs not less important services, by guarding against diseases, for when any part of much importance becomes seriously affected, its extensive agency excites uncomfortable sensations throughout the system; and thus the patient is under the necessity of resorting to remedies, whose timely use arrests the disease; whereas did not the system so readily sympathise, the disease might go on to such an extent, as would either prevent the restoration of the part it had attacked, or even prove destructive of life. Another important office



produced by it is after severe injuries. If the restoration were to be effected by the part itself, this would often fail in accomplishing it, as we have the opportunity of witnessing in bad constitutions, when very extensive mischief has been committed. No re-action then takes place, and death is the immediate consequence of the injury; but in a good constitution, this system soon receives a sympathetic feeling from the injured part, and from its peculiar connection with the vascular system, excites that degree of action in this suitable for the restoration of the injured part, and by which alone a recovery can be effected. Should it be said that there is no need of such a monitor as the sympathetic nerve, when the brain so readily receives impressions from every part of the body, and over which it has so much control. I should urge in reply, that the brain has other functions of so much importance to perform, that its being thus impressed would too much interfere with the parts necessary for the maintenance of life, and would produce such a frequent disturbance of the intellectual faculties, as must embarrass very much the operations of the system, and tend to very frequent derangement of the mind, and also to a much more speedy termination of life. It were wise, therefore, that an intermediate system was made; one that should be connected with all the parts of the nervous system, but still be so independent of



them, as not very materially to interfere with their functions on every slight occasion.

For the production of constitutional irritation, it is necessary that a considerable action or inflammation of the affected part should take place, before the excitement exhibiting vascularity after death can be produced in the sympathetic nerve, and according to the degree of this, to a certain extent the action of the heart and arteries will be increased. But why is not the inflammatory action of the affected part at once conveyed to the spinal chord and brain? It seems to be a law of nature that inflammation cannot spread far along a nerve, for it would thus be always liable to be conveyed to these important organs, and death would very often be the result. It is therefore wisely ordained, that the sympathetic nerve shall be affected in a measure just equal to the surface of the local injury; which never could be the case if inflammation of the divided or injured portion of the nerve spread far upwards towards the spinal chord or brain, for then in almost every accident there would be a greater extent of irritation than the constitution is capable of bearing, as is proved in extensive burns and scalds; for if under these accidents the patient be not killed by the first shock, so much irritation and inflammation is excited in the nerves, as is incompatible with the power of resistance and the continuance of life.



It may be asked again, Why then the stimulus is not conveyed to the brain and spinal chord as well as the sympathetic nerve? I would answer that it is by the same law or principle that it should not, because the sympathetic nerve presides over the principal organ of the sanguiferous system, and is therefore more properly calculated for exciting the parts necessary for the reparation of the injury; whereas if the brain and spinal chord had been similarly or principally affected, actions would have been produced, calculated for destruction, and not for restoration.

Sufficient injury or disease can excite the action of both the blood-vessels and nerves of a part, and these seem to have a mutual dependence on each other. This co-operation was observed in the case of Wm. Richardson\*, when there was both great pain and action in the ulcer, and bleeding from the slightest touch; but when the nerve was divided, the pain and inordinate action of the blood-vessels of the ulcer ceased, and with them the bleeding.

It is not the violent shock or *tic douloureux* of a nerve that excites constitutional irritation, but inflammation.

The pursuit of this subject is attended with considerable difficulty, for it seldom happens that a patient dies



of pure constitutional irritation produced by accidents. When death takes place, it is generally from the severity of the injury, which has caused so much depression of the powers of the constitution as not to allow the action of the nerves and blood-vessels to be excited. The appearances of the patient, however, or of an animal, are not to be taken as an index of the state of the internal parts, for sometimes when there is every symptom of the sinking of the vital powers, as in extensive burns, inflammation is going on internally.

Although I am well convinced, from numerous dissections, that the ganglia of the sympathetic nerves have a great vascularity, induced only by several medicines and diseases, yet some are inclined to think that this appearance is present in a state of health. In answer to this opinion, I beg to observe, that I examined an executed subject immediately after it was cut down, and found the ganglia of a pearly appearance, and free from any mark of vessels carrying red blood. I have found one ganglion very red from a number of vessels filled with blood, and the corresponding one nearly white; and I have so often observed this difference, and in such a marked degree in the same subject, as to leave no more doubt in my mind of its being the effect of inflammation, or something bordering on that state, than of similar appearances constituting the inflamed conjunctiva of one eye, and the uninflamed state of the



other. If a judgment be formed from the appearances presented by an injected subject, it will be erroneous, for it is always impossible to speak decidedly of the natural degree of vascularity of any part which has undergone such a preparation. The ganglia may be made red by injection, and so may the conjunctiva of the eye ; we may therefore fairly conclude, that if the injection fills numerous vessels of the eye, which could not be observed during life, that this appearance is equally foreign to the ganglia during health.

It may be asked, how can an almost similar appearance of increased vascularity of the ganglia of the sympathetic nerves be caused by different medicines and diseases, and produce such various symptoms ? I cannot at present give a positive answer to this question. More experience may decide it to a certain extent.

If the same facility of making observations were afforded, it would be found that different dispositions of the arteries are formed in an inflamed ganglion, in a somewhat similar manner to those excited in the eye by different diseases ; and under peculiar circumstances that more or less venous congestion also existed. When this increased vascularity is present in so many diseases, it is difficult to conceive that it can cause all the different symptoms. Although vascularity may be produced by various excitements, it, as well as the fever



and other symptoms, may be modified by the cause. There may be one sort of irritation of the ganglia from a simple wound, another from a poisoned one, and the fever may be modified by the poison or any thing peculiar in the constitution at the time, or by a disordered state of the stomach or any other viscus most prone to morbid sympathy. Mercury may act on the intestines and the sympathetic nerve, and produce one set of symptoms; *nux vomica* may act on the sympathetic and the nerves of the spine, and produce another set totally different; so may a wound produce vascularity of the sympathetic nerve, and this afterwards, modified by any change in the wound, or a peculiar irritation of any of the viscera, may alter the first state of vascularity of the ganglia produced by the wound; so that the second irritation shall be communicable to the spinal nerves in the same manner as that arising from the presence of the *nux vomica*; and this new irritation shall continue, although the wound itself have ceased to create any disturbance, and until some other excitement or medicine shall have produced another disposition; and this last change forms the great desideratum for the cure of tetanus.

I cannot leave this part of my subject without recommending to the pathologist the perusal of the elaborate work of Professor Lobstein on the sympathetic nerve; and to those who think these investigations so



minute as to be useless, the following lines may not be altogether unworthy of consideration.

He says "Quamvis dictum sit, in nervi sympathetici affectibus nil detegi posse, quod in sensus incidat, tamen attenta me docuit autopsia, manifestas in ipso nervo occurrere inflammationes, quæ variis morbis respondent; hinc intime convictus sum, alias mutationes organicas in nervo intercostali reperiri posse, si sollicite in eam rem inquirere velint anatomix cultores\*."

Again—"Certe non vilipendendæ sunt illæ nervi sympathetici morbosæ notæ, et non levis momenti judicari debet istius inflammatio, qua nimirum vires vitæ, in summum intensitatis gradum evectæ, phænomena producunt plus minusve gravia †."

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\* Lobstein De Nervi Sympathetici Humani Fabricâ, Usu et Morbis. Page 147.

† Ibid. Page 153.



## CHAPTER XVI.

## OF TETANUS.

TETANUS is divided by nosologists into Idiopathic and Traumatic. The one arises from cold, or some other cause that disorders the general health; the other may arise from the same cause, but is complicated with a wound or injury of some part of the body.

If Traumatic Tetanus always followed a very painful or extensive wound, there would be an apparently satisfactory reason for its violent symptoms, but as it likewise supervenes on a trifling injury, or a wound that is nearly or entirely healed, there is the greatest difficulty in comprehending how it is produced.

With a view of removing as much as possible this obscurity, I have been induced to inquire how the body is usually affected after accidents. From that inquiry I have been led to state, that when a severe injury has been received, the ganglia of the sympathetic nerves become irritated, and consequently the



parts to which they distribute nerves. When the constitution is healthy, I believe the irritation of the ganglia goes off in a few days, and then the parts supplied by them return to a state of quietude, and again perform their healthy functions.

When the ganglia of the sympathetic nerves have been thus affected, and the irritation has subsided, an unhealthy action in the wound may excite a fresh irritation in them. Or even if the wound be healed, the passions, improper food, and other causes, may continue, reproduce, or increase the disordered state of the organs receiving nerves from the ganglia, and thereby excite a fresh irritation in them.

When the ganglia of the sympathetic nerves have once been in a state of irritation, I believe they are very susceptible of its renewal. When they have become again irritated, it may be readily conceived that the irritation, modified by the confinement during the healing of the wound, or by some disordered viscus, may be very different, and by this change made much more formidable in its consequences ; and it may therefore be readily conceived, how in this state it may be communicated to many of the cerebral and all the spinal nerves, and from these to the spinal chord ; thus producing tetanic spasms, varying according to the part of the sympathetic nerve most affected, as well as the extent and complexity of the irritation.



## CASE :

A man\*, æt. 47 years, had a fibro-cartilaginous tumour, removed by amputation, which adhered loosely to the spine. After an interval of two years he came a second time to the hospital, requesting to have another tumour removed, which had made its appearance, and the highest part of the skin of which was inflamed and ulcerated. Having first taken a purgative, and at the same time caught cold in the rainy season of October, he was immediately seized with trismus and opisthotonos, which in the space of two days destroyed him, after every medicine had been tried in vain.

On opening the body, nothing was found but a vascular network filled with blood on the surface of the spinal chord, and a quantity of serum effused within the sac formed by the dura mater ; and a very distinct inflammation of the semilunar ganglia.

## CASE :

In two individual†, who died in 1819, with very decided ataxo-dynamic symptoms, we found the semilunar ganglia having a remarkable redness, which appeared throughout to be produced by a very minute

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\* Lobstein *De Nervi Sympathetici Humani Fabricâ, Usu et Morbis.* Page 152.

† *Clinique Médicale*, par G. Andral, fils, tom. i. Page 419.



injection of the cellular tissue, interspersed between the small grains, of which the ganglia are composed. One of the individuals had presented, during the last forty-eight hours of his life, violent trismus and a tetanic rigidity of the superior extremities.

#### EXPERIMENT.

October 21st.—At nine P. M., one grain of alcoholic extract of *nux vomica* was given to a large bitch.

22nd.—At half past seven A. M., another grain was given. At nine she had slight spasms, and when she attempted to bark her mouth was shut involuntarily.

At half past five P. M., another grain was given. She has appeared more dull throughout the day.

23rd.—She is rather dull. One grain was given at eight A. M. At nine she has spasms and appears unable to bark.

At five P. M., she had another grain.

24th.—At five P. M., she had a grain and a half.

25th.—At half past seven A. M., she had two grains. At a quarter before two P. M., two more grains were given; a quarter of an hour after she appeared to have some difficulty of breathing, and had her tongue constantly out of her mouth. At four she had a most violent paroxysm of tetanus, in which I thought she would have expired. In the morning she was much recovered.



26th.—At half past nine A. M., two grains were given.

27th.—She appeared quite well. At two P. M., she had two grains. She had spasms in the evening.

28th.—At two P. M., she had two grains. At five she was rather dull, when two grains more were given. Half an hour after she had a violent paroxysm of tetanus, and appeared as if she would expire.

29th.—She appeared quite recovered. At half past one P. M., I gave her two grains more. At five, her limbs were quite stiff, when she had three grains more. At six, she was rather heavy, and this state continued until eight, with a slight stiffness of the limbs. I then gave her three grains more. About a quarter before nine she did not seem more affected than she was at eight. About eleven she had a violent paroxysm.

30th.—At eight A. M., she appeared better, but walked as if her limbs were stiff. At this time she had three grains more. At nine she had a violent paroxysm. At six P. M., she had nearly recovered, when I gave her three grains more.

31st.—At a quarter before ten, she appeared nearly well. I then gave her four grains. At a quarter before two P. M., she continued the same, when she had four grains more. At seven she had five grains.

November 1st.—She is very stiff. At eight A. M.,



I gave her five grains. At nine she had a violent paroxysm. At half past one she had six grains. She had another violent paroxysm. She was found dead at seven P. M.

She always had a good appetite.

#### EXAMINATION.

This took place on the second, at nine A. M.

All the ganglia of the sympathetic nerves, and especially those of the right side, had a considerable redness. The lumbar ganglia were less red than any of the rest. The par vagum was unusually vascular. The axillary plexus, especially of the right side, was rather more vascular than usual, and the same was observed respecting the sciatic nerves.

The pia mater both of the brain and spinal chord was very vascular. There was a little fluid within the sheath formed by the dura mater near the cauda equina. The substance both of the brain and the spinal chord appeared healthy.

The absorbent glands were unusually vascular. The stomach contained much food; its villous coat was red, but I could not consider it diseased. The small intestines contained food, and their villous coat was quite natural. The large intestines were full of fæces, and had considerable very red patches on their mucous



coat, which appeared to have been produced by the pressure of the fæces.

The lungs were very purple but not diseased. The heart was sound. There was an increased vascularity on the outside of the aorta.

The ganglia were kept in cold water, and a considerable redness was observable in them forty-seven hours after the examination.

CASE :

May 9th, 1823.—Richard Burton, æt. 37, a strong healthy man, had the misfortune to pierce with a spike the joint between the metacarpal bone and first phalanx of the little finger, about three weeks ago. I did not see him before this evening. The hand is not much swoln, and the wound not very painful. On the sixth he first perceived an uneasiness in his face. This evening he has opisthotonos and spasms of the muscles of the face; but I understand he is not so much affected as he was in the morning. He can open his mouth considerably. The pulse is natural. The bowels are open. The tongue has not an unusual appearance. He has taken half an ounce of spirits of turpentine twice; and as he appeared better, he was ordered to repeat the same quantity to-morrow, and to take two grains of submuriate of mercury and one grain of opium every four hours.



10th.—He appeared better this morning. He is much troubled with wind. He has taken the spirits of turpentine twice.

In the evening he was worse. The finger was amputated at the middle of the metacarpal bone. There was no hæmorrhage at the time, but it came on soon after, and he lost a great quantity of blood.

11th.—He was worse, and had a considerable degree of fever. The spasms were very violent.

12th.—When I saw him at noon he appeared nearly exhausted, and he died very soon after.

#### EXAMINATION.

This took place about sixteen hours after death.

After opening the spinal canal, the sheath formed by the dura mater was divided, and was found to contain a small quantity of limpid fluid. Many adhesions were found between the loose arachnoid membrane and that lining the dura mater. On the loose arachnoid membrane there were a few small spots of cartilaginous matter. The veins of the pia mater were much loaded with blood. The spinal chord was divided in many places, and appeared perfectly healthy; but in the beginning of the dorsal portion there was a spot of coagulated blood, of the size of a small pin's head, in the midst of the medullary substance; many of the ganglia



of the spinal nerves were examined, but they did not exhibit any altered appearance.

There was an effusion of bloody serum between the arachnoid membrane and the pia mater of the brain, at the situation of the squamous portion of each temporal bone. The veins were turgid, but there was not any diseased appearance in the brain.

The lungs were very purple, and in a state of expansion, and were much loaded with blood. On the pericardium covering the heart, there was a patch of coagulable lymph as big as half a crown, and there was another about the origin of the aorta. There was an increased vascularity of the outside of the aorta through the chest.

The villous coat of the stomach, especially at the cardiac extremity, was exceedingly vascular. There was not any unhealthy appearance in the intestines. The mucous membrane of the bladder was very vascular. The rest of the abdominal viscera were sound.

The psoas muscle of each side had blood effused into its substance.

The par vagum in the neck was quite healthy, but at the root of the right lung the nerve had an increased vascularity, which did not exist in that of the opposite side.

There was an enlargement and a greatly increased vascularity of all the ganglia of the sympathetic nerves



in the chest, and also of the semilunar ganglia; in several of those in the abdomen, the same appearance existed, only in a less degree, but in some there was neither the least redness nor enlargement.

The nerve of each arm and the sciatic nerve examined, appeared perfectly healthy.

I shall now proceed to make a few observations on some of the symptoms of tetanus, and the parts which appear to be implicated in the disease; and then inquire what inferences may be drawn from them as relating to the most probable method of cure.

The cause of the spasms, or at least the cause of their continuance, seldom exists in the injured part; for if this be removed, a slight alleviation sometimes ensues, but the spasms generally return with the same violence.

The muscles implicated in the disease are supplied by nerves both from the brain and spinal chord. Is it therefore to be presumed that both these organs are in the first instance affected, or only their nerves?

The functions of the brain are seldom disturbed except towards the close of the disease, but sometimes remain perfect throughout. In one of the worst cases I have recorded, the patient was quite sensible to the moment of his death. On dissection we find increased vascularity of the pia mater, but we find it likewise at the termination of many other diseases; and I think it



can only be looked upon as an effect of the general disturbance.

The muscles connected with mastication and deglutition are generally first affected, and the nerves distributed to these are principally derived from the brain; but as this organ does not appear to suffer until the end of the disease, it is difficult to conceive how the parts of it, from which the affected nerves originate, can be disordered and produce such violent symptoms, whilst the functions of the organ in general remain undisturbed, and no particular morbid appearances can be discovered on dissection.

We find an increased vascularity of the pia mater of the spinal chord; and this I cannot help considering as an effect. This appearance certainly shows that great irritation existed there. There cannot have been inflammation, or we should more frequently see its consequences, viz. an effusion of coagulable lymph, and purulent matter, and more or less of paralysis; moreover, it would not be possible for so speedy and so complete a recovery to take place, either from the disease in the human subject, or after leaving off the extract of *nux vomica*, when violent tetanic spasms have been produced by it.

In the case of a child, related at page 213, a great part of the posterior surface of the spinal chord had coagulable lymph effused on it; but how often this



occurrence takes place, or what would have been the event had life been further prolonged in this instance, it is at present impossible to conjecture. The sympathetic nerve was not examined, and, therefore, it must remain for future investigations to determine whether the inflammation of the membranes was a primary affection; for in all the other examinations after death, both in the human subject and the animals killed by the extract of *nux vomica*, I have found an increased vascularity of some of those ganglia.

As the disease attacks the muscles supplied with nerves both by the brain and spinal chord, and neither of these organs appears in the first instance to have its functions disordered, we may fairly conclude that the cause resides in some other part.

No other parts except the ganglia of the sympathetic nerves have a similar, or so free, a communication with the nerves supplying the muscles usually affected.

I do not mean to assert that tetanus is a specific complaint entirely seated in the ganglia of the sympathetic nerves, but that the ganglia are the important parts of the nervous system to which the first irritation tends, and from which it proceeds to the rest of the nervous system.

When a few doses only of the extract of *nux vomica* are administered, its influence goes off, and the spasms cease, even when they are so violent as almost to ex-



tinguish life; and after having ceased, they do not resume their violence until more of the extract is given. It may therefore be presumed, that in the human subject the cause continues to operate so long as the disease is violent, and that the spasms can only be regarded as a symptom. There, nevertheless, seems to be a gradual accommodation of the body to the medicine, for larger doses are subsequently required to produce the same effect as the smaller ones did at first; and if the spasms do not destroy the human subject in the first few days, he seems capable of withstanding their shocks.

From the complete manner in which the spasms go off, and the health is restored after their production by the extract of *nux vomica*, and likewise in many cases in the human subject, we may fairly conclude, that for some time no material change is produced in the structure of the body, and therefore that the disease is not irremediable.

According to the violence or mildness of the disease, I conceive the irritation is confined to the ganglia and some of the cerebral and spinal nerves for a certain time; it is then communicated to the membranes of the brain and spinal chord, and sometimes causes so great an effusion of fluid as must add to the danger, and may produce sudden death.

No very important anatomical facts relating to this subject have been recorded by medical authors; there



are few complaints, therefore, in which the method of treatment has been more empirical, and few in which the termination has been more generally fatal.

Different opinions have existed respecting the injury required for the production of tetanus. It was generally believed that a tendon was always implicated in the wound, but without any good reason. It may however be asserted that the neurological doctrine is not founded on a more satisfactory basis. It will not be denied that a few examples only of wounded nerves have been recorded ; but it may on the other hand be fairly asked whether the wounded limbs have in these cases been inspected with that care or nicety necessary for detecting changes in the minute nerves, and I think it will be conceded, that very few examinations have been so conducted. Without attempting to decide this question, I shall lay before the reader a few of the facts that have been noticed. It is to be feared that the source of tetanus is very far from the wound, which in some cases has ceased to exist at the first manifestation of the symptoms. It would be satisfactory to find that a wounded nerve was the immediate cause in every instance, for then there would be a better chance of applying a remedy. If it could be proved that a portion of the cases depended entirely on this cause, it would be encouraging to find that even the few were under the controul of surgery.

The ancients frequently confounded the nerves and



tendons together; and even the learned Dr. Willis has either done the same thing or proved that the irritated tendons have a more acute perception than has been latterly ascribed to them. I shall transcribe the following paragraph, because the information it contains, bears not only upon the particular subject before me, but upon the opinions I have stated at the beginning of this work. He says\* “among the moderns very many have determined irritation of the nervous parts to be the cause of convulsion; taking their conjecture from thence, as I suppose, for that by ocular inspection, it appears from the vellication itself, and by the only touch of the nerves, that spasms are induced: and indeed we have already observed in the dissection of a living whelp that the knife being put upon the naked ends† of the spinal nerves, presently both themselves

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\* Of Convulsive Diseases, folio edition, page 4.

† The word, ends, has been construed from caudicibus. It is probable that it was intended to apply to the roots or beginnings of the spinal nerves just when they begin to collect into fasciculi; for in speaking of the origin of the sympathetic nerve, he says, *Dein nervo sexto paris inosculatur, et exinde surculum, modo unum, modo duos remittit; qui cum surculo altero a nervo sexti paris reflexo, uniti, nervi intercostalis radicem sive caudicem primum constituunt.* *Cerebri Anatome, Cap. xxii. p. 90.*

Restant plures aliæ nervorum conjugationes, quorum radices, sive origine in medulla spinali consistunt. *Cap. xxix. p. 409.*

Although the writings of this great man are so much obscured by heterogeneous matter, it nevertheless must be confessed, that both himself and his able coadjutor Dr. Lower, were deeply skilled



and the bodies of the muscles, in which they were inserted, were hauled (*convelli*); neither is it unusual that spasms are excited almost in every man by punctures of the nerves and tendons. I remember by reason of an ulcer in the arm of a certain man, that the tendons of the muscles were laid open, and when touched by a

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in the anatomy and physiology of the nervous system, so much so indeed, as to make it a matter of surprise, at least, that their doctrines on the Uses of the Nerves, should have been left almost unnoticed for nearly two centuries.

A question might arise as to whether Willis had been instructed by the works of the immortal Galen, but from the following passage it would seem that he was not; for he says, *quoad nostras vero observationes circa nervos instituendas, me neque aliorum vestigia calcare, nec prius dicta usque ad crambem repetere, in sequentibus plane liquebit.* Cap. xviii. p. 236.

There is good reason for presuming, that the opinions of Erasistratus and Herophilus, had also been the induction from experiment, as we are informed by Celsus that they possessed not only the most abundant, but the most extraordinary opportunities of prosecuting their inquiries.

In these latter days, it has been too much the custom for many anatomists of this country, to tell their pupils that they relied entirely on their own observations. But if learning had been the handmaid of their inquiries, the fruits of these might have been more abundant, and many cruel experiments rendered unnecessary. The manner in which the magnificent library at the College of Surgeons is frequented by the Profession, leads to the hope that a great change has taken place, and when this institution shall have become the receptacle of every learned author, may we not expect that many a sleeping germ may be quickened, the glory of learning advanced, and eventually crowned by the discovery of new remedies for the alleviation of human misery?



surgeon's instrument, caused in the patient a certain rigor through his whole body, and forthwith, a concussion arising, made him quake for a good space" (*aliquandiu inhorruisse*).

## CASE :

A middle aged woman was admitted into the London Hospital on account of a popliteal aneurism. This case happening before the adoption of Mr. Hunter's operation, Sir William Blizard, as he had done successfully before, opened the aneurismal sac and placed a ligature on the artery above and below the tumour. The ligatures were detached, the aneurismal part sloughed away and the healing process was rapidly advancing, when Sir William endeavoured one day gently, as he thought, to extend the limb from the state of flexion in which it had been since the operation; the woman suddenly expressed agonising pain and within a few hours was seized with tetanus, of which she died. On an accurate examination of the limb, the cutaneous nerve, which accompanies the lesser saphena vein, appeared to have been divided in the operation, and the inferior portions having become attached, to have been stretched throughout in the attempt to extend the limb, and thus probably happened the tetanic symptoms. The case, admitting the justness of the conclusion, might be interesting in memory, on an attempt to



change the position from that in which a limb had long rested.

Hennen says, I never found any peculiar appearance of the wounds themselves, except in one, when the radial nerve was somewhat thickened, and a small splinter of bone was sticking in it; the man lived six weeks\*. “Another† case is related in which a portion of a whip was found imbedded in the cubital nerve. A coachman playing with a young man gave him a blow with his whip on the fore-arm. A small wound was produced on the fore-part of the membrane in the course of the cubital nerve. The wound healed, and at the end of a few days a nodosity only remained at the site of the cicatrix. Some time after, this young man was brought to the hospital, labouring under tetanus in an advanced stage. He died, and M. Dupuytren examined the boy in the presence of a physician, who thought that the cause of the tetanic affection consisted in inflammation of the spinal arachnoid. This membrane however, as well as the other organs, was found to be perfectly healthy. M. Dupuytren next examined the nodosity, which remained on the cicatrix in the fore-arm, and was much astonished to find a portion of the whip enveloped in the very substance of the cubital nerve.”

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\* Military Surgery, page 248.

† Medical Gazette for January 30th, 1830.



Larrey \* relates three cases where it was produced by an injury of the larger nerves. In the first, the anterior crural and sciatic nerves had been injured by a ball; in the second, the median nerve had been tied with the brachial artery; and in the third, the nerves had been tied in amputation of the leg.

I possess the thumb of a man in which there was a partial division of one of the dorsal branches of the radial nerve; the semilunar ganglia were also highly vascular. It cannot be presumed that this patient would have been cured either by the division of the nerve or the amputation of the thumb, as the inflamed ganglia still would have remained and continued the tetanic symptoms; for in the case of Richard Burton, the finger was amputated without any good effect; and on examination there was found great vascularity of the ganglia of the sympathetic nerve. A very interesting case † is related by Dr. Murray, in which there was a wound in the sole of the foot from a rusty nail; the posterior tibial nerve was divided and the patient recovered.

Larrey ‡ relates two cases in which incisions were made with good effect.

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\* Mémoires de Chirurgie Militaire, tom. iii. p. 290.

† Medical Gazette, February 9th, 1833.

‡ Mémoires de Chirurgie Militaire, tom. i. p. 269, and tom. iii. p. 307.



The first was that of a man who was struck by a ball, which crossed the right arm, and wounded the biceps and coraco-brachial muscles, and the radial and internal cutaneous nerves. On the eighth day he began to have great pain ; and it was wished to divide a bridge left by the wound, in which were found some branches of the internal cutaneous nerve, but the patient refused to have it done. The next day his local pains were very acute ; he had convulsive motions of the hand and fore arm, heat in the whole system, and locked jaw ; he was very restless, and in continual agitation. The rapid progress of the symptoms determined Larrey to divide the bridge, and cut the bottom of the wound, where he found several nervous bridges. This operation was very painful ; but two hours afterwards the patient was much relieved, and in the space of two days all the symptoms disappeared.

The second was that of a man who received an injury from a spear on the right side of the forehead. The point of the spear had slid obliquely from below upwards and inwards under the pericranium, so as to make a deep fissure in the frontal bone : one of the superciliary nerves was grazed by the cutting side of the spear. Nine days passed without any alarming symptoms, and it was considered as a simple wound ; but in the night between the ninth and tenth days tetanus came on, with convulsive motions of the cor-



responding eye-lids, and a loss of sight in that eye : there was a little mental wandering, a very acute pain, locked jaw, and a very marked disposition to emprosthotonos. Emollients were immediately applied to the wound, and diaphoretic and opiate draughts were given without effect ; the complaints went on increasing, and in twenty-four hours would have been at their greatest height. The wound was then examined with a probe, which gave very acute pain ; this determined Larrey to divide from below upwards with a bistoury the whole of the superciliary muscle, the nerves, and vessels : the patient was immediately relieved, and in less than twenty-four hours all the tetanic symptoms had disappeared.

Dr. Silvester\* has related the case of Elizabeth Fox, who broke and lacerated the first joint of the fourth finger of her right hand ; this part was removed ; afterwards tetanus came on, which was no doubt of the chronic kind, and the symptoms were moderated by large doses of opium. "Finding that the spasms were rather kept under than cured, and that the jaw remained almost equally locked, I desired Mr. Harrison to take off the whole finger ; for as part of the bone of the severed joint was grown more bare, and the skin and tendons drawn back past recovery,

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\* Medical Observations and Inquiries, vol. i. page 1.



I much suspected that all I was doing was scarce any thing more than barely palliating the severity of the symptoms unless the cause was removed : and indeed, though the night after this amputation was rather worse than any she had had for a week, yet the next day she began to mend and continued to do so every day more and more. Her convulsions left her by degrees, first those of the arms and back, and then those of the legs : the wound proved kind and cicatrised as soon as could be expected ; but the jaw still remained stiff and difficult to move. As the symptoms abated, I lessened the dose of opium nearly at the rate of one grain every day ; at last she went out of the hospital perfectly cured, except a small degree of stiffness in her jaw."

Larrey \* relates a case in which amputation of the limb removed the tetanic symptoms and saved the patient's life. Hennen † says amputation of the wounded limb relieved all the symptoms, but the patient died of a fever, which hung upon him during the whole period of the complaint and carried him off in the sixth week. Other surgeons have practised amputation, but the success has been so trifling that no encouragement is held out for having recourse to it.

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\* Mémoires de Chirurgie Militaire, tom. iii. page 297.

† Military Surgery, page 246.



It may be a question whether the irritation occasioned by so large a wound, as that in amputation, prevents the good effects that might otherwise have accrued. It is probable that the fresh irritation thus excited and conveyed to the sympathetic nerve, already inflamed, may tend to keep up or even aggravate the spasms. On the contrary it may be questioned whether the division of the affected nerve, or the trunk leading to this, made at a distance from the wound, would obviate the risk of causing this increased irritation from amputation. Although nothing ought to be left to conjecture there is too much reason for believing that the immediate cause of the tetanic symptoms is not generally in the local part at the time of their invasion, and that the conjectures of Mr. Abernethy are too well founded for allowing any expectation of deriving much advantage from an operation. He says, "when the irritable and sloughing state of the wound shall have gone off, when healthy granulations have formed, and the cicatrix is rapidly advancing, in this state tetanus may occur. How are we to account for this? I am inclined to think that it is to be accounted for in the following manner. We know that the disposition to disease occurs long before the action of the disease takes place. In the painful and bad state of the wound, the disturbed state of the nervous system has produced disease of the digestive organs which reacted on the nervous organs;



so that the disorders have reciprocally aggravated one another ; so that at last, even though the wound is drawing to cicatr~~is~~isation, or has even healed, and there is no longer any local irritation, the disposition to tetanus, from the established irritation of the cerebral and visceral functions, comes into activity. Perhaps those who know nothing of the opinions I have formed on subjects of this kind, may not thoroughly understand what I mean. I propose this as a question to surgeons, Whether the disordered state of the digestive organs, established during the irritative state of the wound, may not be the occasion of tetanus when that irritative state has ceased ?”

The facts I have adduced are both curious and important, and therefore are, perhaps, entitled to some notice ; but I cannot presume on their being sufficient of themselves to enable us to form any decided rules of practice, and it is therefore with much reluctance I offer any observations on this part of the subject.

From the appearances on dissection of patients who have died of this complaint, I cannot help concluding that there is a state of parts bordering on inflammation and therefore that general blood-letting is indicated. Fever, and other decidedly inflammatory symptoms, may not generally be present, yet they sometimes exist in a very great degree.

With a view of removing this congestion of the



vessels of the spinal chord, blood should be taken from the back by leeches or cupping.

The functions of the digestive organs are very frequently disordered, and as this state must aggravate all the other symptoms, every possible attempt should be made to restore them. The patient ought to be purged as soon as possible. A few doses of submuriate of mercury may be given, and any other strong purgative, until the bowels are freely emptied.

In experiments on animals, I have found decided marks of inflammation of the ganglia of the sympathetic nerves produced by mercury. As there is a similar appearance of the ganglia in tetanus, I cannot help supposing that the use of mercury is very doubtful, if not altogether hazardous ; and so many cases on record, in which it has failed to restrain the disorder, show that it cannot by any means be depended on. I am willing to believe that practitioners may have thought it beneficial, because a patient, who has used it, has recovered. I have seen it administered in chronic tetanus, and the patient has got well ; but the recovery was very slow ; and whether it had any influence over the disease is most difficult to determine. These observations on mercury may well apply to constitutional irritation. Indeed several instances are on record in which tetanus has come on during a mercurial course.

When the patient has been well purged, it appears



reasonable to suppose that quieting and relaxing medicines may be of use, as the compound powder of ipecacuanha given in frequent doses.

Whether the meadow saffron would have any influence over tetanus I cannot determine; but from the appearances on dissection, I do not despair of a discovery of some similar medicine, which has a powerful influence in allaying irritation of the nervous system, for the removal of this dangerous and painful disease.

We are informed by Sir James Macgrigor\*, that patients are never attacked by this disease after twenty-two days have elapsed from the receipt of an injury; and by Dr. Dickson†, that since the bowels have been properly attended to, its prevalence has been comparatively rare in the public service in the West Indies. May I therefore be allowed to suggest, that surgeons should take care that the functions of the digestive organs are duly promoted by the administration of opening medicine, a suitable diet, &c., and that cold is particularly guarded against, after all accidents and operations? Injuries of the fingers and toes appear so trifling as to require but very little attention: and I conceive tetanus is frequently the consequence of the slight regard generally paid to them.

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\* Medico-Chirurgical Transactions, vol. vi. p. 45.

† Medico-Chirurgical Transactions, vol. vii. p. 454.

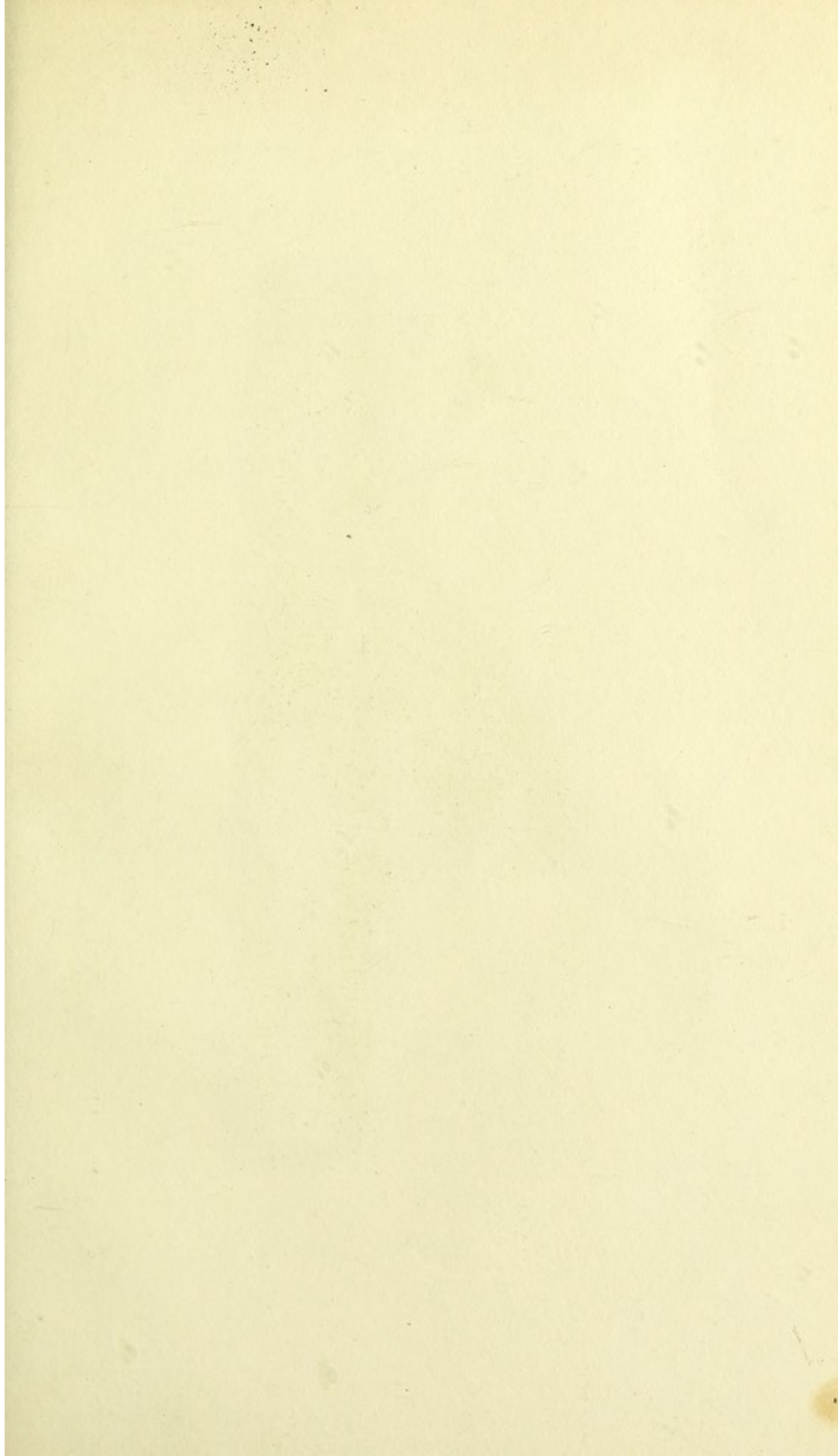


When a person goes on well for some days after an accident or operation, and begins to complain of stiffness of the neck, or, as I have heard it expressed, of soreness of the throat, immediate alarm ought to be taken by the surgeon, that tetanus is impending, and proper remedies should be at once administered.

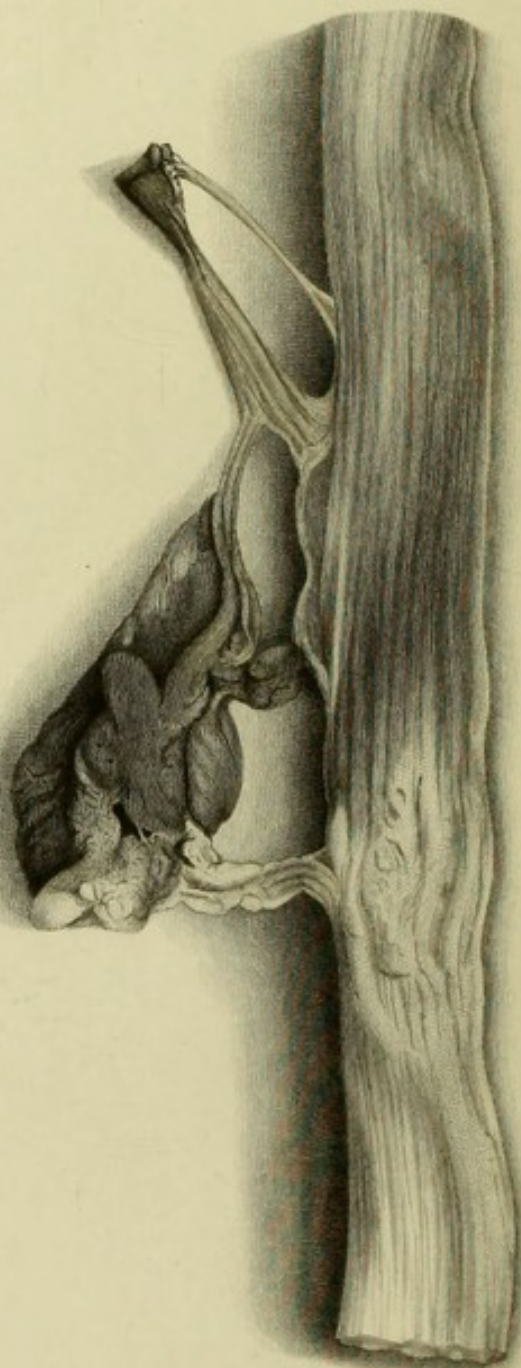








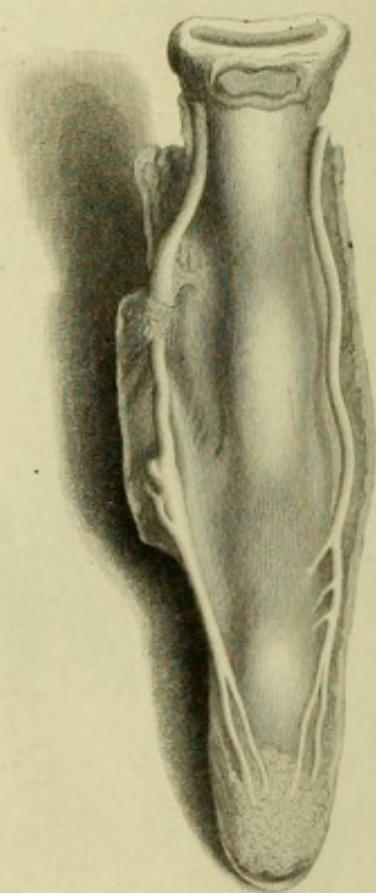








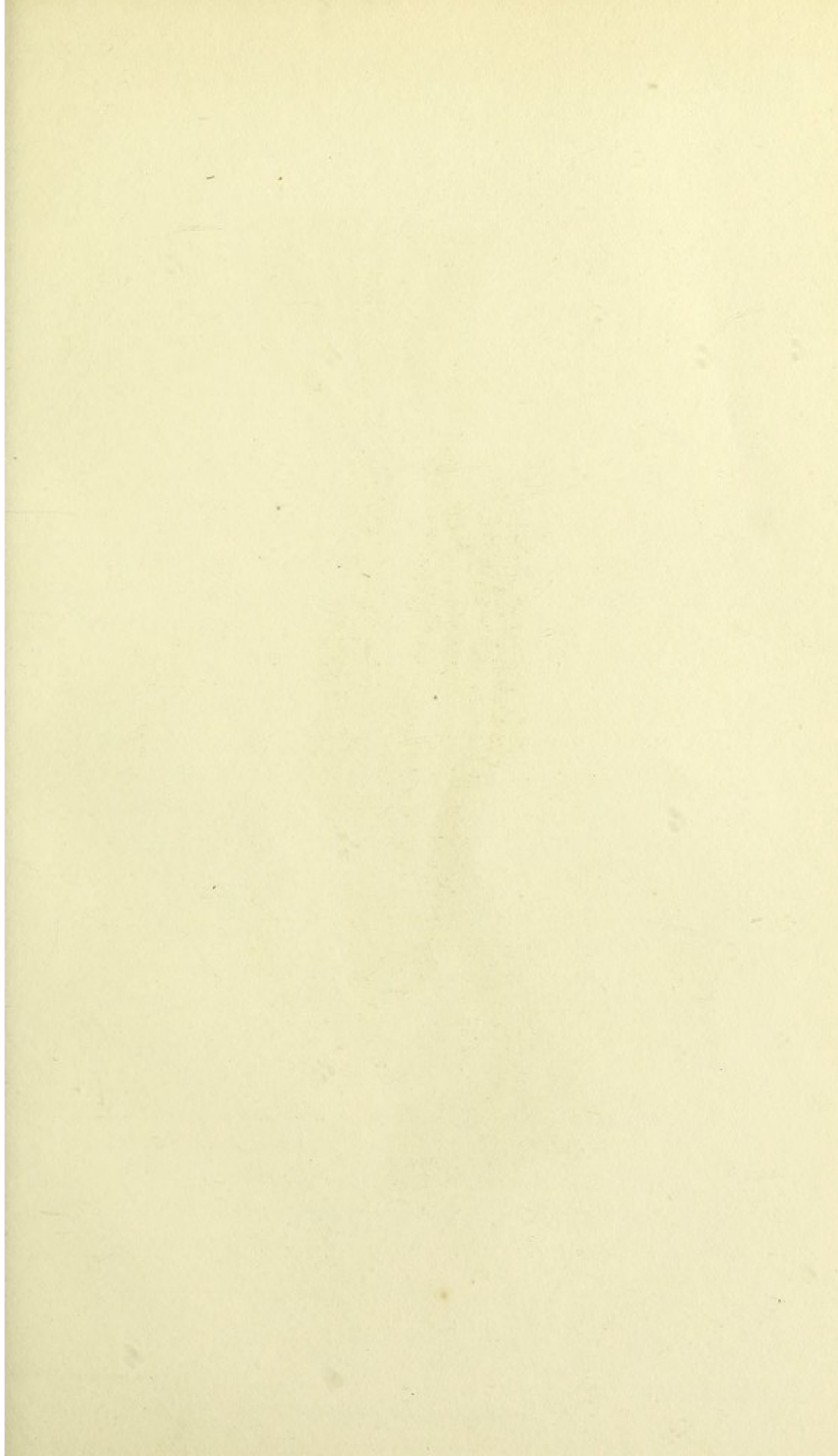




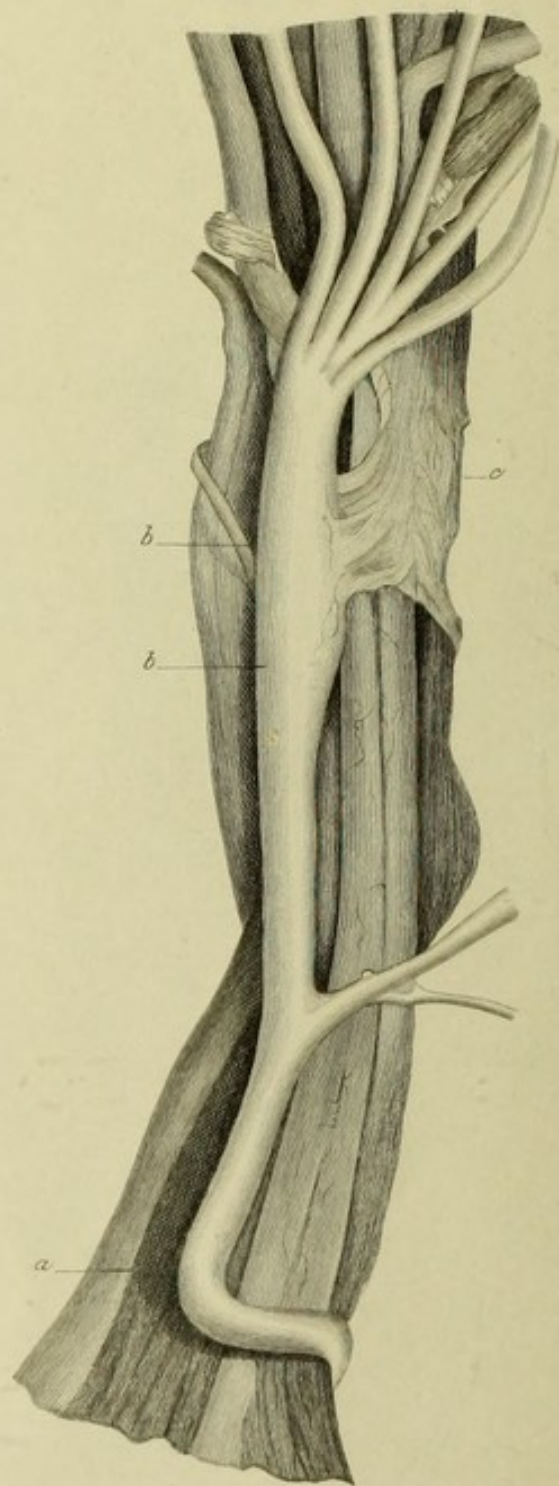
Drawn by E. West.

Engraved by E. Finden.












## EXPLANATION OF THE PLATES.



### PLATE I.

THIS plate exhibits the sciatic nerve of John Wright. Some of the fibrils have been lacerated by a portion of a fractured thigh-bone, and are surrounded by a coagulum of blood. The case is related at page 107.

### PLATE II.

This plate shows a partial division of one of the digital nerves of Miss Willson's finger. At the place of the original wound near the middle of the second phalanx the division of a fibril is seen; the cut end of this, nearest the tip, is incorporated with the cicatrix, the other is formed into a small bulb.

Near the middle of the first phalanx the place is seen at which the nerve was divided in the first operation, and both the cut ends have become incorporated with the cicatrix.

The case is related at page 129.

### PLATE III.

This plate exhibits the median nerve of David Franklyn, whose case is related at page 60.

- a. The trunk of the median nerve drawn from its situation, to show more distinctly its connexion with the sheath of the tendons.



- b. b.* Enlargements of the nerve.
- c.* The natural connections of the sheaths of the tendons of the flexor muscles thickened.

#### PLATE IV.

This plate is taken from the leg of Susanna Hostler, whose case is related at page 73.

- a.* The anterior tibial nerve.
- b. b.* Numerous filaments going from the dorsal branch of the peroneal nerve to the base of the fungus.

#### PLATE V.

The figures of this plate are taken from the same preparation as the preceding one.

*Fig. 1.* Shows the long cutaneous branch of the peroneal nerve connected with the posterior part of the fungus, as it passes downwards to terminate in the outer side of the back of the foot.

*Fig. 2.* Shows the mouths of the fungus.

*Fig. 3.* Shows the appearance of a perpendicular section of the fungus.

*Fig. 4.* Shows a portion of the base of the fungus magnified.

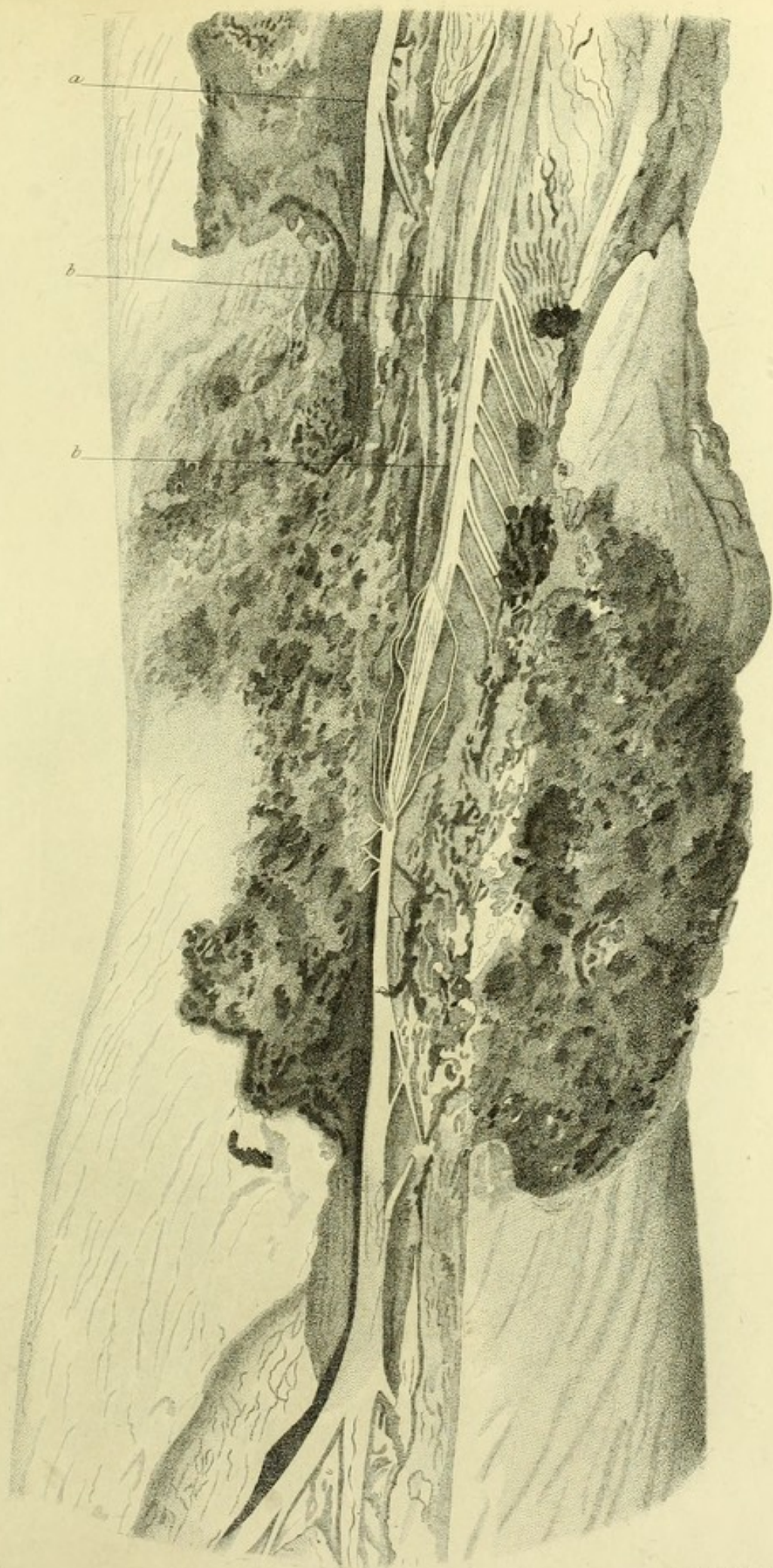
*Fig. 5.* Shows the blood-vessels going from the base to the cells of the fungus magnified.

#### PLATE VI.

This plate is taken from the leg of William Richardson, from which a portion of the peroneal nerve was removed. The case is related at page 77.

- a.* Peroneal nerve.
- b.* The part giving off the anterior tibial nerve, and the dorsal branch of the foot.







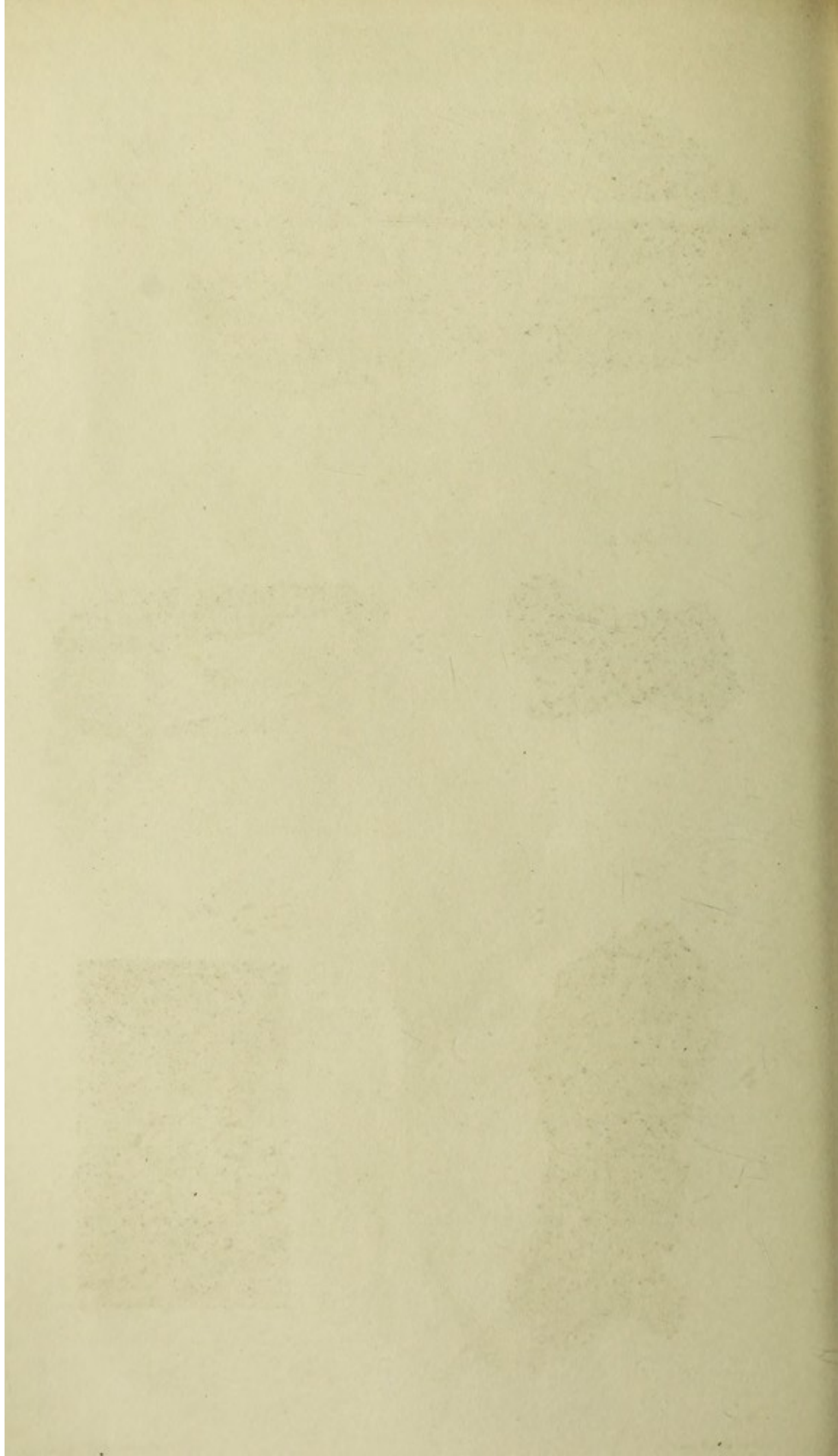




Fig. 1.

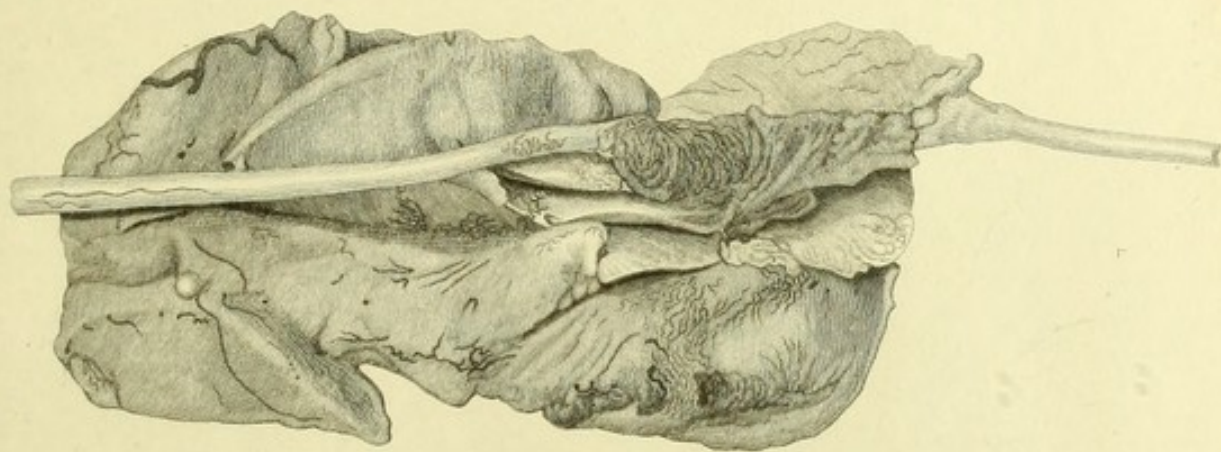


Fig. 2.



Fig. 3.



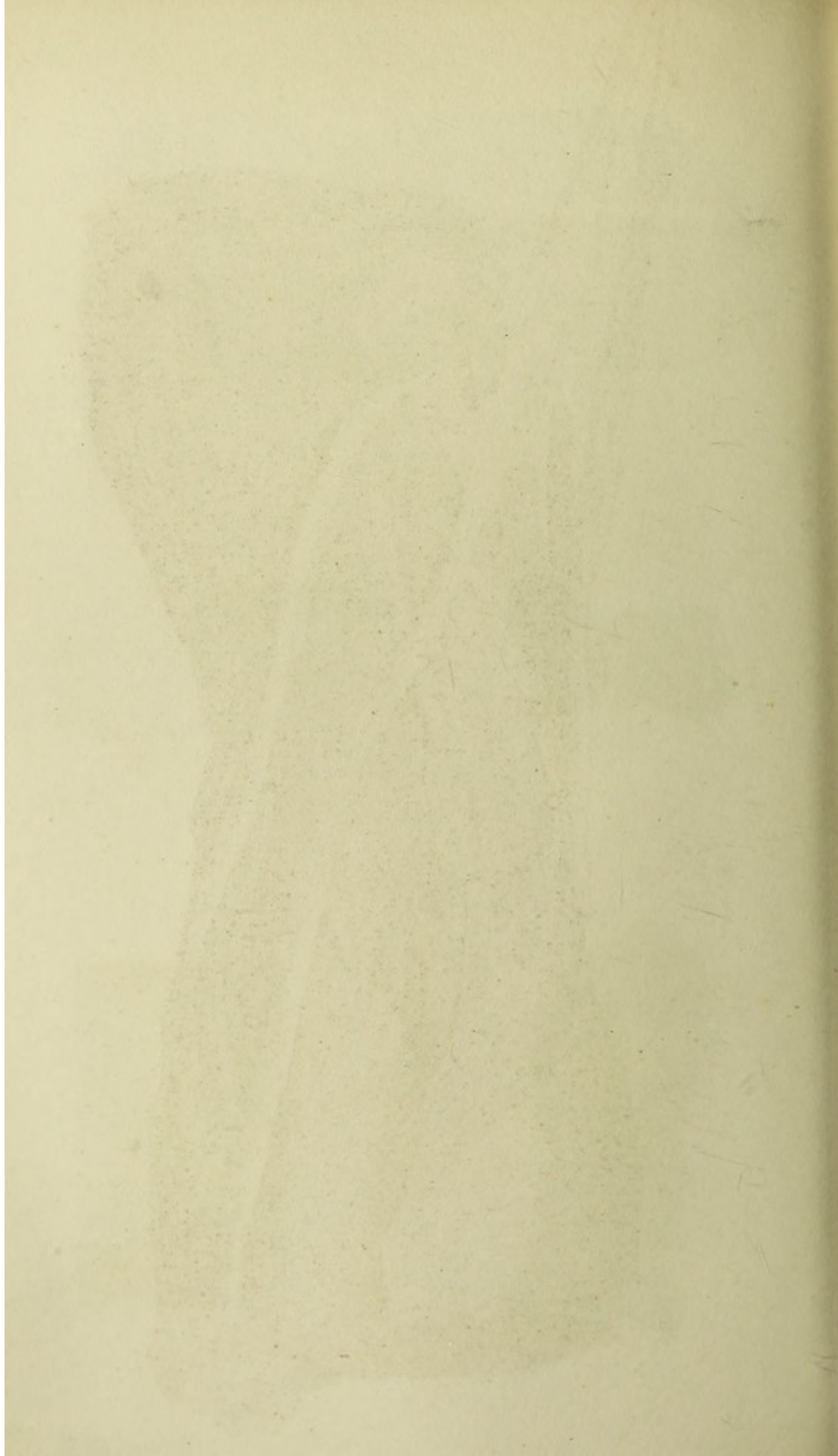
Fig. 4.



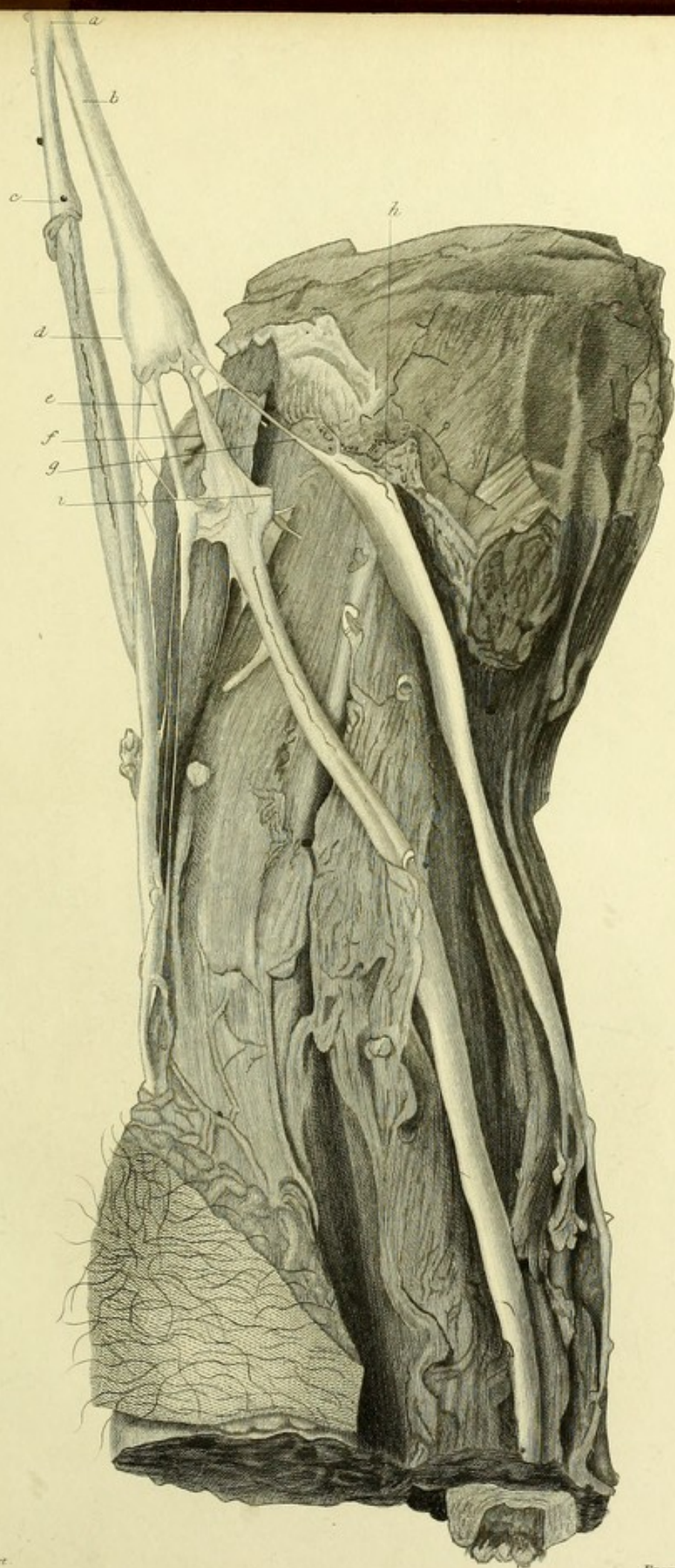
Fig. 5.







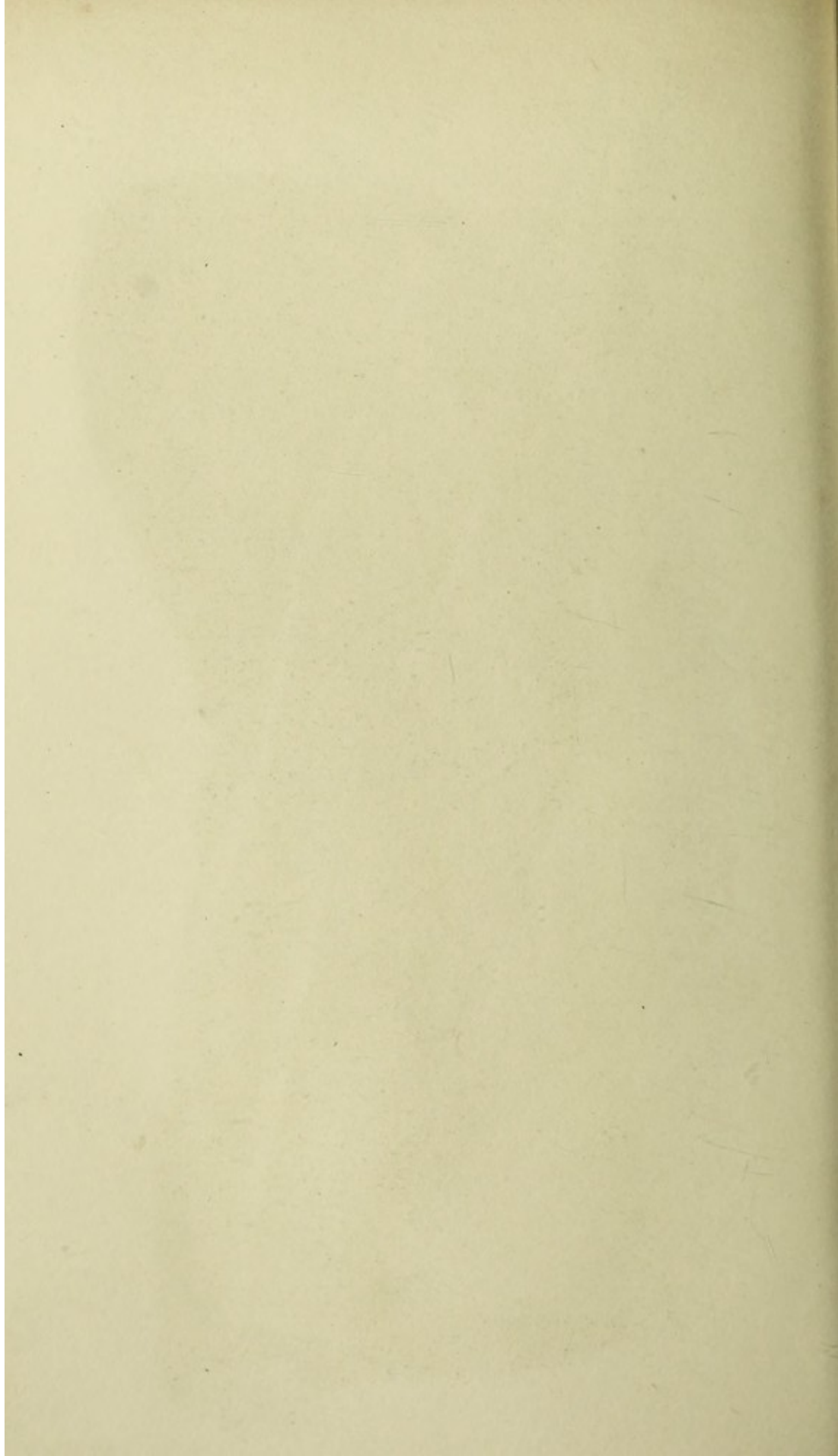




Drawn by E. Hart.

Engraved by J. Stewart.

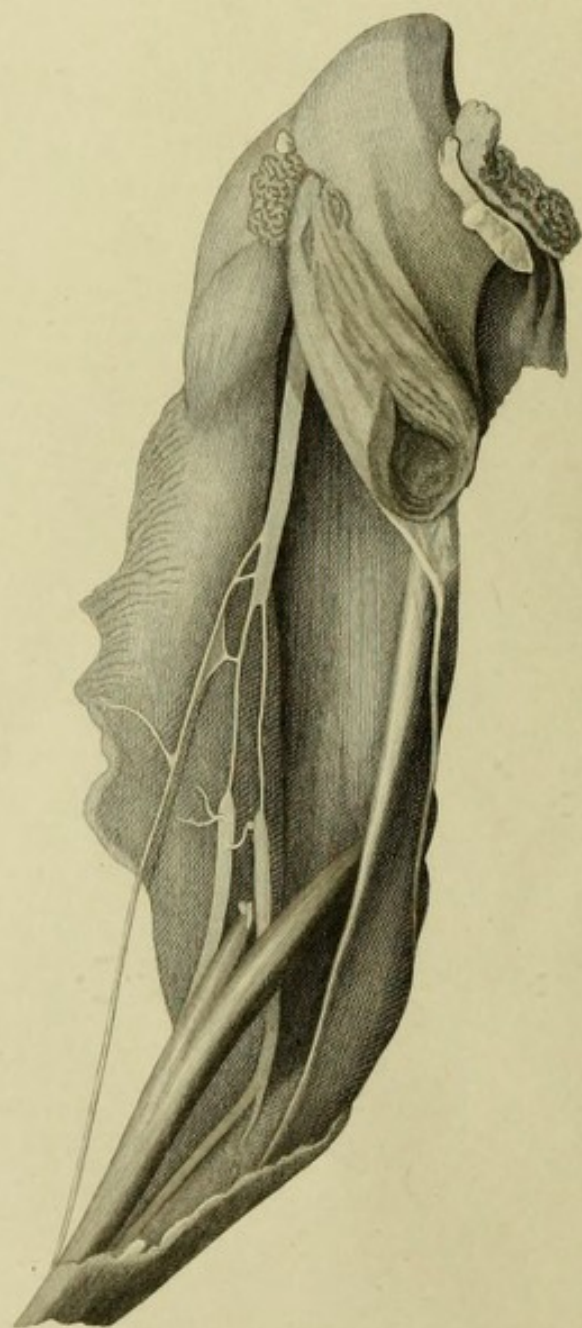












*Drawn by E. West.*

*Engraved by J. Stewart.*

*Published Nov. 1<sup>st</sup> 1820 by J. Drury, 36, Lombard Street, London.*



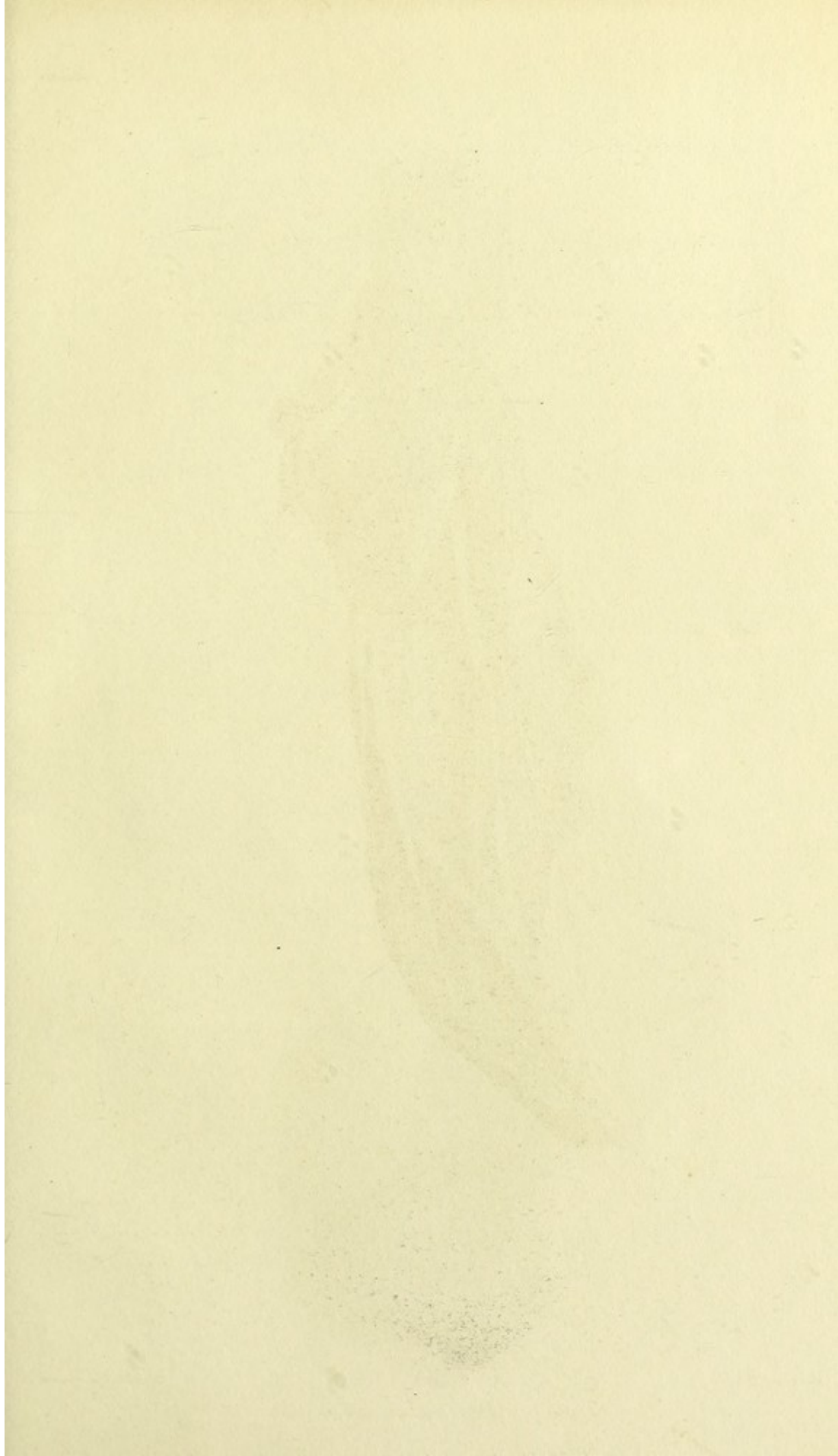




Fig. 1.

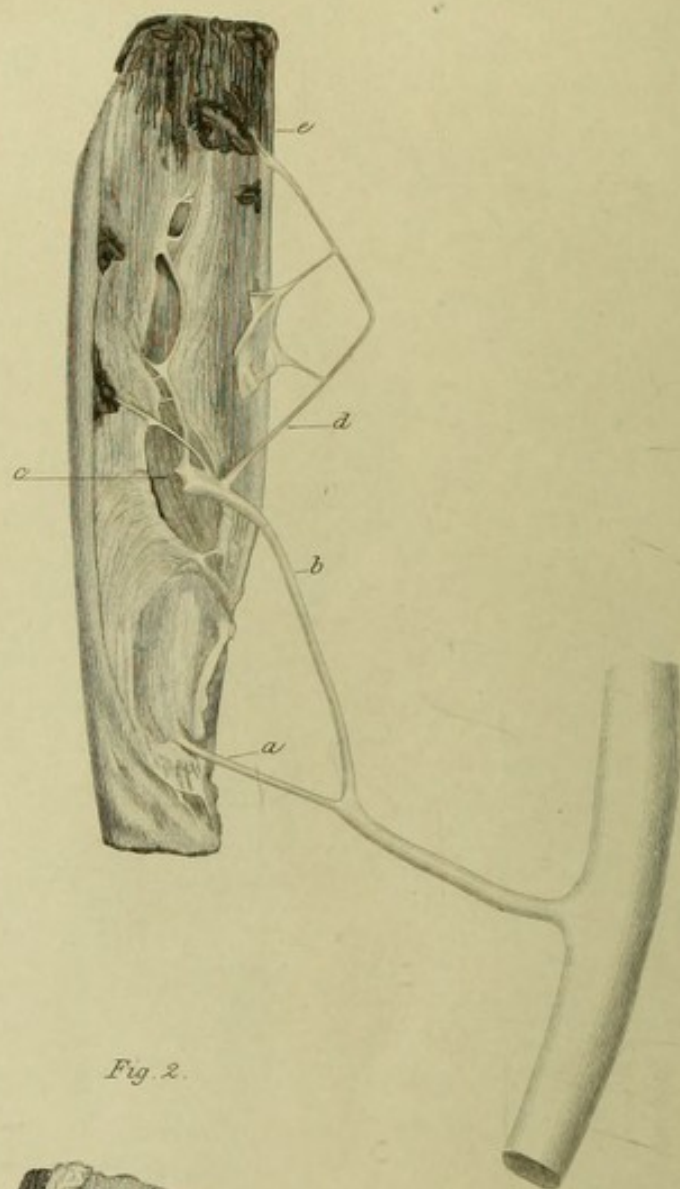
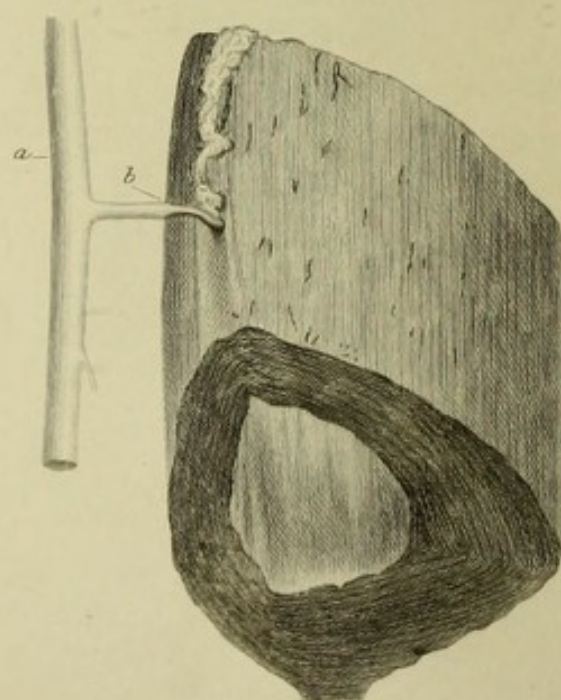


Fig. 2.





- c.* The long cutaneous branch passing to the outer side of the back of the foot.
- d.* The nerve enlarged where it was divided.
- e.* A branch going from the divided extremity to the surrounding parts.
- f.* A branch going from the divided extremity to the dorsal branch.
- g.* A branch going from the divided extremity to the anterior tibial nerve, which is turned to show the connection more distinctly.
- h.* The corner of the anterior tibial nerve which most probably joined the dorsal branch at *i*.

## PLATE VII.

This plate was taken from a preparation of the rabbit's leg, which formed the subject of the eighteenth experiment, and shows the regeneration of nerve after a portion has been removed.

## PLATE VIII.

*Fig. 1.* Shows a branch of the posterior tibial nerve distributing filaments to a portion of the fibula.

- a.* A branch going to the periosteum.
- b.* A branch distributing filaments to the muscle, periosteum, and bone.
- c.* Two filaments entering the substance of the bone.
- d.* A branch giving filaments to the periosteum, and terminating in a portion of muscle at *e*.

*Fig. 2.* Was taken from a portion of tibia in the case of William Richardson, related at page 77.

- a.* The saphenus nerve.
- b.* A branch continued into the substance of the bone.

On each side of *b*, some filaments were distributed to the periosteum, but these were removed for the purpose of showing more distinctly the branch entering the bone.



## PLATE IX.

Represents a portion of the gastrocnemius muscle, and a branch from the internal popliteal or sciatic nerve distributed to it.

- a.* The internal popliteal or sciatic nerve.
- b.* A branch of this nerve dividing into two others, which are distributed to the muscle, and form the membranous and plexiform appearance.

## PLATE X.

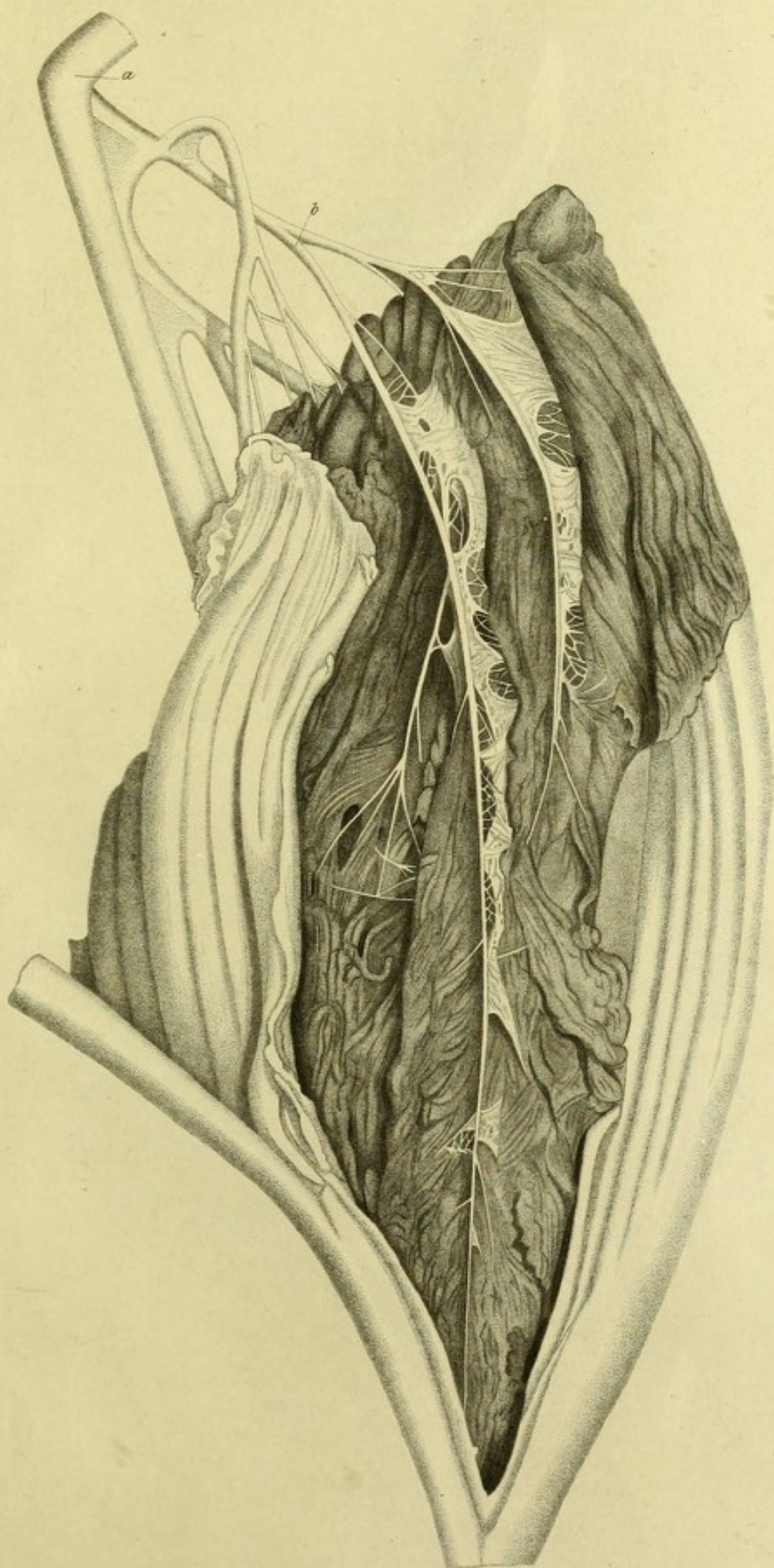
- Fig. 1.* Shows the Schneiderian membrane of the horse raised, and some of the sinuses, containing coagula.
- Fig. 2.* Shows some of the sinuses empty in a transverse section of one of the turbinated bones, with the Schneiderian membrane attached to it.
- Fig. 3.* Shows the sinuses and veins distended with blood which had been coagulated by injecting a solution of oxymuriate of mercury by the carotid artery.
- Fig. 4.* Shows the same as *fig. 3*, only that the coagulated blood has been removed.

To show the extent to which the Schneiderian membrane may be distended, it is only necessary to introduce a blow-pipe into the vein that returns the blood from the inside of the nose and inflate it. This plate exhibits one of the most beautiful structures in the animal economy. It is similar in man, the horse, ox, and sheep, and is peculiarly calculated for resisting the pressure of the atmosphere on the Schneiderian membrane, which otherwise would be so pressed against the bone, to which it is attached, as to entirely prevent the nerves from performing their functions.

A nearly similar structure to this of the nose exists in the soft palate of some animals.

THE END.







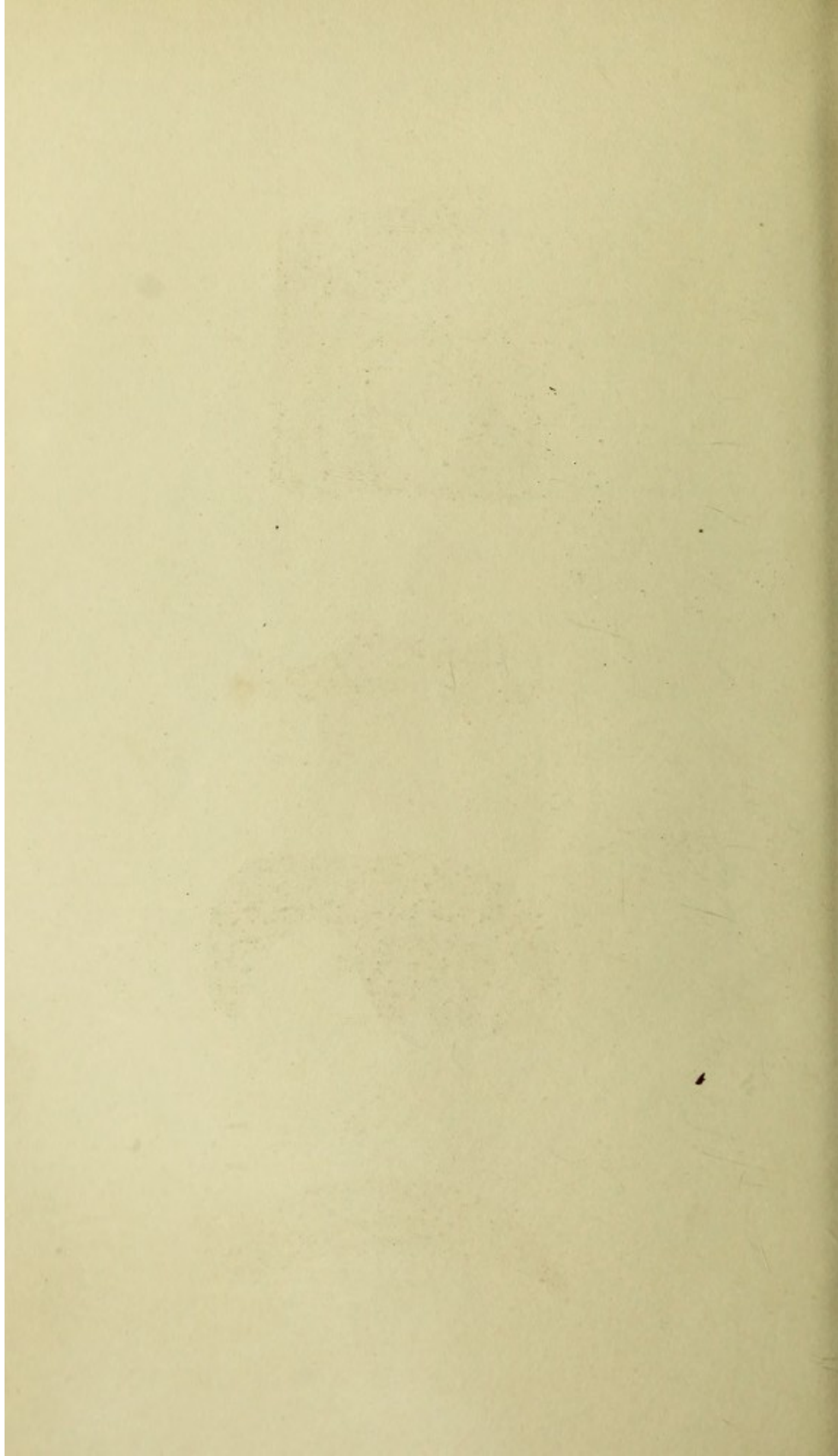




Fig. 1.

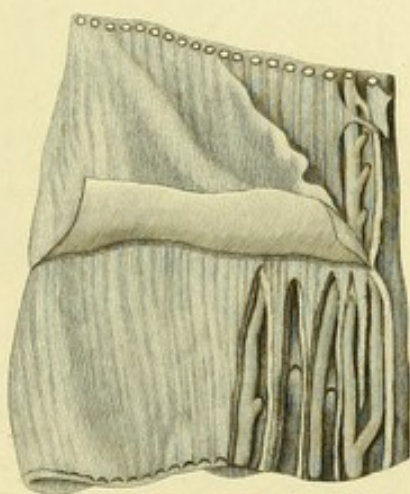


Fig. 2.

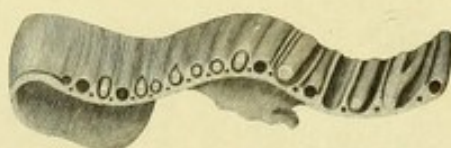


Fig. 3.

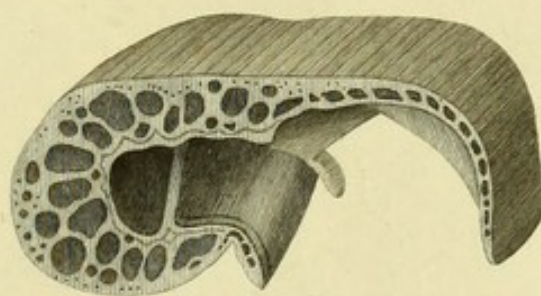
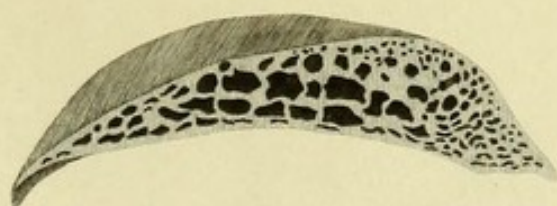
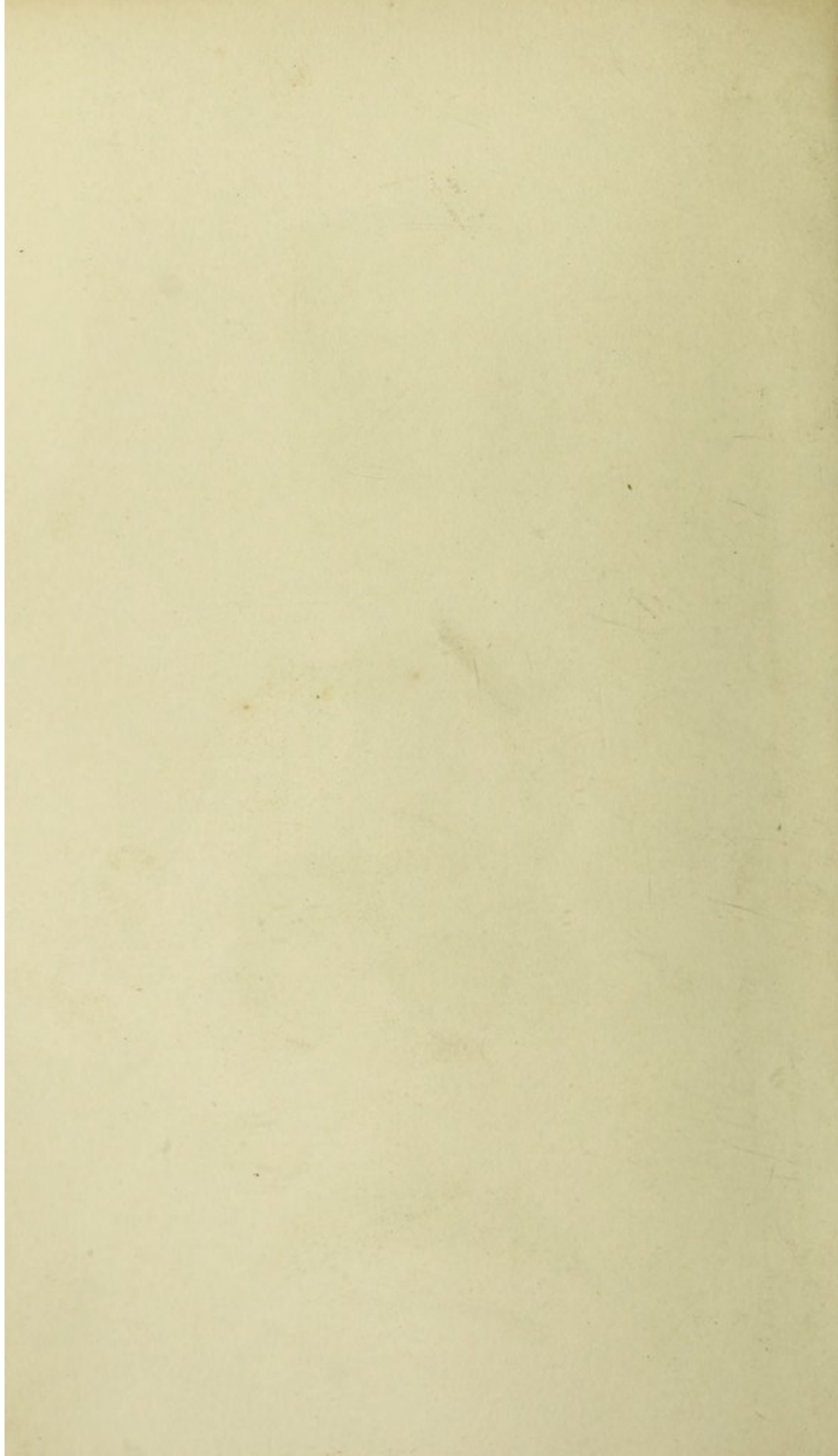


Fig. 4.



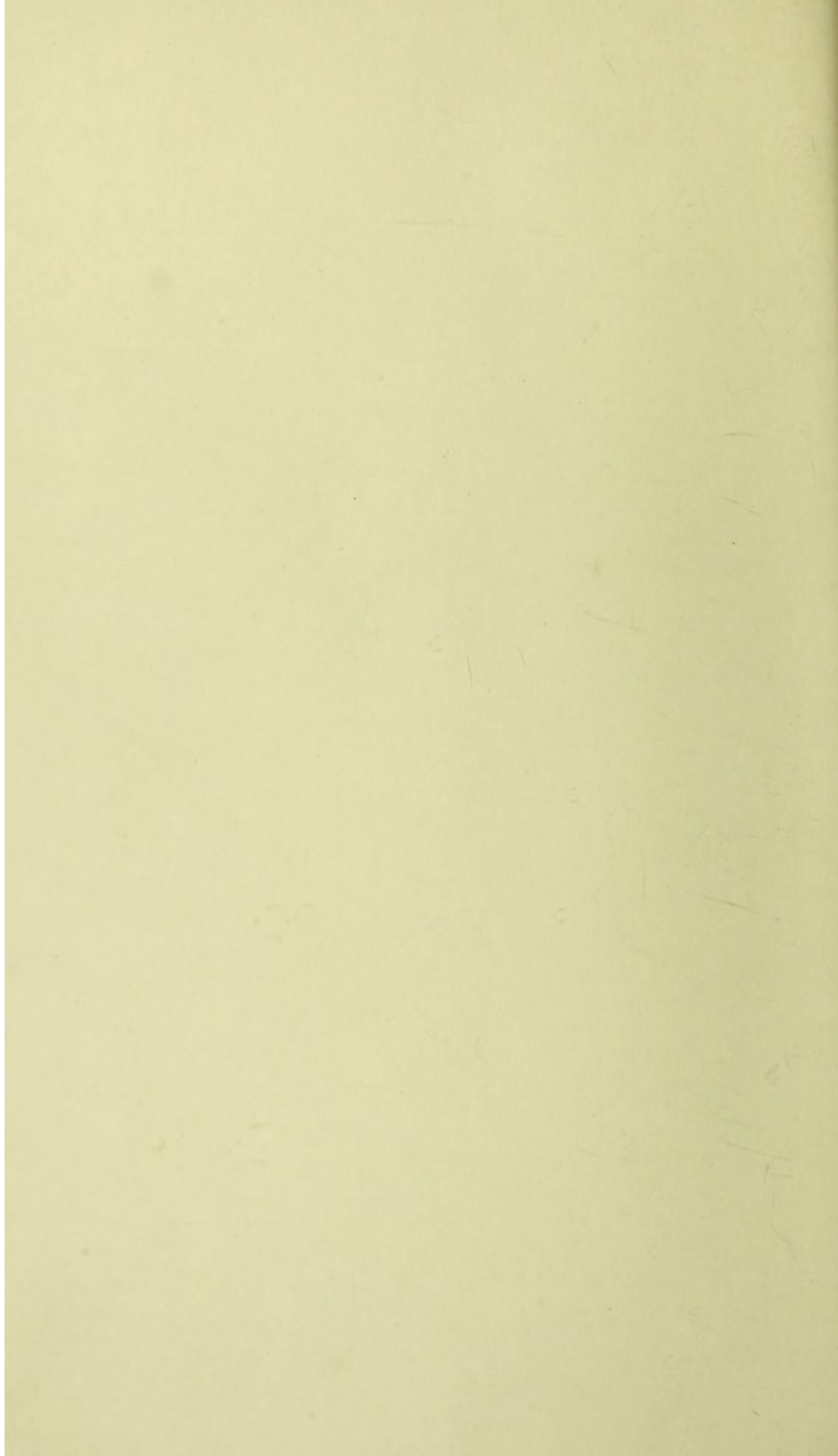














R. B. 26. 6. 1981



