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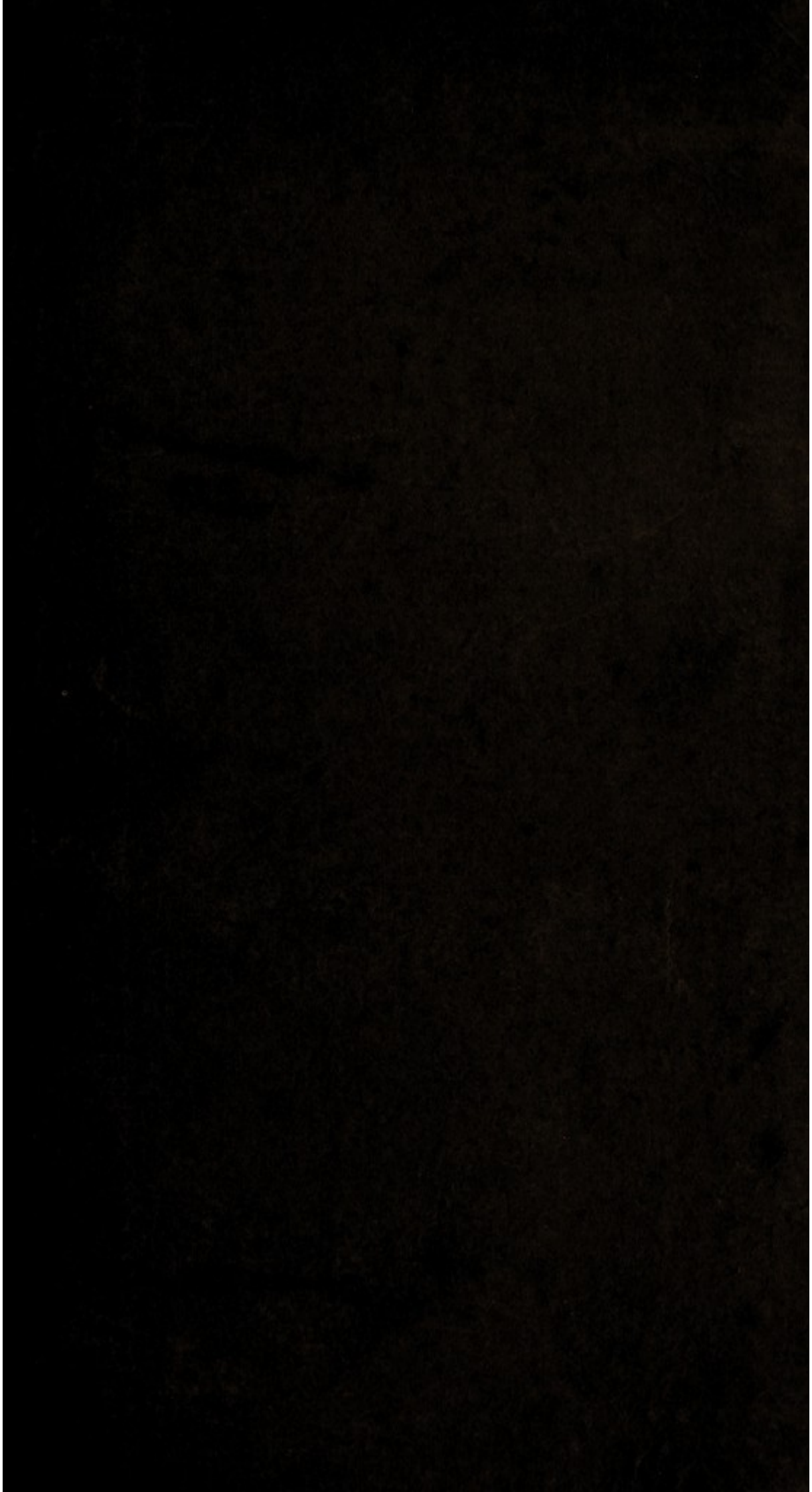

OBSERVATIONS

ON

GUN-SHOT WOUNDS,

AND ON

Injuries of Nerves,

&c.

Printed by S. Gosnell, Little Queen Street, London.

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REQUIRING THE

DIFFERENT OPERATIONS OF AMPUTATION,

&c. &c &c.

Published separately for the Convenience of those who have purchased the first Edition of the latter Treatise.

By G. J. GUTHRIE,

Deputy Inspector of Hospitals during the Peninsular War; Surgeon to the Royal Westminster Infirmary for Diseases of the Eye; Consulting Surgeon to the Western Dispensary for Diseases of Women and Children; Member of the Medical and Chirurgical Society of London; Associate of the Medical Societies of the Faculty of Paris and of Aberdeen; Lecturer on Surgery, &c.

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1820.

TO

FIELD MARSHAL

HIS ROYAL HIGHNESS

THE DUKE OF YORK, K. G. G. C. B.

Commander in Chief of all His Majesty's Forces,

&c. &c. &c.

SIR,

WHEN Your Royal Highness assumed the command of the British Army, the higher situations in the Medical Department were filled by men from private life, who had no further interest in it, than what concerned their own immediate duties. The lower situations were held by men, who being nearly precluded from all hope of advancement, were frequently careless of improvement.

Your Royal Highness soon perceived that little was to be expected from a body of men thus constituted; and by abolishing the sale of medical ap-

pointments; promoting from rank to rank according to merit; and by making the higher situations fair objects of ambition to all, imparted to them a vigour of thought and action to which they had hitherto been unaccustomed, and brought the department to its present state of efficiency and public consideration.

Previously to this period, the Medical Officers of the Army, strictly speaking, had done little towards the improvement of science. The many and important additions made to it, since Your Royal Highness extended to them your gracious protection, attest its power; and the benefits which the sick and wounded of the Army have received from their improvement and the amelioration of their situation, must be highly satisfactory to Your Royal Highness.

Military surgery, or that which more immediately relates to wounds and injuries inflicted on the field of battle, has, during this period, undergone nearly a total change, and I have thought it my duty to lay at the feet of Your Royal Highness the following work, which records many of these changes, and which is offered more as an humble tribute of that gratitude and affection for Your

Royal Highness's person and authority, which is universally felt and acknowledged throughout the Army, than from any idea of the intrinsic merit which it may be supposed to possess, by

Your Royal Highness's devoted,

And very humble Servant,

GEORGE JAMES GUTHRIE.

2, *Berkeley Street, Berkeley Square,*
December 28, 1820.

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ERRATUM.

Page 188, second line from the bottom, *for* spinal, *read* spiral; and refer for a case, in some respects analogous, to a paper by Sir E. Home, in the second volume of the Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge, page 154.

ON

GUN-SHOT WOUNDS.

Solutions of continuity, caused by the collision of any solid substance, impelled by the force of gunpowder against the human body, are so denominated; and have been always supposed to possess some peculiar properties, which render them different from all other wounds. This opinion arose from the appearances accruing after an injury of this kind differing from those of any other; and as gun-shot wounds, in the surgical division of wounds into, incised, contused, lacerated, &c. belong entirely to neither class, they should be considered as a separate one, depending for their general treatment on the common principles of surgery, but subject to many peculiarities. In referring to the general principles of surgery for an explanation of the phenomena of gun-shot wounds, I by no means wish to estimate so lightly as many authors have done, that knowledge in their treatment which is to be acquired by experience; for, although experience without principles would never lead to a thorough understanding, or the perfecting of any subject, yet a knowledge of principles alone, without that information which is to be acquired by practice, would, in this instance, of the two evils, be most detrimental to the generality of patients: for the received principles of any science may be found to be erroneous, whilst the laws of nature are immutable.

The nature of a gun-shot wound admits of much more difference than most wounds received in civil life from accidental causes; for, the injury, as in many other cases, is not

only that of degree, but is differently modified, according to the part of the body injured, the size and shape of the offending cause, and the force with which it is impelled. The wound may, therefore, be at the same time, incised, contused, lacerated, and penetrating; it may be a simple injury, as regarding the parts of the body injured; or complicated, or serious, when parts essential to life, or of consequence in the animal economy, are wounded; either, as relating to the lesion of the functions they perform, or the constitutional symptoms that supervene from the injury.

To enable us to investigate these peculiarities with advantage, to adapt our practice to the leading characters of each injury, to proportion our measures to the urgency of the case, to abstain from interference where it is unnecessary, or useless, and to act with energy where decision is required, it is advisable to treat of gun-shot wounds under different heads; and I have chosen the following classification, as sufficiently explicit and instructive.

1. On gun-shot wounds, or, of wounds in parts of no vital importance or comparative consequence in the human frame.

2. On gun-shot wounds accompanied by lesion of the larger nerves.

3. On gun-shot wounds, or injuries of the extremities, requiring the operations of amputation.

4. On gun-shot wounds accompanied by lesion of the larger arteries.

5. On gun-shot wounds affecting the head and neck.

6. ——————————— thorax.

7. ——————————— abdomen.

8. On gun-shot wounds accompanied by fracture of the bones.

1. OF SIMPLE GUN-SHOT WOUNDS;

Or, of Wounds in Parts of no vital Importance or comparative Consequence in the human Frame, and which in general require little Interference on the Part of the Surgeon.

A WOUND made by a musket-ball is strictly a contused wound, and has therefore been supposed to partake, in a remarkable degree, of the immunity such wounds generally enjoy, of comparative freedom from pain and hæmorrhage; whilst the process of restoration, or filling up of the wound, has been equally presumed to be preceded by considerable suppuration, or of sloughing of the parts more immediately affected; being fundamental errors of principle, which have had a fatal influence on the practice resulting from them. For the degree of contusion is entirely dependent on the shape of the projectile, the force of impulsion, and the resistance opposed, which equally influence the symptoms and appearances resulting from the wound.

From the ideas usually attached to a contused wound, it has been supposed that gun-shot wounds are not painful at the moment of infliction. This, as a general principle, is erroneous, although in many the pain is but trifling, whilst in others it is severe, and, in some few rare instances, the patient has been unconscious of the injury. Allowing for the difference of sensibility in individuals, and the different manifestations of suffering made by them from the same apparent cause, it may be concluded, that, in soft parts, the pain felt is in an inverse ratio with the degree of contusion; we might perhaps say more justly, ought to be; for, in two persons suffering apparently from the same kind of injury, and with the same detriment, one will writhe with agony, whilst the other will smile with contempt. I have seen a sluggish phlegmatic individual actually dancing and screaming from a shot

through the thigh, whilst a very irritable man has only regretted it as an inconvenience. At the first battle which took place in Portugal, the 29th regiment, to which I was attached, had 200 men wounded in storming the heights above the village of Roliça, and most of these men were lying in a line of two hundred yards extent; they were all known to me by name as well as by person: the conflict was soon over, and the difference of expression in begging for assistance, or expressing their sense of suffering, will never be obliterated from my memory; and it would have been a lesson to those who deny that pain and constitutional alarm are attendant on gun-shot wounds, which they would never have forgotten. From a mistaken sense of duty I marched with the regiment towards the enemy, who reserved their fire until the troops actually met, and I saw and *heard* the first gun-shot wound received from an enemy, that I ever dressed. It was on the shoulder, and the soldier described it as a severe numbing blow, depriving him momentarily of the use of his arm, and followed by a severer pain. Whilst correcting this sheet for the press, an officer has called upon me who was wounded by a cannon-shot, on the fore part of the thigh, at the siege of Badajos; and he describes his sensations at the time as being a confused sense of a severe injury, followed immediately by great pain in the part affected. Shortly after the battle of Vimiera, I was wounded myself in the legs by a musket-ball, which fortunately only grazed one and bruised the other; yet it would be difficult to convince me that I did not suffer great pain from the injury. During the battle of Vimiera, I was examining a wound in the arm of a soldier, when he received another ball in the nates, the pain of which made him spring from the earth, and induced us both to seek for shelter. That pain is a general attendant on gun-shot wounds I think I may be permitted to declare with confidence; that it varies in intensity I have admitted, and that in some very rare instances it is not experienced, cannot be disputed; for, on several occasions, I have had applications for assistance on account of one wound, and have

perceived from the bleeding that another had been received, of which the soldier was unconscious. But this never takes place when an organ of importance is injured, and is a circumstance by no means peculiar to gun-shot wounds; for, when two men, or even children, are wrestling or fighting, many injuries are sustained which usually cause much pain, but which at the moment are not felt; and in battle, when the ball is impelled with great force from an unexpected quarter, whilst the soldier is anxiously engaged in another, he may be wounded without being immediately sensible of it. I am induced then to conclude from many considerations, that the greater the velocity with which the projectile is impelled, the rounder and smaller the size, and the less the resistance opposed, the less will be the sensation of pain produced in the sufferer. But even this opinion must be received with considerable latitude, for man admits not of mathematical precision, and a cannon-ball will sometimes completely destroy the internal texture and life of a part, without tearing the skin or causing much pain, and yet the shot causing such injury have usually lost the greater part of the velocity with which it was originally propelled. A musket-ball, merely impinging against a soft part, without rupturing the skin, invariably causes much more immediate pain, and for several days much more inability, than if it had actually entered, or passed through it. Major King, of the Fusiliers, was killed at New Orleans by a musket-ball, which struck him on the pit of the stomach, leaving only the appearance of a contusion, apparently in the same manner as a blow from the hand of a pugilist on the same part.

The subject of pain is, however, of trifling import, when compared with that of hæmorrhage; it is merely a matter for discussion, whilst bleeding must be one of great anxiety, and may be the cause for necessary or unnecessary action. The erroneous idea, which has pervaded alike medical books and the minds of medical men, that gun-shot wounds do not bleed unless great arteries are wounded, has arisen from generalizing too much, when the authors have not been actors in the scenes

they describe; or from their first laying down a supposititious foundation, and then rearing on it a superstructure such as it ought to be according to theory, without encumbering themselves as to the fact. According to theory, a gun-shot wound being a contused wound ought not to bleed, in the first instance, because the parts are dead or deadened; and if it should bleed, some great blood-vessel must be injured; whilst, according to the same authority, secondary hæmorrhage was to be expected and dreaded at the moment of the separation of the sloughs. Hence have I seen a surgeon on the field of battle, groaning under the weight and inconvenience of a sack full of tourniquets, not one of which he would, in all probability, have a proper opportunity of applying, and tormenting himself for days after the action, in the expectation of secondary hæmorrhages, which never took place. Facts are often opposed to theory, and in nothing more than on this point; for, although some gun-shot wounds bleed but little at the moment of infliction, there is, in the greater number, more or less loss of blood, and occasionally in considerable quantity, although there be no vessels of importance injured. In wounds of the face and neck, the quantity lost is often considerable, and the clothes are generally covered with it. If the ball inflicting the injury, should have come in contact with any solid substance, previously to its touching the human body, it may have become of an angular, irregular, and even flattened form; the wound will be, in consequence of this change in the ball, more lacerated than contused, and the loss of blood, in all probability, greater. The colour of the blood will be arterial, but a wound of a large artery is not to be feared, unless it be emitted in great quantity, and per saltum, and continues to be poured out of a bright colour and without intermission, in spite of the common pressure, or means made use of for its suppression; in which case the lesion of an artery of some magnitude is indicated. The bleeding from a simple flesh wound soon ceases, and does not return, except some violence be done to the part; whilst in a case of wound-

ed artery, it sometimes continues until the patient dies, which is frequently the case when a large artery is partially divided. If the artery be completely divided, a considerable quantity of blood is quickly lost, and the patient may also die; but in general, syncope, or a state nearly allied to it, supervenes, and the hæmorrhage ceases spontaneously. The same thing takes place when a limb is carried away by a cannon-shot, and proves the safeguard of the patient's life; for, serious and destructive bleeding has ceased, in most cases, before a tourniquet can be applied, and indeed in the greater number of cases they are of no use whatever; for, after the hæmorrhage has been once spontaneously suppressed, it does not in general return; and whenever it does return, the patient's life will certainly be lost, unless proper and effective assistance be at hand *. I am here stating general rules, and not noticing

* Mr. Wardrop, in an interesting paper inserted in the tenth volume of the Transactions of the Medical and Chirurgical Society, entitled, "Some Observations on a Mode of performing Operations on irritable Patients, in which Bleeding to Syncope is recommended, in order to overcome the Irritability and Sensibility for the Time required," considers the loss of blood as otherwise advantageous, because he had almost universally observed, that those patients recovered from operations best who lost the greatest quantity of blood; "a fact," he says, "strikingly illustrated after the battle of Waterloo, when it was found, that the wounded who were left in the field, and not taken into hospitals till the fourth and fifth day after the battle, recovered much sooner than those who were immediately attended to. This difference could only be accounted for, by the bleeding from the wounds being so extensive as to produce syncope; thus preventing inflammation and fever." The fact I do not object to, but the inference is, I think, incorrect, being incompatible with the statement made above. The loss of blood which occurred in these persons, took place only at the moment of injury, and was in the same proportion as in those cases which were carried into the towns, and improperly fed and treated. If a second bleeding had taken place from a wounded artery, the patient's life must have been lost, unless a proper operation was performed, as will be further shown in the Chapter on Wounded Arteries. The real truth is, that the patients thus exposed,

exceptions; for, when a large artery is only partially divided, the application of a tourniquet, or the production of the effect of it by any other means, will alone prevent a fatal termination, which actually did happen in three cases which have come to my knowledge, in one of which the femoral, in the other the humeral, and in the third, the carotid artery was wounded. In the same manner the application of a tourniquet, or of pressure, may save a few ounces of blood in some particular instances, and, consequently, the life of a valuable man; but in general it is not the tourniquet which suppresses the hæmorrhage and saves the life of the patient, but the spontaneous efforts of nature alone.

It may be received as a general rule, although admitting of exceptions, that a hæmorrhage thus spontaneously repressed will not recur, unless from impropriety of conduct, or accidental violence; neither will a due degree of suppuration or sloughing in the wound effect it. The chance of secondary hæmorrhage is but trifling; and if in such cases as these it is so, there can be no doubt but that it must be next to nothing in others where no vessel of importance has been injured. On the separation of the sloughs, a little blood may occasionally be lost, but it is generally caused by the impatience of the surgeon, or the irregularity of the patient, and seldom requires attention. Sometimes at this period, that is, from the eighth to the twentieth day, a large artery will give way from sloughing or ulceration; but the proportion of cases requiring the ligature of arteries, will not be greater than three or four in a thousand taken indiscriminately, exclusive of hæmorrhage caused by hospital gangrene, inordinate slough-

were nearly all suffering from fracture of the lower extremities, which prevented their being removed, until the means of transport were plentiful; and these unfortunate men were not benefited by the exposure, although they indubitably were by the starvation they underwent. The want of food has never been found injurious after any great battle, inasmuch as abstinence is an excellent mode of preventing inflammation; but it is not consonant to common sense to suppose that proper surgical care is not more serviceable than neglect.

ing, or broken bones, which are not the usual causes hitherto alluded to as inducing secondary hæmorrhage; and which, as they may almost always be avoided by proper care and management, cannot with propriety be considered, as legitimate causes.

It is not intended to deny that hæmorrhage does occasionally take place from wounded arteries, which cannot be controlled in time, or, which requires the tourniquet; but it is not common, and seldom occurs unless a large vessel is divided near the heart, or is only partially divided and cannot retract, when the patient will continue to bleed until he dies*. An artery when not hit direct, more commonly recedes from the ball by its elasticity, and its coats only are injured without any hæmorrhage immediately taking place, although the parts injured may subsequently slough; but this does not necessarily follow, for, in some instances, when all the coats are affected, they inflame, and the canal of the vessel becomes obstructed, of which I have a preparation, where a ball passed between the femoral artery and vein without dividing either; and in others, I have reason to believe, the vessel completely recovers itself. It is by reason of its elasticity that the subclavian artery so often escapes when the ball appears to have passed directly through its usual track. Sir Lowry Cole, who was wounded at Salamanca, and a piece of whose rib subsequently exfoliated, is a good instance of this kind of injury; and the late Sir E. Pakenham was twice wounded in the neck in the same manner, the ball crossing each time from side to side across the line of the great vessels, without injuring either. His last unfortunate wound was more direct, being through the common iliac artery, and killed him on the spot.

The distinctions, then, usually made, that gun-shot wounds do not bleed at the moment of injury unless a large artery

* Colonel Duckworth, of the 48th regiment, at the battle of Albuhera, received a ball immediately through the edge of the leather stock, which divided the carotid artery, and killed him before assistance could be procured.

be wounded; and that they do generally bleed, and often profusely, after suppuration has taken place, cannot be too soon banished from the mind of every surgeon, as they lead to very bad practice, and give much unnecessary trouble: for, instead of waiting with the greatest anxiety for hæmorrhages, when the sloughs separate from wounds in the vicinity of great arteries, the surgeon may think himself peculiarly unfortunate, if he meet with a greater proportion of cases than I have mentioned.

When an organ of importance has been injured, and the blow severe, as by a cannon or grape shot, or shell, or from the fracture of a bone, and even from the attention being directed to the receipt of an injury from the situation in which the soldier may be placed, a peculiar constitutional alarm ensues in a much greater degree than would follow an injury of equal magnitude, precisely in the same spot, from any other cause. It affects alike, although not in an equal manner, the coward and the brave, the man of learning and the unlettered soldier. As it is, however, an affection often greatly augmented from an association of ideas, so is it more immediately controlled by men of sound judgment, or command of mind, and is more certainly removed by the knowledge of the injury being of little consequence.

On the receipt of a wound which has the appearance of being fatal, or if circumstances of situation can give rise to such an idea in the patient's mind, the constitutional affection is often as manifest at first as when some vital organ has been injured; but it subsides much sooner, and offers us in doubtful cases a diagnostic symptom of the greatest value and certainty. When Marshal Soult was driven out of Oporto in 1809, that part of the army to which I belonged seized on some boats and crossed the Douro very unexpectedly into the heart of the town. The 29th regiment, which first landed, immediately pushed through the town to seize upon a ridge above it; the confusion was great, the French had not expected it, and had not abandoned the town: the troops, the

baggage, sick, &c. fled in all directions, and the inhabitants began to take summary vengeance on the stragglers. The 29th advanced rapidly on the French army, which finding itself turned, immediately retreated in confusion. At this moment one of the skirmishers suddenly came upon his adversary, in consequence of the rapidity of the advance, with only a small bank between them; both parties presented, the muzzle of the pieces nearly touching, both fired, and both fell. The British soldier after a minute or two, thinking himself hit, but still finding himself capable of moving, got up, and found his adversary dead on the other side of the bank. I saw him immediately afterwards in considerable alarm, being conscious of a blow somewhere, but which on diligent search proved to be only a graze from a ball on the ulnar side of the arm; yet the certainty he was in of being killed, from the respective positions of the parties, had such an effect upon him at the moment of receiving this trifling injury, as nearly to deprive him for a short time of his powers of volition: whereas, if the wound had been received from a concealed or distant enemy, it would in all probability have been little noticed; there would have been no impression on the mind, of the unavoidable and impending danger, and little or no consequent alarm*.

The continuance of the constitutional alarm or shock ought to excite great suspicion of serious injury; and when wounds have been received in such situations, or bear such appearances as render it doubtful whether any parts of vital importance have been injured or not, the surgeon may sometimes make up his mind as to the fact, from it alone, when other symptoms more indicative of the injury are wanting; and under

* I perfectly recollect the amusement several of us used to receive whilst attending the hospitals as young men, when butchers were ordered to be bled; for we found that they invariably fainted, and generally sooner than any other persons, which we attributed to associating the idea of blood with death; their trade leading them to see one as a necessary consequence of the other.

all such circumstances, he ought to be particularly guarded in the prognosis or opinion given to the patient or his friends, although every other appearance should even lead him to suppose the injury to be less serious.

The late Sir William Myers was struck by a musket-ball at the battle of Albuhera, on the outside of the right thigh, which broke the bone, without appearing to splinter it to any extent. I directed him to be conveyed to the village of Valverde, and was led to hope, from the appearance of the wound, for a favourable result; seven hours after the accident I found him very restless, exceedingly anxious, and the countenance indicating something more than a compound fracture of the thigh. On questioning him, he complained of pain in the belly, and I immediately suspected that the ball had slanted off (for he was struck on horseback, with the thigh bent), and had passed upwards into the pelvis. The increasing symptoms of inflammation of the abdominal viscera confirmed my suspicion, and in spite of bleeding, and all the care I could bestow, he died early in the morning with the greatest calmness. When I informed him that he had but an hour or two to live, he pressed my hand, and said, "My good friend, how many envied me this morning going into action in command of the fusilier brigade! how few will envy me now!" He made me promise that he should not be opened, and I know not the exact course of the ball; it may perhaps have passed through the thyroid foramen.

Major-general Sir Robert Crawford was wounded at the foot of the lesser breach at the storming of Ciudad Rodrigo, by a musket-ball, which entered the outer and back part of the shoulder through the posterior fold of the armpit, and came out at the axilla. I saw him immediately afterwards with Dr. Robb, who pointed out a third wound apparently too small for the entrance of a ball, and resembling a slit. We at first hoped, that this had not been made by the same ball, especially as the thoracic symptoms were not urgent, but the continuance of the uneasiness and the augmentation of the symptoms

soon convinced Dr. Robb of the extent of the injury; and after death, the ball was found rolling about on the diaphragm, having just had sufficient force to penetrate between two of the ribs, but without injuring the lungs.

During the successful assault on Badajos, Captain James, Deputy Assistant Adjutant General, was brought to me, having been wounded severely on the nates and back part of the thighs, at the foot of the breach, whilst giving directions to the troops. There were four openings, two apparently corresponding with the other two, as the entrances and the exit of two balls; and as he was so close to the enemy at the moment of injury, it was conceived the balls might readily have passed out. Some time however had elapsed, and the general alarm and distress having but little subsided, the sensation at the præcordia being oppressive, and the general feeling of derangement great, I suspected, and was almost convinced, that the openings did not correspond, although their external appearances and direction would admit of the supposition, and that there were three balls at least, one of which must have penetrated into the cavity of the abdomen. The rising inflammation proved this opinion to be correct, and this gallant officer died on the twelfth day, not from inflammation, for that had been subdued, but from hæmorrhage per anum, in consequence of the separation of the sloughs from some internal vessel.

On the retreat of the British army from Fuente Guinaldo in 1812, Captain Prevôst, aide de camp to Sir Edward Pakenham, was wounded in the left side by a ball which passed out at the right hypochondrium. From the slanting direction and small size of the ball, it could not readily be followed by the finger into either cavity; and from its appearance, the surgeons who first saw him were in hopes that it had not penetrated the chest. The anxiety I have alluded to, remained, and rather increased; and from that circumstance alone I pronounced an hour afterwards, that the wound was of a very

serious nature. I discovered, on dissection, that the ball had injured the left lung, the diaphragm, and the liver *.

That this constitutional alarm and derangement is not always present to so marked an extent, I most willingly admit, and that the proper, and what might be considered even necessary and characteristic symptoms attendant on an injury of the most sensible and highly organized parts, are also sometimes wanting, the following case will show.

During the battle of Talavera I was shifting my situation to avoid the ricochet shot of a 12-gun battery, stationed immediately in front of the place I had chosen for my wounded, after the assaults of the preceding night; when I saw a man running after me waving his hand, and calling out to me to stop, which I did, and was rather impatient on finding that he wanted me to examine his head, on which he protested that one of the round shot I saw plunging arround us had just alighted; and pulling off his cap, which bore the mark of the injury, he showed me to my astonishment, that not only was the skull driven in, but a portion of the brains and mashed bone intermingled with the hair. I sent him to the rear, and never saw him afterwards, although I searched for him in the different hospitals †.

* From the examination of this and other cases which recovered from the immediate injury, I am induced to believe, that wounds of the diaphragm (in consequence of the motion of the part) never unite, but always leave an opening with rounded edges, through which herniæ of the stomach or intestines are apt to be formed, and sometimes become strangulated.

† The plunging of shot, technically denominated ricochet, is a pleasing, although awful and deceitful sight, the ball appearing to bound like a cricket-ball; and we are only led to estimate its force by the manner in which it ploughs up the ground. At the affair of Castrojon, previous to the great battle of Salamanca, a poor Irish lad of the 27th regiment was silly enough to call out to his comrades, on seeing a shot of this kind, "Stop it, boys;" and to endeavour to do so with his foot, which was smashed to pieces, so as to render amputation necessary. The oddity or naïveté of these fellows, who obtained the name of the "Babes," was further exemplified on the same day by ano-

The infliction of a gun-shot wound of any importance, is then generally followed by more or less loss of blood, of pain, which is occasionally acute, and by a peculiar anxiety, alarm, and loss of animal and organic powers, that are in a great measure characteristic of this kind of injury. The patient, if the injury be great, is often unable to stand without support, his muscles are not subservient to the will, a deadly paleness overspreads the countenance, a tremor pervades the body, big drops of sweat bedew the forehead, the heart almost ceases to act, and if a great artery be divided, the patient's life is only saved in consequence of this diminished energy, or even by a complete state of syncope.

On the receipt of a simple gun-shot wound the patient is in general brought to the surgeon, slightly hurried and alarmed, with some little loss of motion and power in the part, which bleeds, or perhaps only oozes, or if it be some

ther of them at a very critical moment. The troops had been marching from three in the morning until long after mid-day, under a burning sun which killed several in the ranks, especially Portuguese, and the whole were greatly exhausted. At this moment the French, after a severe cannonade, attacked the left of the British army; and Sir Lowry Cole, who commanded, in order to put an end to the affair, charged them with the 27th and 40th regiments and some squadrons of cavalry. The troops, harassed to the last, moved very slowly, the French stood firm; and when the parties had nearly closed, and it was doubtful which would turn (for one party or other always run), the French broke, and left us the field of contest. But at the critical moment, and when one half minute more would have crossed their bayonets, one of the Babes, seeing a large stone, stooped down, and threw it into the French square with the characteristic exclamation of "Hurrah, my boys!"—On the subject of charging with the bayonet there is great misapprehension: the parties never actually meet, and struggle foot to foot and hand to hand; on the contrary, one side runs away as soon as the other comes close enough to do mischief. This is, and has invariably been the case with the British, when regiments, or large bodies of men have met: small bodies of men may have personal conflicts, but almost all those who are wounded by bayonets, will be found to have received their wounds after the affair had been decided, or rather in the subsequent scuffle.

time done, it is stiff, dry, and painful. If the ball should have passed through the part with great velocity, the sensibility will be much destroyed, there will be little pain, but this will be increased as the wound approaches more to a laceration of parts; and it will be most severe at the moment of the injury, and for some time afterwards, if the injury should amount only to a contusion or bruise, without any division of the skin.

As an injury of this kind is always caused by the impulsion of some foreign body with violence, which will in general have carried with it some part of the clothing, or other extraneous substance, it is of consequence to ascertain if the ball have passed out; and it is not always possible to decide which is the entrance or the exit of the ball; or, when the openings are distant, whether they are caused by the same, or two distinct balls. To ascertain this, the patient ought to be placed in the position he was in on receiving the injury, and with reference to the probable situation of the enemy, when the nature of the wound will be more clear. Suppose a soldier to have a wound on the outside of the knee, and another near the hip, if it be ascertained that he was stepping forwards at the time, and the enemy much above, or a little below him, the course of the ball will be satisfactorily accounted for; and if the opening near the knee be round and a little depressed, whilst the other is a little torn, or is merely a small slit, the entrance and the exit of the ball will be clearly marked. If, however, both openings are rounded, depressed, and the finger can with care be introduced a little way, there is great probability of there being two distinct wounds. If there should be but one injury, the course of the ball can seldom be followed, it may have passed above or below the fascia, but in neither case will there, at the moment, be any mode of distinguishing the track it has taken: if it be below the fascia, the inflammation will of course be considerable; if in the cellular membrane, there will then be more of laceration than contusion; and

the parts will unite in great measure by the adhesive inflammation. In many cases the track of the ball will be marked by a black line along the skin immediately over it, indicating a greater degree of jar and contusion, but not necessarily terminating in suppuration, nor requiring an opening to be made for the discharge of matter.

The absolute necessity for placing the patient in the same situation or position he was in at the moment of injury, has been insisted upon by the most ancient authors; and it is said that one of them was so scrupulous on this point, as to cause a soldier, who had been brought to him wounded, to be replaced on his horse, that he might more readily estimate the various parts which had been injured. After the battle of Toulouse, my attention was directed to a soldier who was said to have received a slight wound in the thigh, but whose foot had sphacelated without any apparent cause. I instantly declared that the femoral artery had been injured, but the attendant surgeon replied, that the wound was not in the immediate course of the vessel. On desiring the man to bring his limb into the same position in regard to us, that he supposed himself to be in towards the enemy when he was wounded, the possibility of such an occurrence was demonstrated, and subsequent dissection proved the correctness of the opinion. After the battle of Pampeluna, much surprise was excited by the femoral artery having escaped injury from a wound which appeared to pass directly through it; but on putting the patient in the same manner in position, it was evident that the ball might readily have passed at some little distance to the outside of it. At the battle of Talavera a soldier received a ball on the outside of the ancle, a corresponding opening appearing at the trochanter; the course of the ball seemed inexplicable, until the man related that he was running, and had his foot raised at the moment of injury.

The wound made by the entrance of the ball is generally different from that made by its exit. The most marked

peculiarity attending the entrance, is a circular depression, capable of admitting the little finger *, and of a livid colour; whilst the exit is more ragged, not depressed, sometimes little more than a slit or rent, although at others it may be much torn. But these appearances are by no means constant, or so strongly marked. If the ball impinge with violence against a surface capable of offering considerable resistance, the entrance will be well marked. If the resistance offered be nearly equal to the momentum, the ball will lodge, or pass through with a well-marked exit; but if the velocity and impulse be greatly superior to the resistance, the exit, although not a depression, will often partake in the appearances of the entrance; the velocity with which the ball passes through the part, overcoming so instantaneously the resistance, that the laceration which would otherwise take place in the passage of the ball from the dense medium of the body to the rarer one of the air, does not occur. When a ball is moving with little impulse, the entrance is by no means so well marked. The natural or different connexions of a part of the same structure, often influence the appearances of the wound, as may be exemplified by comparing the state of the skin at the exit of a ball in the back of the thigh, and the back of the hand. In the thigh there may be only a hole, partaking of the nature of a slit; but on the back of the hand, the whole skin may be torn up, so as to make a frightful-looking wound of what is in reality, not so. At the battle of Salamanca I was requested by a young assistant to give my opinion, whether amputation should be performed or not, in a case in which a musket-ball had destroyed the metacarpal bones of the little and ring finger, and torn the skin from off the whole of the back of the hand, leaving it in rags and of a frightful appearance. I desired the fingers to be removed, the pieces of skin to be brought back to their respective places, and made to cover in the surgical wound; which was readily accomplished, and a useful part of a hand preserved.

* The French balls are smaller than those used in the British army.

When the wound is caused by a piece of a shell, a flattened and irregular-shaped ball, or other sharp-edged instrument of destruction, it is very much of a mixed nature, between contusion and laceration, and the entrance of the ball is more indistinctly marked. This lacerated state is frequently seen in wounds from pieces of shells, and portions of integuments are often torn up, which may be laid down with advantage, and union fairly expected; and if this should not take place immediately, it may in general be effected in a short time afterwards, with little suppuration or loss of parts.

If there be but one opening to be seen, it is usual to suppose the ball has lodged; but this does not always follow, although the finger may pass into the wound for some distance; and a want of knowledge of the possibility of such an occurrence has often given rise to much unnecessary examination and anxiety. It sometimes happens in injuries of the head, that the ball drives a piece of bone nearly of its own size into the substance of the brain, although it does not actually penetrate with it, but falls to the ground. A ball will often be turned, as is well known, by a slight resistance, which is not directly opposed to it; but if the resistance be greater than the momentum, and offered by an elastic body, the ball may retrace the passage it has made, as, for instance, when opposed by the cartilages of the ribs, or any strong tendon. An officer, at the battle of Toulouse, received a slanting shot on the left side of the chest; the ball entered, passed under the skin, injured the pectoral muscle, but was stopped and ejected by the cartilages of the ribs, before it reached the sternum. The finger could follow the track, and the absence of all symptoms indicating lodgment, or further injury, proved the ejectment of the ball.

After the battle of Waterloo my opinion was requested on the case of a very young officer of the rifle corps, who has since entered the Church, who was struck, as was supposed, by a canister-shot on the knee, which had lodged in the head of the tibia, although it could not be felt. I examined

the joint, found a large external opening with the bone broken within, as if a ball had entered deep into its substance; the whole joint was in a state of suppuration, the pulse 130, and he was much emaciated. Amputation was performed with great dexterity and despatch by Staff-surgeon Lindsey, and the patient's life was only saved by this gentleman's unwearied diligence. I examined the joint, after the operation, but no ball could be found; it had never lodged.

Sometimes the clothes of the individual will not be torn by the ball, and are carried in with it for the space of half an inch or even more, (Mr. Patterson, of the 25th dragoons, informs me he has seen this happen in India, a part of the leather breeches going into the wound like a purse). It is not, however, so easy to account for a ball carrying in a part of the shirt, or of a silk handkerchief, for the distance of three or four inches, without the linen or silk sustaining any injury.

At the battle of Vimiera an officer of the 40th regiment, while under the fire of the enemy, requested me to look at a wound he had the instant before received in the thigh. I saw that the shirt had gone in with the ball, and on pulling at the shirt, it came out from the depth of four inches, a perfect *cul de sac*, having the ball at the bottom of it. Ambrose Paré relates a case precisely of the same kind, but with a view of proving, what in his time was of some consequence, that balls do not burn. The clothes of the patient should then always be examined, not only to ascertain the fact, but to enable us to discover what part of them may be carried in with the ball.

If the ball has passed directly through a solid part, it will generally carry out with it any portion of the clothes of the sufferer, or other foreign substance which it may have driven in before it; and if the part, after being placed in position, admits of easy examination by the finger, or by the probe, it may be made for the sake of satisfaction. But as balls often lodge, it is absolutely necessary to ascertain,

if possible, their situation. They will frequently be found on the opposite side of the limb, near, or immediately below the skin, the elasticity of which has resisted and overcome the momentum of the ball; and in many instances when the skin has yielded, a flannel shirt, or the red coat, has stopped its further progress. When the force with which the ball is impelled is not great, or is nearly exhausted, it is often stopped by the bones against which it strikes, without fracturing them, or even doing any sensible injury. A ball, after impinging against the soft parts of the body, is always flattened to a certain degree on one side, or loses its globular form; but when it strikes against and is stopped by bone, it is distinctly flattened by it. A ball will often pass into or through a bone, and be afterwards stopped by the periosteum, a ligament, or the skin. In the three first instances the ball is lost or hidden from our researches, and is only discovered by the subsequent results. A ball may also lodge in the tibia or femur, without fracturing them. I have related the case of one in the chapter on Wounded Arteries, which passed through the femur, above the condyles, into the knee joint, splitting it upwards in its axis, without impairing its powers of support.

When the ball is not passing with great force, it may become a penetrating, without being much of a contused wound; it will apparently drop into the limb, without destroying the parts around it, which close in with little suppuration or slough; a great part of the wound will appear to unite by adhesive inflammation; and if the ball do not press upon some important nerve, or impede the action of a muscle or muscles, either by its position, or the adhesive inflammation which ensues and forms the sac that surrounds it, it may remain quiet for life. I have seen many of these cases where the injury committed and the symptoms which ensued were trifling; and I have seen on the other hand, where the symptoms of inflammation and suppuration were of little import, that permanent lameness followed.

Lieutenant-colonel Creagh, of the 93d regiment, received a wound of this kind at the battle of Vimiera; the ball entered at the upper and outer part of the front of the leg, passed downwards and backwards under the soleus muscle, and could neither be felt nor followed at the time. Under the application of cold water, little inflammation ensued, and only a trifling suppuration followed; no slough was discharged, and the wound healed. He has never since been able to get the heel to the ground; the ball has formed a sac for itself immediately over the flexor muscles, whose motion it impedes, and it is now, after a lapse of twelve years, to be distinctly felt. I could not, however, promise there was no risk in removing it, neither did I press the operation; and my friend prefers putting off the evil day, although it has once or twice placed his life in extreme danger, by forcing him to ride into action under circumstances of particular exposure.

In severe wounds, where a ball passes deep through muscular parts, or slightly injures the bone, it is in general more of a contused wound, and a variety of circumstances and actions must take place before a cure can be accomplished; but it does not appear to me that they have been duly estimated, and especially those that immediately ensue.

The two great points of difference usually attributed to a gun-shot wound, the absence of hæmorrhage and pain, are too much exaggerated, as I have already noticed; for there are few wounds of this kind which do not bleed and are not painful, sometimes indeed extremely painful, from the instant of infliction, not only in the part injured, but often in a more distant one, as in the thumb and fore finger, when the outside of the arm has been wounded; the little and ring finger, when, on the contrary, the inner side has suffered; or in the sole of the foot, when the back part of the thigh has been wounded; and, indeed, in the finger and arm, when a ball has passed through the neck. But this is not truly the

pain that is alluded to; it arises from a large nerve being injured, and referring its sensations to the part on which it is distributed; but it is a pain the surgeon must particularly attend to, as indicating the principal mischief, when, from the appearance of the wound, little injury might be suspected. Pain then often becomes of great consequence, as, in addition to position and other circumstances, it enables us to judge more accurately of the parts that may have been injured, and of the course of the ball.

An officer of the 29th regiment was wounded at the battle of Talavera, by a musket-ball, on the fore part of the right thigh, which made its exit through the left nates. It wounded the great femoral vein, passed upwards and inwards into the perinæum in front of the urethra, without injuring it, although matter afterwards formed at that part, and was evacuated. This gentleman, after some time, perfectly recovered, but all the superficial veins of the wounded thigh have greatly enlarged, almost appearing varicose, and communicate with the superficial veins of the abdomen, which are also of increased dimensions, forming a beautiful venous anastomosis that is very remarkable when compared with the other side. It would be difficult to make out the cause of the peculiar direction this ball took, from any data we are acquainted with. Knowing, as we now do, the results, an approximation might be made to it, but that embraces considerations perfectly unknown at the moment of injury.

From what has been said, it will be understood, that position even must not be too scrupulously observed in making an examination; for, although the passage of a ball through even a distant course is sudden, the spasmodic action of parts is more so. And I can conceive, although the muscles of a limb may be at the moment of injury in a state of moderate contraction or relaxation, that several of them may be in a very different state whilst the ball is actually passing through them: add to this the difference of resistance of many parts, and of the same parts under different circum-

stances, and the necessity for deviations from the supposed position at the period of injury will be evident, in order to enable us to find balls that are hidden. I am occasionally consulted by two gentlemen having balls within the knee-joint, which can only be felt when the limb is in a state of flexion, although the injury was inflicted when it was in a state of extension. Whilst, then, position is to be attended to with strictness in the first instance, due attention to the action of the different parts must not be neglected. The various degrees of resistance of each part may be speculated upon; and, if no symptoms supervene, such as pain, hæmorrhage, loss of particular function, which may be called positive symptoms, the surgeon may form a conjecture as to the probable course of the ball, and examine accordingly.

In all such examinations, whether in the exact course of a ball or at a distant part, the surgeon should never forget to make a counter-pressure to the fingers with which he is searching for the ball. This is most essential in the extremities, where counter-pressure will often bring an extraneous body within the reach of the finger or probe, which otherwise would not have been attainable; and the pain which is often excited in a particular part by this pressure, is an additional indication of the track or situation of the ball.

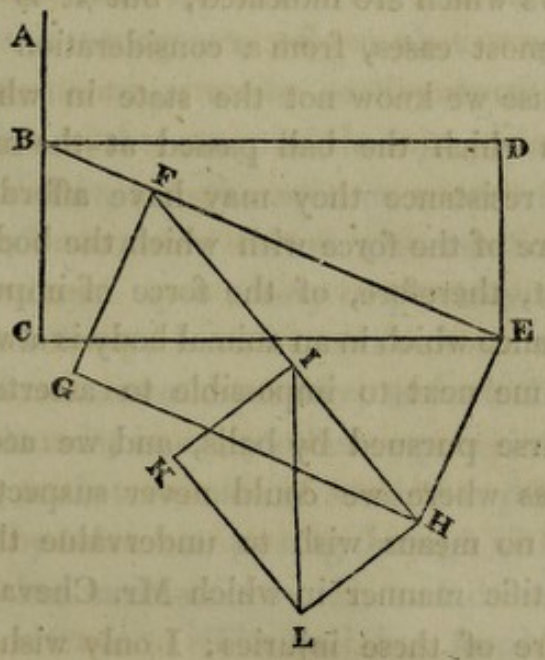
Mr. Chevalier *, p. 51 of his very interesting work on

* The less of the original impulse is left in a shot still moving, the more liable will it be to be stopped or turned out of its course by any given resistance.

Every new resistance which a shot in motion meets with, will operate so as to produce not only a diminution of its momentum, but also a change in its direction; every fresh resistance being in fact equivalent to a fresh power, acting in a different line to that in which the shot was previously moving. As a body acted on at once by two powers will not move in the direction of either, but in the diagonal of a parallelogram, of which two sides are formed by the direction and momentum given by each of those powers respectively; so every change of impulse or resistance will cause the body to move in so

Gun-shot Wounds, has accounted for the injury caused by the collision of a ball, or other rounded substance, and the deviations in its course, on mathematical principles and the laws of matter; and although they may afford a more probable conjecture on the subject, they are by no means, in my mind, satisfactory or adequate to account for the extent of injury or disease that takes place, or the deviations in the course of the ball. If the body were an inanimate substance, the extent of the injury might be estimated in this manner; or if it were composed of known substances of equal densities or

many changes of direction, till at length its momentum is overcome, and it becomes quiescent.



Suppose, therefore, any body, a shot for instance, represented by *A*, to be moved by a power with the velocity and in the direction *A C* to *B*, where it meets with a new impulse, with the momentum and direction *B D*, it will move in the line *B E*, the diagonal of the parallelogram *BDCE*. Now, being acted upon by a new power or resistance *FG*, it will have its direction again changed, and will move in the line *FH*, the diagonal of the parallelogram *FEGH*; if at *I* another power or resistance *IK* act upon it, it will move in the line *IL*, the diagonal of the parallelogram *IHKL*: and if it meet with no further power or resistance to change its direction again, will stop at *L*. But if it meet with any other power, or if any power still operating upon it be subtracted, its direction will change accordingly.

powers of resistance, the course of the ball might be calculated; but it is composed of parts that are possessed of life, of the powers of contracting with energy, of opposing at one time a greater resisting force than at others; and of varying the force during the passage of a ball through its substance, either by a spasmodic or natural contraction of the parts, depending upon their muscularity or elasticity in a manner that constantly varies, and which we cannot estimate, because we cannot know in what manner or when it has been employed. In searching for a ball which cannot be immediately discovered, we shall frequently find it where we have no suspicion of its lodgment. In this case, I have no doubt it has obeyed the laws which are indicated; but it is impossible to discover it in most cases, from a consideration of those laws *à priori*, because we know not the state in which the parts were, through which the ball passed at the moment of injury, nor the resistance they may have afforded. We are equally unaware of the force with which the body is impelled. Being ignorant, therefore, of the force of impulsion and the power of resistance which in an animal body is always changing, it appears to me next to impossible to ascertain by calculation the course pursued by balls, and we accordingly find them in places where we could never suspect them to be lodged. I by no means wish to undervalue the mechanical or rather scientific manner in which Mr. Chevalier would explain the nature of these injuries; I only wish to doubt the complete application of these rules to the human body, and to caution the younger military surgeon against placing too much dependence upon them. He should never forget that he is considering the human body, which is possessed of vitality, and not to be regulated by physical laws. A shot through the lungs will cause an instantaneous derangement of the whole system, but the resistance afforded by the part has little to do with it; it is the lesion of the organic functions, intimately connected with life, that is the cause of the derangement. In the same manner, I do not conceive

that the general affection of the system depends alone on the shock received, or the resistance opposed to the force of the body impinging, but on the effect the injury committed, has on the nervous system; for instance, two men shall lose their legs by the same cannon-shot, or, two shots from the same battery whilst in the same situation: the force of resistance and of impulsion will be nearly equal in both, yet the general affection will be very different; in one, so great as to destroy life; in the other, it may only be perceptible in a moderate degree, depending not upon any difference of mechanical force, but of the powers of life or vitality.

The nature of the injury having been ascertained, we are next led to the mode of treatment; and it is at this point precisely, in the management of gun-shot wounds, that it is necessary to turn our attention to the constitution of the patient, as well as to the nature of the injury, in order that we may not be deceived in the estimate we are about to form of the chances of success or failure. Inattention to this point, or too much reliance upon theory or preconceived opinions received from authority, have been the causes of the great differences that have arisen in practice, and which have appeared in gun-shot wounds, in every other respect similar.

Simple gun-shot wounds of muscular parts, which have been inflicted by substances passing through with *great velocity*, are more or less contused wounds, and do not heal or unite by the first intention. The ball has forcibly torn its way through the soft parts; and by the quickness with which this has been effected, they are deprived in part of their sensibility and life; but there is no absolute loss of substance, there is none driven out. The parts actually touched by the ball may be totally destroyed, the sensibility of those immediately in succession will be considerably deranged, and extending towards the sound parts until the degree of deviation from the state of health is lost in the surrounding substance. It has been attempted to give a degree of mathematical precision to an explanation of the nature of this injury,

by describing a figure in concentric circles, the internal one indicating the hole made by the immediate passage of the ball; the next, and more external ones, denoting the different changes which have taken place in the sensibility or actions of the surrounding parts. This explanation would be correct, if a part were one homogeneous whole, possessing the same texture, vitality, and powers of resistance; but as this is not the case, and, on the contrary, every part is differently constituted, so do we find that a ball in its passage through a part, is the cause of a different kind of injury to each particular texture that it touches, the extent of which is not regulated by any mathematical precision, but by the natural power of the part and its peculiar sensibility. The death of every texture does not, then, take place to the same extent on all the sides of a wound, as I have distinctly and particularly instanced to be the case with arteries. The slough which comes away is never equal to the extent of the wound, and it is perhaps only at what may be termed the orifice of entrance that its circular form corresponding to that of the bullet is distinctly marked. Neither does the death of the part injured take place to its utmost extent at the moment of injury. The small vessels throw out their blood, and this discharge diminishes, and finally ceases, as their life is exhausted; the sensibility of the parts behind being diminished, the blood does not pass freely through the vessels, and the cellular substance at the orifice, and commencement of the wound, looks of a livid colour, as if full of blood. There is a bloody discharge from the wound, which is increased on pressure, there is a little bluish discoloration of the skin surrounding the openings, particularly that of the entrance of the ball; and, in most cases, there is pain of the part, and uneasiness of the limb, from the instant of the infliction of the injury. The track of the ball is then partially filled with matter deprived of life, and which must be discharged, before the part can be restored to its natural state; but this dead matter retains its attachment to the surrounding

substances, and must be removed by the process called sloughing, and which, in this instance especially, is dependent on the actions of other parts which have been themselves subjected to the unequal range of injury committed by the ball. When these actions commence in parts which have been injured, although not deprived of life, they are often unable to sustain them, and, in turn, die, depending again upon the strength of those further from the wound for their separation; so that, after the process has continued for a few days, the track of the ball, even under the most favourable circumstances, is much larger than it was at the moment of injury; whilst, if the constitution and the powers of the part be bad, or unequal to the support of the necessary actions, the death of the whole ensues, instead of the death of a part.

Inflammation is the process of nature, by which the repair of injured parts commences, and on the due management of which in gun-shot wounds our good and bad success depends; but inflammation is itself dependent on the powers of the constitution generally, and of the injured part particularly; we must then look to it as the regulator of our practice, the arbiter of our good or bad success.

Mr. Hunter, who filled the office of Surgeon-general to the army, has said, in his work on inflammation, "that whatever is to be the consequence of injuries, especially inflammation, is produced much more readily in a strong constitution than in a weak one. A wound, for instance, made upon a person of an healthy constitution and sound parts, will unite almost at once; it admits readily of an union by the first intention. A greater strength of constitution, and of parts, admits of resolution, while in the adhesive state of inflammation, very readily; and, therefore, tends much to prevent the suppurative inflammation from taking place, for it gives a better disposition to heal by the adhesive, so that the union of parts by the first intention, the inflammation and resolution, as well as the readiness to change from the one to the other, according as the preceding is prevented, depends equally upon

the strength and health of constitution, and parts inflamed. We may also observe, that a greater strength and soundness of the constitution, or parts inflamed, when the inflammation has got beyond the stage of resolution, and has assumed the disposition for suppuration, hastens on inflammation and suppuration, and also brings it soon to a termination; whilst, at the same time, the matter is brought more quickly to the skin by ulceration."

"Whatever is the step which nature is to take, whenever an injury is done, or a necessity for inflammation has taken place, it is performed with readiness and facility in strong constitutions and parts*."

At page 233, he says: "As the effect which this inflammation has upon the constitution, is by sympathy, it must be in proportion to the readiness with which the constitution assumes that action. This susceptibility is stronger in some constitutions than in others; and every constitution is more susceptible of sympathy with some parts of the body than with others."

"The kind of constitution which is least affected by this inflammation, is that which is in general most healthy, where sympathy hardly takes place; this happens to be the case with such constitutions as can most readily perform all the different operations with ease; and when the parts inflamed are able to manage their own business, they thereby affect the constitution less; for we shall find, that a constitution may be affected by a local disease, merely because it is beyond the power of the part to cure itself."

So far Mr. Hunter reasoned from observation, and is supported by facts; his subsequent remarks on the same subject are deduced from experience, and are partly supported by facts; but from a wish to generalize too much, in order to form a perfect theory, his meaning has become, in part,

* Mr. Hunter on Inflammation, especially Chapter II. On the Fundamental Principles of Inflammation.

doubtful, and in a practical point of view might have done much mischief, if the observations of practitioners had not opposed the illusions of theory.

Weakness of constitution and weakness of parts, Mr. Hunter naturally opposes in the same Chapter, to soundness of constitution and strength of parts, and as inducing opposite effects, which will be readily admitted; but being aware that objections might be brought against this theory of apparent strength and weakness of constitution, and of parts, and especially from the circumstance of inflammation not taking the course he had laid down in many persons apparently of a sound constitution, and particularly after accidents, he was induced to add the following explanation to his theory, the reasoning of which cannot, I conceive, be reconciled by any ingenuity consistent with facts, with his preceding statements; and that the facts of the case are decidedly against it, I shall fully demonstrate, when on the subject of Amputation.

He says in continuation, page 233, "But it is to be observed, that constitutions in full vigour, or which have not been in the smallest degree accustomed to local disease, take the alarm much more readily than those which are not in such full health, or which have been accustomed with local disease. Thus, if a man in perfect health gets a very bad compound fracture in the leg, or has his leg taken off, either for this fracture or in consequence of any other accident, he stands a much worse chance of recovery than one who has been accustomed to a local disease: even the man with the compound fracture will do much better if his leg is not taken off till the first symptoms are over; or at least we may be certain, that the symptoms arising from the amputation will not be nearly so great as those arising at first from the fracture, or would have arisen from the immediate amputation. This would appear to be a contradiction to the above position; but upon an accurate investigation I think it may be accounted for; for, first, I do not look upon full health as the best condition

to resist disease; disease is a state of body which requires a medium; health brooks disease ill, and full health is often above par; persons in full health are too often at the full stretch of action, and cannot bear an increase, especially when diseased; and, as I before observed, it is a new impression on the constitution, and till it be in some degree accustomed to local disease, it is less able to bear such as is violent; besides, the removal of a diseased part which the constitution has been accustomed to, and which is rather fretting the constitution, is adding less violence than the removal of a sound part in perfect harmony with the constitution; the difference, however, is not wholly owing to that cause, for the circumstance of a constitution being accustomed to a mode of life, &c. which it is to continue, makes a considerable difference."

Mr. Hunter has here supported his opinion by an inference drawn from the bad success of some operations of amputation; but it appears to me, on attentive consideration, that he drew the inference first, and afterwards shaped his theory to it. If this should have been the case, the stability of the theory is entirely dependent on the truth of the supposed facts from which the inference was deduced, and, as I shall show them to be erroneous, when on the subject of Amputation, and as they are distinctly admitted to be so, by every army and navy surgeon in Great Britain, by most surgeons in civil life, and by every foreigner of the slightest attainments, this part of the theory must fairly sink with the foundation on which it was erected. The apparent contradiction, which Mr. Hunter himself admitted, is by no means removed by the explanation he has given; but is, on the contrary, more fully established. The circumstances from which he drew his inference, and which he considered as facts, remain; but they are to be accounted for in a very different manner.

If Mr. Hunter had lived a few years longer, he would have rectified the error; he would never have opposed (as many of his pupils have done) theory to facts, and obstinately persisted in that, which can neither be reasonably nor justly maintained.

In grounding our practice on the theory of strength and weakness of constitution and of parts, which Mr. Hunter has established as his basis; and, in throwing off the exception, which has not been found consistent with facts and observation, we are only doing what he would himself have done. The surgeons of the army revere his memory, and are proud to think that the first surgeon in the army, was alike the first surgeon in civil life. They are not then likely to undervalue that work which has rendered his name immortal, and the basis of which he acknowledges to have been founded on observations made in the army; they only wish, for the sake of mankind, to impress upon their brethren and his successors, the simple fact, that knowledge is never stationary, and that, although Mr. Hunter did more than any one man could be expected to do for surgery, there is still something to be done: that it is not sufficient for us to repose under the shelter of his name, but, by endeavouring to imitate him, render ourselves more worthy of the honour we enjoy of being his countrymen.

That surgery is not an art dependent on manual operation and dexterity alone, is, in truth, no where so well exemplified, as in those cases which require the greatest exhibition of both; for we find that, although the operative part has been performed with the most scrupulous nicety, we are still dependent on the natural powers of the constitution for ultimate success; if these fail, our dexterity is unavailing, whilst, if they are equal to our wishes, we shall be often successful, although the operative part should not have been so happily accomplished. How many operations do we not daily see fail, contrary to our expectations? and on reflecting on the causes of our failure, are we not perpetually referring to the state of the constitution, rather than to the mode of operating? Are we not obliged to confess that there is a peculiarity in the constitution of every person, although there may be a general similarity in the whole? Do we not perceive that these again are modified by a variety of circumstances, of

age, of climate, of disease? and ought we not to be convinced that it is only by a careful steady comparison of these peculiarities, under every variety of circumstance, that we can attain a general knowledge of the capability of each under disease?

This study, this comparison must be made, however, on an enlarged scale; the enlightened surgeon should imitate the ruler of an empire, who, in bringing within his observation the peculiarities of each of its component parts, and providing for one without injuring another, legislates for the poor as well as the rich, for the whole empire as well as the metropolis. He should carefully examine the progress of disease in every constitution, and under every variety of circumstance; he will not fail to observe, that the state of health of an inhabitant of a large town is sometimes different from that of a person residing in the country; that this is subject to great modification, and that there is again a difference between the rich and the poor of both, independent of age, habit, or irregularities of conduct; he will accurately ascertain the state of health in each of this description of persons, to enable him to judge of the alteration that may occur during disease; and he will then be convinced that he cannot form a general rule for the whole, from the study of any one peculiar class, without subjecting himself to constant error, any more than the legislator of a great empire can govern different nations by the same laws that are adequate to the maintenance of order in the metropolis.

In fact, the surgeon must have the same expanded views. If, unfortunately for society or himself, he take only one view of disease; if he treat all persons by the same rule, by that standard of health to which he is most accustomed, he can neither be generally useful, nor highly eminent in his profession; to carry on the comparison, he can only be respected as the magistrate of a city, not the legislator of a country.

When I alluded, in the first edition of my work on Ampu-

tation, to the opinions of several of the gentlemen who advocate, on this erroneous principle, the propriety of delay in cases of injury where amputation was clearly indicated, I endeavoured simply to refute them by facts, which I was disposed to hope might be sufficient, although I feared they would with some be unavailing. The theory on which their opinions were founded I hardly noticed; but the more often I have since that period examined into it, the more firmly am I convinced that it is maintained, by the few who still persist in it, from the partial views alluded to, and not from that extensive consideration of the subject which its general importance to mankind demands. I believe it has arisen from laying down one standard of health to reason upon, instead of many. If we ask, are the constitutions of a robust countryman, a healthy tradesman, a luxurious man of fashion, a nervous lady, a drunken spirit-drinker, alike, there will be no hesitation in replying in the negative; yet each of these persons may be in a perfect state of health, according to his own standard, every function may be performed with the greatest regularity; but let them be attacked by disease, and then the difference of power of their respective constitutions will be immediately perceived; one has the means of resistance, whilst another, although in health, may be, as Mr. Hunter has expressed it, at the full stretch of action, and cannot bear an increase, having no means of resistance; like a set of springs from particular manufactories, they shall all look externally alike, externally good, but when we put them into high action, we find many of them break, and are unable to sustain it; still we should not be justified in condemning the whole because some of them were bad; we must, on the contrary, endeavour by a stricter scrutiny, to find out which of them are deficient in that quality we seek for, that we may regulate the action according to the powers. In the same manner, if certain qualities be necessary in the human body to enable it to support and resist disease with effect, it does not follow, because some persons only have the appear-

ance of them without actually possessing them, that we are to conclude they are unavailing; on the contrary, we must endeavour to distinguish between those who only appear, and those who do really possess them.

A state of high health is opposed to that of disease, as two extremes; but between them there must be very many shades of difference, and although this difference may be scarcely perceptible between any two, it is well marked at various stages or intervals. As a datum to proceed from, we must select that which is the most perfect, not only in appearance, but as to fact; and I have no hesitation in saying, that it will be found among persons from fifteen to forty years of age, who possess a constitution capable of suffering an increase of action, or an abstraction of any stimulus or power, with little and, at all events, no permanent inconvenience; being a state of soundness of constitution, and strength of parts equal to the support, for many days, of that general derangement called fever, and, if there have been no local derangement, remaining at its termination without disease, but in a state of debility; or persons capable of sustaining an injury, attended by the loss of a large quantity of blood in a few hours, and rapidly recovering from it with symptoms of debility only. This, which is the most prevalent state of constitution, I consider as the most healthy, and the state to which Mr. Hunter's theory applies; and so far from a person enjoying this state of robust health, being above par, and incapable of sustaining an action above it, it is in my opinion exactly the reverse; he is able to support an increase in a moderate degree without inconvenience, and in a very violent degree without detriment, provided the powers maintaining it be adequately reduced. In other words, when great inflammatory fever or inflammation come on, either of which is a great increase of action, the patient can bear it for several days without any permanent detriment, provided he lose blood in proportion to the increase of action, in order to prevent its destroying the texture or function of any vital

part. If this be not done, the patient must be very soon carried off, because the action will increase so rapidly as to be soon incompatible with life, unless relief be obtained. The great difference between good and bad constitutions on this point is, that this inordinate action can be repressed and removed in a person of a sound constitution, without leaving any bad effect behind; whilst in a bad one, the same, or even an inferior degree of action, would inevitably destroy; because the powers of the patient would neither be equal to support the action, nor having supported it, recover from it; nor even to bear the means for its suppression. The remedy would be as bad as the disease. In good constitutions the increased action may, by moderate bleeding, be so balanced with the general powers of the system. that inflammatory fever, or even local inflammation, may go on for several days, and at last terminate, under proper treatment, without detriment. In bad constitutions this is impossible, for if evacuations are at all indicated, they must be effected in the first days, I might even say, hours, for the patient will otherwise be unable to bear them; his powers will sink, and the fever, or inflammation, will be brought to an unfavourable termination. A good constitution can bear a high action and a direct reduction of power, for a sufficiently long time. A bad constitution can bear neither for half the same period; and if the reduction of the action is to be attempted by reducing the power (that is, by bleeding), it must be done at the commencement. Persons of bad habits will almost always bear bleeding once. Old people bear it much better. I am quite certain, from long experience, that many of both descriptions are continually lost, from a want of decision in practice, in the first instance. An ulterior state of disease is too much regarded, and the consequence is, that we have so many unfortunate sequelæ.

If we refer to the systematic works on medicine of Great Britain, or what are called systems in which all diseases are

enumerated, for I will not call it by any other name, it will be found that sixteen ounces of blood is the largest quantity ordered to be abstracted in any acute inflammatory disease, either of the brain, heart, lungs, stomach, or intestines. Now, in none of these diseases will that quantity suffice: if the constitution be good, and the action high, it may mitigate its violence; but it will not, even if repeated at the end of a few hours, remove the disease, as it is termed, by resolution. I am perfectly aware that in many books of very late date and in modern practice, the quantity abstracted is often doubled, and more frequently repeated, that bleeding is regulated by effect, and not by quantity: with effect, as considered with relation both to the disease and the constitution of the person. But this change has only been effected, like the change of opinion in regard to amputation, compound fractures, &c. within the last few years, and mainly from the opinions of army and navy practitioners, who have this inestimable advantage in the improvement of the practice of physic, that, seeing their patients from day to day previously to the commencement of the disease, they can duly estimate their powers, they can then watch the course of the complaint, and its termination; and, from a certain number of well-marked cases, can judge of the powers of the system generally, and the effects of remedies in different cases; whilst practitioners in civil life are often only called upon when the disease has advanced to a stage that does not admit of immediate or a complete removal, or in which it has so altered the actual appearances of the persons from which we judge, that a correct estimate cannot readily be made of the powers of the constitution.

In the spring of 1801, the regiment to which I belonged was exposed to the sharp winds on the Berry Head, the southerly headland of Torbay, and many suffered from inflammation of the lungs, some strong, some weak persons, others old, others young, and of variously estimated constitutions. I treated them as I had been taught in London; almost all those who were first attacked, young or old, died,

and as I went through the whole treatment and examined the bodies after death, I found that in all, the disease sooner or later had gone on to suppuration. On due consideration I could not find any thing to accuse myself of; I had allowed for difference of country life, &c. and yet I had not done more than temporarily mitigate the disease. The officers of the regiment, who had been led by the late Mr. Rush, who was my patron and friend, to think me as well qualified as any other of my standing, began to be uneasy, and it became necessary to meet the difficulty. I made up my mind, that the next case of pure inflammation should not terminate in suppuration, whatever else might be the result; instead, then, of attending to the pulse, and to the quantity of blood drawn, I only considered the general capability of my patient, and knowing his constitution to be good, I bled him until an obvious effect was produced, until the breathing became free, and the pain was nearly or entirely removed. This man rapidly recovered, so did others in succession; indeed since that period I have hardly ever lost a case that I have seen in proper time. I had found the clue I wanted, to remove me from the labyrinth in which I was involved; and it was a leading incident in my life. I gained the approbation of a body of men, who were for a moment doubtful, but who after a lapse of twenty years (those of them who survived that eventful period), have lately bestowed upon me as a public mark of their esteem, and acknowledgment of services rendered as surgeon of their regiment, the most valuable present that has yet been offered to any officer of that rank.

Two years afterwards, in America, I received another lesson in a disease which runs its course in a much shorter period—inflammation of the bowels. I lost a patient at the end of two days, although I treated him with greater activity than is usually recommended: a second followed the same course: they were as usual examined, and the principal medical officer on the station, on his own inspection, was satisfied that they could not have been saved, but this did not satisfy me;

my former lesson was not forgotten, I was not a predestinarian, and was sure I had either done too much or too little. The decision was in favour of the latter, and an opportunity of proving it was not long wanting: a strong able-bodied grenadier had, on receiving his month's balance, absented himself for the remainder of the day and the night, and was only discovered early next morning, in consequence of his sufferings rendering it necessary for the people with whom he was to apply for advice. The man had gone to bed intoxicated, but not so drunk as to be unable to speak or walk, and had been writhing for several hours with pain in the belly. He confessed to having drunk a gallon of spirits during his absence, and it was evident there was now no time to lose. It was the case I wanted, and I instantly bled him, in the horizontal position, in a pewter wash-hand basin, until he fainted. When able to answer, he said the pain was easier, but as it continued half an hour afterwards with greater severity than was compatible, in my opinion, with safety, the bleeding was repeated, which relieved him greatly, and again for the third time, two hours afterwards; the bowels became open, and I felt myself in the right; a dose of calomel and opium, and a blister to the abdomen, &c. &c. effected a cure; and I have seldom lost a patient from enteritis since, except when caused by external injury.

Colonel Barns, of the Royals, of a spare habit of body, was wounded at the battle of Salamanca, in 1813, by a musket-ball on the left side, which cut the cartilages of the lowermost false ribs, and broke the bone, a portion of which separated, and was removed; the liver was also injured; the bilious discharge from the wound continued for several weeks, and his life was saved with great difficulty, principally by the unremitting care and attention of Staff Surgeon Walther, then Assistant Surgeon of his regiment. During this period I saw him, and considered his case as peculiarly interesting. The wound closed, and Colonel Barns was enabled to return to his duties, although suffering from a sensation of dragging pain

and weight in the side, which was increased on any exertion either of riding, walking, or speaking, and sometimes becoming acute. When in Scotland, he suffered from an attack of acute inflammation, and only escaped with life under the kind and judicious advice of Dr. Paterson of Ayr. He was now induced to come to London, and in the autumn of 1819, he was again attacked in the most serious manner, whilst under the care of my colleague, Dr. Charles Forbes, of Argyle Street. The pain in the right side, extending over the stomach, and down to the umbilicus, was constant, acute, and increased on pressure, the pulse very small, indeed scarcely perceptible, the extremities, especially the feet, cold and uncomfortable, the countenance depressed and extremely anxious, bowels confined, and the stomach rather irritable; a number of leeches had been applied, and other remedies administered. Under such urgent symptoms it became necessary to act decisively, and Dr. Forbes and I agreed, that the *constant pain*, and which was increased on pressure, ought to regulate the practice to be pursued for the removal of inflammation, although every other symptom seemed imperiously to forbid depletion. I bled him, whilst Dr. Forbes kept his finger on the pulse, his eye upon his countenance; and as the one did not diminish, but rather increased in force, and the other became if any thing less anxious, I abstracted twenty ounces, before the arm was tied up; the pain now diminished, and he felt relieved, but it shortly after rather increased, and in the course of an hour we decided on taking away twelve ounces more of blood, which was done, with the most beneficial effect; a blister was applied over the part, and a dose of calomel and opium was repeated. He shortly became tranquil, the pulse rose, the extremities lost their coldness; he dozed a little early in the morning, and although the pain continued in a slight degree for several hours, and much soreness remained for many days, we had no hesitation, on the bowels becoming open, in pronouncing him out of danger. Two months afterwards, in consequence of walking about two miles rather hastily, he had

another and equally severe attack of the same nature; but there was now no cause for doubt, and he was relieved in the same manner. He found, that whenever he bent his body, a portion of the rib seemed to press in on the liver, and often gave him acute darting pain; and on pulling on his boot rather hastily and with some bodily exertion, a third attack ensued. It therefore became necessary to prevent the bending of the body forward, and as much as possible to confine the motion of the liver, which seemed to have formed such close adhesion with the peritoneum of the parietes of the abdomen and diaphragm, as to deprive it altogether of that sliding motion of which it is naturally capable; and consequently to expose it to the slightest degree of pressure made upon the irregular points of bone, which can be readily distinguished on a careful examination. To effect this, stays were adapted to the body, with iron plates instead of whalebone, and he has obtained the greatest ease from their use, as well as having avoided a return of the inflammation. Once only has there been any tendency to it, and then the pain evidently originated in the stomach, instead of the region of the liver; and continued for several hours, until he fell asleep; on its returning after dinner in the same manner for several days, calomel, opium, and purgatives removed it, but it became necessary to give the opium in the quantity of a grain and a half two hours before dinner, and the purgative of equal parts of the infusum sennæ and the decoct. aloes comp. every morning. This case is throughout a well-marked instance of the advantages to be derived from a correct diagnosis and decisive practice. At one period the pain was entirely dependent on inflammation, latterly on spasm, and derangement of the primæ viæ; but if the two had been mistaken, and the treatment adopted for the one, had been substituted in the other, the result would have been deplorable. I do not believe that the substance of the liver was ever materially affected by the inflammation, but the treatment, as far as regards depletion, was not in the slightest degree less vigorous than it would have been had the organ it-

self been principally implicated. The only difference of any consequence would have been a more protracted illness and medical treatment.

I am accustomed in my lectures, when on the peculiarities of constitution, and the consequent treatment of inflammation, to draw a parallel between inflammation and spasmodic affections, and to illustrate it, by reference to the diagnosis between colic and inflammation of the bowels, in order to point out the necessity of a just discrimination between them; the inflammatory disease requiring a vigorous and effective immediate treatment to save life, whilst the spasmodic affection may be often mismanaged, or inertly treated, without any serious detriment ensuing. I now dwell on it, because it is necessary to establish the doctrine and practice I shall subsequently recommend, and it seems to me that an error of great magnitude may, and is actually creeping into notice, which cannot, I apprehend, be too soon unmasked. It has arisen, not from too minute attention to morbid anatomy, for that is impossible; but from combining the facts which it has yielded, without sufficient reference to the preceding symptoms. The error I allude to, is that of considering the diseases of each tissue or texture of the body separately, and without due attention to their intimate connexion and mutual dependence on each other. I refrain from noticing foreign authors on this subject, to avoid a multiplication of references, especially as the pith of the observations of Broussais *, Gasc †, Montfaucon ‡, as well as of our countrymen, Pemberton § and Abercrombie ||, are

* Broussais, Histoire des Phlegmasies, ou Inflammations Chroniques, chap. iv.

† Gasc, Peritonite, vol. xiv. Dictionnaire des Sciences Médicales.

‡ Montfaucon, ditto.

§ Pemberton, A Practical Treatise on various Diseases of the Abdominal Viscera, 1820.

|| Abercrombie's Researches on the Pathology of the Intestinal Canal. Ed. Rev. No. 63.

brought before us in the second number (Analytical Series) of the Medico-Chirurgical Review, by Dr. Johnson, to whose zeal and ability the public is greatly indebted. It is there stated, in consonance with the views which have resulted from the pathological labours of the French practitioners, that the peritoneum is the part or tissue which is originally invaded in the greater number of instances, and that the disease takes its name, IMPROPERLY, from the organ over which the principal inflamed portion of peritoneum is spread. By this, it is intended to abolish the names of gastritis, enteritis, &c.; and to adopt the term peritonitis in a sense different from that in which it has hitherto been entertained. I am led to this presumption, from observing that the disease usually denominated enteritis, is treated of under the head of peritoneal inflammation; and a discussion occurs as to the simple circumstance of whether the bowels are costive, or otherwise, during the attacks of inflammation; a fact which is decisive, in my mind, of the impropriety of allowing the diagnostic and essential symptoms of disease to be discarded or overlooked, for the sake of the nominal and unimportant designation of it. The peritoneum is not, of itself, a vital organ, in the true acceptation of the term; and only becomes so when it is intimately connected with one. Thus, the peritoneum lining the parietes of the abdomen, is by no means of so much importance in the animal economy, as the peritoneum covering the intestines; which fact is distinctly shown, not only by inflammation attacking these parts, but by the symptoms. The result of acute inflammation of the peritoneum covering the intestines, inertly treated, is, usually, death at the end of from twenty-four to forty-eight hours; whilst acute inflammation of the peritoneum lining the walls of the abdomen, may continue for several days, or at least twice forty-eight hours, without causing death, and will often, under very inert treatment, become a chronic disease. *Acute* inflammation of the peritoneum

covering the bowels does never take place without the bowels being costive. Dr. Pemberton says, they "are obstinately costive," and supported by such an authority, I will not make an exception to the rule in *pure acute* inflammation, whilst I admit the frequency of its occurrence in pure acute inflammation of the peritoneum lining the walls of the abdomen. I contend then, that whenever it is possible to make so correct a diagnosis as to enable us to ascertain, or even to suspect, that it is the peritoneum covering the intestine, the stomach, &c. that is inflamed, the disease should be named from the organ that is affected, for if it be not at the beginning affected, it cannot long remain so. If the inflammation should have attacked more viscera than one, the disease should be named from the most important; the term peritonitis should be confined to the inflammation of that part of the peritoneum lining the walls of the abdomen alone. Or if it be considered wise to refer to the texture, at least let the name of the subjacent viscus, or viscera, be attached to it. It is admitted that the absence of redness in the peritoneum is no proof that previous inflammation did not exist; the same is allowed in regard to the skin, yet no such allowance seems to be made for the other tissues, or structure of the stomach or intestines, for, if they are not actually altered in texture, they are pronounced sound and unaffected, although, during life, they have, like the peritoneum, shown every sign of suffering from acute disease. The same signs are discoverable in other fatal cases, where the whole texture of the part is greatly altered, or even destroyed and mortified. We presume then to pronounce that parts, which are so intimately connected with each other as the different coats or tissues of an intestine, are all sound, except that one which is in a high state of inflammation; whilst at the same time we acknowledge the great, and almost insurmountable, difficulty of deciding in the examination of this very part, of how much is due to congestion, how much to inflammation, and, in some particular cases, whether the

appearances are actually dependent on one or the other. I beg to be understood as always alluding to acute, and not chronic cases; and I should be most happy to be informed, which, or what, are the diagnostic signs or characters by which a true inflammation of the peritoneum covering the intestine, likely to prove, or which has proved fatal, can be distinguished, during life, from one which has also invaded its proper substance. At present I know of no such characters, not even when suppuration has been induced, as the following case will show, in which there were no unusual symptoms.

A soldier, quartered in the Strand barracks, was taken ill after some irregularities, and was confined to his bed one day without his illness being reported. On the second day he was seen by the usual medical attendant, and on the third sent to the York Hospital, Chelsea. On his arrival he complained of intense burning pain at the stomach and umbilicus, which was increased on pressure, was always present, although sometimes more violent than at others; the stomach was irritable, rejecting every thing, the bowels were constipated, pulse quick and small, countenance expressive of anxiety and pain, the skin hot. Active depletion, and the other usual remedies, were employed in vain, and on the third day after his admission he died. Being accidentally in the dead house, I opened the body, and was equally surprised to find no marks or signs of inflammation on the intestines near the navel, to which the greatest pain had been referred, and to see the stomach much enlarged, of a whitish colour, and so changed from its natural appearance, as to resemble the thick smooth part of boiled tripe. On cutting into it, I found it nearly as thick, in consequence of the cellular membrane between its coats being loaded with matter resembling pus, which could be easily pressed out, leaving a honeycombed appearance, in addition to the very unusual thickness of the stomach, which was evidently in an equable state of suppuration throughout. I removed the stomach, and gave a part of it,

in its recent state, to Dr. Hooper, in whose museum, and the medical one at Chatham, the only specimens of a disease are to be found, which has not hitherto, I believe, been described in any book of morbid anatomy. The formation of an abscess in the stomach, although a rare disease, has sometimes been met with, and is generally fatal.

If there be a symptom more observable than another, it is one which is yet common to all vital organs. I mean anxiety. The able observations of Dr. Dickson, of Clifton, noticed by Dr. Johnson, allude to this, although they more properly refer to the appearance of the countenance, as indicative of pain. The anxiety I intend to distinguish as a symptom, I have alluded to in dangerous wounds, and is not only of the mind, as shown by the countenance in a very expressive manner, but of the body, as demonstrated by great uneasiness. Anxiety is constantly observed towards the fatal termination of acute diseases; but when a vital organ is affected, whether it be its internal structure or not, this symptom is often present at an earlier period. In some cases it is a more certain sign than the pulse of great derangement; in others, more distinctive than pain, which is sometimes referred to a part that is unaffected, and is, in all, indicative of the greatest danger, and demonstrative of the necessity of corresponding exertion on the part of the practitioner. In the case of gastritis, which I have related, the pain was referred so steadfastly to the region of the navel, that enteritis was looked upon as the principal disease, whilst no sign of it could be discovered, after death, in the parts corresponding to it.

In the year 1813, when at Lisbon, I met with several fatal cases of inflammation of the heart in hard drinkers, and of metastasis of rheumatic inflammation. In none of these were the symptoms very strongly marked; indeed inflammation of the heart frequently exists without being suspected, and more particularly when combined with inflammation of the chest. The symptoms most usually relied on, are the frequent oc-

currence of syncope and the irregularity of the pulse; but they are not always present. Portal says, "Sometimes a most acute attack of carditis is accompanied by syncope, the cause of which cannot be misunderstood; but at others, the symptoms of inflammation are so little marked, or even observable, that if syncope supervenes, the cause is not known, and the true character of the disease is misunderstood, until dissection demonstrates an inflammation of the heart*."

"There is another, and not uncommon, species of carditis, which is not indicated by the acute symptoms we have enumerated. It is that which sometimes follows ardent or malignant fevers, and even the plague. It occurs after divers metastases, such as rheumatism, gout, erysipelas, &c. &c. and which species is very seldom discovered but on dissection." Portal supports his opinion by references to Morgagni, Senac, Lieutaud, &c. and it coincides with my experience. There is one symptom I have remarked, however, in an extraordinary degree, in all the cases I have seen, and that is *extreme anxiety;* and in a much greater degree than other symptoms would appear to warrant, or than can be accounted for from the apparent nature of the disease. In obscure cases of inflammatory affection of the chest, I consider it more constant, more pathognomonic of carditis, than fainting or irregularity of the pulse.

In a case of acute inflammation of the chest following the cure of stricture of the urethra, and in which I had the benefit of the opinion of that able physician Dr. James Forbes, the only symptoms present, except extreme anxiety, were of pneumonia. The inflammation of the heart was not suspected. The pulse was regular, the patient not subject to faintings. After death, the pericardium and heart were found highly inflamed, thickly coated with coagulable lymph,

* Portal, Mémoires sur la Nature et le Traitement de plusieurs Maladies, p. 166 et seq. Paris, 1819.

and a considerable quantity of fluid, in part resembling purulent matter, was found in the cavity of the pericardium. The preparations of the heart, and of the urethra, are now in the Military Medical Museum at Chatham, and are both of them very valuable of their kind.

Anxiety is then a symptom deserving the strictest attention in all affections, or injuries of vital organs, for, whilst it is present, although other symptoms be mild, the patient is always in imminent danger.

A soldier applied to me for an external injury, labouring at the same time under some internal complaint, for which he had been recommended to take bark, on the supposition that it was an ague. I found on inquiry that the paroxysms were not regular, that the rigors were only slight shiverings, the heat was permanent, the skin dry, the sweating stage absent, pulse from 112 to 120, and a peculiar expression of anxiety of countenance that could not be accounted for. From this symptom I conceived that bark was improper, that the disease was not ague, that something more serious was impending: my opinion was not received, the bark was continued, wine mixed with water was allowed, but the man did not amend. The rigors, it is true, were suspended, and so was the bark, but the skin remained dry and harsh, the pulse always quick, sometimes full, the anxiety constant, the body rather wasting, although the appetite was better than could be expected. In this state he was removed to the country, for the benefit of the air, the complaint being considered nervous, the abdomen indicating no signs of derangement on pressure, nor the chest on inspiration. I still predicted an explosion, which would develope the mischief, and gave a caution on the subject. This developement occurred suddenly, in the shape of a paralytic affection of one side, and examination after death showed the formation of an abscess on the opposite hemisphere of the brain. He would have been reckoned a rash and ignorant man, who would have advised the abstraction of blood from this patient at an early period

of the complaint. I believe, reasoning from the result, there are none of us, who would not have done it. A few ounces of blood from the jugular vein might have saved the life of a valuable man *.

There are two things then, which I wish to impress on the minds of students; first, that a peculiar degree of anxiety in an early stage of disease, is indicative of great derangement of some important and vital organ; and, secondly, that on reading foreign authors on wounds and inflammatory diseases, they should remember that inflammation seldom runs so high or so rapid a course in foreigners, and especially in the natives of warmer climates, as in our countrymen; that the necessity for depletion is never so great, and that very many inflammatory complaints, which, under the inert practice of a foreign physician or surgeon, terminate favourably, or in a chronic state of disease, would with us destroy the patient in a few days. I consider this fact of so much importance in the prevention of error, that no student should read such works without first repeating it†.—To return to the importance of a

* Bleeding from the jugular vein is, in my opinion, much more effectual in all cases of internal derangement of the head, than from the temporal artery, or any other part. I believe it to be particularly so in cases which may be denominated chronic, or in low obscure inflammations or congestions. I have several people attending at my Infirmary for Diseases of the Eye, in whom the advantages of it have been most striking. In some cases of fits resembling epilepsy, it has put a stop to the disease. In epilepsy itself it has been useful, and in amaurosis from pressure on the brain, in congestion, and in impending paralysis, it has been of the most marked utility, when other general and local bleedings have failed.

† In India, I am informed by Mr. Paterson, the fact is so well established, that no practitioner would think of treating a native in the same manner as he would a European, for any wound or inflammatory disease: and the symptomatology of these people might as well be applied to the diseases of Englishmen, as the medium rate of violence of symptoms of foreigners, to the more violent and rapid course of the same disease in natives of Great Britain. It is not, then, only the actual natural constitution of the patient that is to be considered, but his mode of living.

due estimate of the powers of the constitution on the one hand, and a correct diagnosis on the other, with relation to practice.

Suppose two persons, of a middle age, residents in a confined part of London, addicted to full living, and what I consider as one of the marks of a very bad habit, corpulent, and of a sallowish complexion, and tinted with red vessels on the cheeks. Suppose that these persons as nearly resemble each other as possible, and that both are attacked (to carry on the argument) by inflammation of the peritoneum. In one, the symptoms shall be of enteritis, a *constant* hot burning pain at the region of the navel, increased by paroxysms, but never absent, augmented and rendered unbearable by pressure, constant motion of the body, which is never at ease, nausea and vomiting, anxiety of countenance, bowels confined, pulse quick, perhaps hard or uncertain or variable. In the other, the symptoms shall be of peritonitis; the pain less urgent, the general uneasiness and anxiety more moderate, the derangement of stomach not extending, or seldom amounting to vomiting; the pulse quick, the bowels may be either confined or open. In these cases we have acute inflammation in two persons, whose constitutions are equal to no continuance of exertion, not to say an increase of it; because an increase for a short period many of them can bear without detriment. Is it not of advantage to name these complaints differently, that we may not for a moment lose sight of the leading feature of the disease, the seat of it? Have we not a great advantage in having it constantly before us, that there is a difference in the mode of treatment? It is true we treat diseases according to symptoms, not according to the name we bestow upon them; but if there be an argument in favour of distinguishing diseases from each other, that have a general similarity, I know of none more strong than that which rests on difference of symptoms, and a marked difference in practice. In the first case of well-marked enteritis, we will suppose that we have had it in our power to ascertain, from pre

vious illness, that the patient bears bleeding very badly, that the abstraction of twenty-four ounces of blood is likely to bring on dropsy, or the greatest general debility, even terminating in death. In such case, what is to be the practice? are we to allow the disease or the physician to kill the patient, or to combine the efforts of both, by applying leeches and fomentations to the belly, giving purgatives and glysters, and then attributing his death to his badness of constitution? A person in this state is precisely in the situation of a man who has sustained a serious injury of an extremity, requiring amputation. It must be done at the moment, or it never will be done. He is capable for a short time of bearing a great increase of action, but he is totally incapable of supporting it for any length of time. A person of this description, attacked in a warm climate by fever, which is not quickly cut short, almost invariably dies. Whatever is to be done must be done quickly. The patient with enteritis must be bled to the greatest extent that he can bear with safety. I consider twenty ounces taken at once, to be more efficacious than thirty ounces drawn at three periods; the effect on the constitution will be more immediate, more productive of benefit, and less permanently injurious. In the first case, there will be only loss of blood to contend with, inducing debility; in the second, both loss of blood and the effects of protracted disease; which last is in such cases by far the greater evil, inasmuch as it is generally a fatal one, from the mischief done to some organ or organs of vital importance.

The patient with peritonitis, although in danger, is yet less urgently so, than he who is labouring under enteritis. The quantity of blood drawn need not exceed ten ounces; and great reliance may be placed on purgatives, especially on calomel, with opium, and blisters to the abdomen—remedies which are alike of little use in well-marked enteritis, until the inflammatory symptoms have been relieved by blood-letting.

A person with a habit of body and constitution of this kind, seems certainly to be at the full stretch of action, and

incapable of supporting an increase for any length of time; but in some there is a greater semblance of incapability, than actual reality of it, and they bear disease better than could be expected. In all such cases we should look to and estimate on the worst, and then we can only be agreeably disappointed. When an amputation is performed on persons of such constitutions, the great attack is on the nervous system, which appears to be the least capable of bearing it. The object is to tranquillize and obtain rest; for reaction soon follows, a reaction which the system at large cannot support. It is at this period, the greatest nicety of practice, the greatest discrimination of constitution is required. The general symptoms of fever which ensue, are those of synochus degenerating daily into typhus mitior, or nervosa, as it is used to be called, and ultimately in death, with every appearance in many cases of derangement of the biliary organs. In others it may even assume the appearance of typhus gravior. The termination is regarded more than the present state of the disease, the period for action is allowed to pass away unheeded, and because the patient dies, his death is unfairly attributed to the operation having been done at an improper period. In many such cases death must, I know, be the result, under any mode of treatment, but not in the proportion usually supposed. At the first moment of injury, the operation should be performed so that the shock to the nervous system may if possible be continuous, and opium with purgatives should be administered to allay it. As soon as the reaction becomes permanent, the surgeon must bring all his stores of observation and experience forth; for an erroneous decision is pregnant with danger, either one way or other: general fever has taken place, and he must estimate the patient's powers of supporting and resisting it. The great error attending Mr. Hunter's facts, as drawn from hospital treatment, in my opinion, takes place here; cordials, stimulants, opiates are continued, instead of active purgatives and saline medicines. This state resembles the first, or commencing inflammatory stage, after concussion of the brain.

Blood-letting is generally admissible; it is urgently demanded, when the pulse becomes quick and in any degree full, and followed by an opiate it is frequently decisive. The quantity must here be moderate; sixteen ounces is a full bleeding, and twelve ounces may perhaps be sufficient to ascertain the effect. I believe physicians have lately discovered that the abstraction of blood with moderation in the early stages of synochus, does not always, as was formerly supposed, hasten the approach of typhus gravior. And I can only say, that however sound the judgment, however great the knowledge the surgeon or consulting physician may have in the practice of physic, they will in such cases need them all.

In some cases of this description there will never be an opportunity or proper period for taking away blood. In some few instances cordials and opiates will be more proper throughout.

As external applications, cold ones are injurious; and if amputation be performed, the stump should rather be provoked to suppurate than otherwise.

In many persons who have lived in warm climates, we feel perfectly sensible that their constitutions are unequal to any great exertions, although they appear in good health, and they declare themselves to be so, on inquiry being made. They are in high health according to their own standard, but this is at best a bad one for resisting disease, or rather supporting it. When serious accidents happen to such people, the surgeon is often placed in a situation of peculiar responsibility and solicitude. An error in judgment may be fatal to his patient or to his reputation; and the former is too often sacrificed to the latter where a consultation cannot be had to divide the weight of responsibility. The surgeon is in fact afraid to recommend the decided mode of treatment which the case appears to require, lest it should not be adopted, and be found by accident not to have been necessary; when his professional ability would be doubted, although it was perhaps never more conspicuous that in the recommendation. There can be no doubt but that some persons save their limbs contrary to the

opinion of the faculty; but in most of these cases the limbs are useless, and for one saved under such circumstances, ten persons die; we always hear of the successful cases, but never of the unfavourable ones.

An officer received at the battle of Albuhera, a wound in the right leg, which fractured the tibia; the case was curable as far as regarded the injury, but the patient had lived in warm climates, and his constitution seemed so unequal to supporting any increase of action for the necessary time, that the propriety of amputation became a subject for serious consideration. It appeared very hard to lose a limb, that in a man of sound constitution might be saved; it was not certain that he was quite unequal to the task, and the wishes of the patient were acceded to. It was soon however seen, that neither the powers of the part, nor of the constitution were equal to the duties imposed upon them; and again, at the desire of the patient, we complied with his wishes and removed the limb. The stump did well for three days, but then the pulse increased in frequency, whilst it rather diminished in strength; the stump began to swell and assume a white colour and doughy appearance, which I knew to be the forerunner of a fatal termination. From what this gentleman did bear, it was fair to conclude, that he would have outlived the amputation if it had been performed on the first day: but then it was operating on a speculation as to the powers of the constitution, not as to the state of injury—an estimate which can only be made by very experienced persons, and adopted by men of equally high characters.

After the assault on Badajos nearly the same thing took place, but I then rather relied more on myself; and as the patient was a hard drinker, I was inclined to operate; but this opinion was not met by my friends, gangrene came upon the extremity, and death ensued.

In the Surgical Essays of Mr. Astley Cooper and Mr. Travers, Part II. page 70, an instance is given by Mr. Cooper of great irritability, which was treated by Mr. Cline by opiates after evacuations, with good effect; and I am happy

to be able to have an opportunity of introducing the names of these two gentlemen in this work, who are not more justly distinguished for their scientific attainments than for their liberality. The case was one of amputation after injury of the knee-joint; and whilst it shows Mr. Cooper's opinion of the necessity of immediate operation, as opposed to Mr. Hunter, strikes also at the root of the theory on which it is founded.

Mr. Wilson, in his last work on the Bones and Joints, page 232, has also given his decided opinion for immediate amputation, where such operation is distinctly necessary; there is not even a caution as to the state of the constitution: and when a man so eminent as Mr. Wilson in anatomy and surgery, thus tacitly admits the fact, the sooner it be publicly understood, the better must it be for mankind. Supported by these authorities I think I can now fairly refute the few remaining advocates for Mr. Hunter's opinion, who maintain that the facts he has stated, still hold good in regard to the inhabitants of London; and that in teaching surgery they must point out the proper practice for London. This necessity I do indeed acknowledge, if surgery were to be practised in London only, and the doctrines were true; but as I believe in neither, and on the contrary, suppose that surgery is to be taught on the great scale, as applicable to all mankind, for the whole empire, for the universe; the practice peculiar to the metropolis (if such existed) would be simply an exception to a general rule, and which it would be less necessary for young men to know, as few of them are to practise in it; and the less that those who are to practise in it, do know of it, the better it will be, in my opinion, for their patients.

When the Marquis of Anglesea received a wound at the battle of Waterloo, which rendered amputation necessary above the knee, the operation was performed about two hours after the receipt of the injury, and his Lordship was able to travel in three weeks. If he had not gone to Waterloo, but remained in London, and had unfortunately met with an accident rendering amputation necessary, it would not (according

to the principles I have combated) have been proper to perform it immediately. His constitution would have been too vigorous in London, although it was not so at Waterloo!

Colonel Turner was struck at the first siege of Badajos in 1812, by a shell on the left arm; I saw him about four hours after the accident, and amputated his arm at the shoulder-joint on the field of battle. He had left London about a month, and was then, as he is at present, of a very vigorous constitution; if he had met with an accident of the same nature in London a month sooner, would the same practice, which was so completely successful, have been bad?

Captain Macgenis, whose arm I cut off after the battle of Albuhera, called upon me two years ago, and among other civil things, said, he hoped he might be under my care if he ever underwent another operation. I told him not to be too confident, for it was said that an operation which would suit a healthy young man in the army would not suit a healthy young man who had a place in the Customs!

Lastly, it is well known that the soldiers of the Guards in London, have hitherto worked at their respective trades, when off duty, and entered into the dissipations of persons of their own class. Whenever these men have crossed the Channel, and met with injuries on service which rendered amputation necessary, it has always been done at the moment and with the greatest success. If these persons had met with an accident a week before in London, rendering such an operation necessary, it could not, I presume, have been done with propriety!

If these statements be facts, and I believe they are undeniable, the advocates in London for the theory and practice I have been combating, must tacitly admit, if they will not acknowledge, one of two things; either that the theory and practice are erroneous, or, that they are unacquainted with the nature of the constitutions of all the young gentlemen and all the young healthy tradesmen about town. I have a suspicion they will rather prefer yielding the least tangible alternative.

Let us view the matter in another light. Four years ago I

had an inflammatory attack on my chest, for which I was advised to lose some blood. The abstraction of twenty-four ounces relieved the pain and effected a cure. A person with whom I was intimately allied, had at the same time an attack of the same complaint; I took from him only twelve ounces of blood, and relied more on other means, because I knew, from his mode of life and other circumstances, that his constitution would not bear a large bleeding; but if I had applied this reasoning to myself merely because I happened to live in London, and without due consideration of the state of my constitution, it is very possible I might have been a candidate for a journey to Italy to relieve me from consumption.

I fully however admit (and I wish particularly to be understood on this point), that there are many persons in London, and in all extensive cities as well as in other places, whose system at large is so bad that death soon follows any great exciting or depressing power acting upon it. We often see, that eating a small quantity of putrid food will produce in a person of this description symptoms which are quickly followed by death; whilst in another of more power and of a better habit, it merely causes vomiting and a little temporary derangement. In such cases the man who would draw blood, would be little better than a fool or an empiric, and amputation in such a state must frequently be followed by death; but it should be borne in mind, that a person under such circumstances would seldom recover from any serious disease, and would never live until the second period for operating.

I am aware that some arguments may be adduced against my reasonings, from what is frequently observed to attend the contagious and endemic fevers of warm climates, which are not always best borne by persons in rude health. But these are exceptions depending much upon the peculiar nature of the fever itself, its causes and effects, and not directly applicable to the points in question, inasmuch as the principles laid down for the treatment of inflammation and of injuries demanding amputation are equally good in these climates

as in Europe, and the only difference in practice is, that, whatever treatment be adopted, it must be more actively enforced.

I have endeavoured, by the different illustrations given of the treatment of inflammation and irregular action in various kinds of constitutions, to convey my ideas on the subject; and I conceive that the following facts may be legitimately deduced from them.

1st, That a person in good health and of a sound constitution, between the age of fifteen and forty years, is the best able to resist disease, to bear the remedies necessary for its removal, and to sustain it for a longer time under proper treatment, than any other class of persons.

2d, That although any given number of persons may be in apparent good health, and every function be regularly performed, still it may be a state of health according to their own standard, and not equal to that which is the most prevalent and the least faulty.

3d, That Mr. Hunter's explanation of the reason, why persons of sound constitution and strength of parts did not bear disease well, viz. that they were at the full stretch of action and could not bear an increase, is not founded; inasmuch as it has been shown, and will be further proved, that under proper treatment they are, on the contrary, the most capable of bearing disease, or an increase of it.

4th, That Mr. Hunter took his examples from persons of the second class of constitutions, instead of the first, and that to the treatment of these persons the bad success may be attributed, rather than to the constitution being so totally incapable of bearing or resisting disease.

It may appear presumptuous to connect the name of Mr. Hunter and the improper treatment of disease or injury together; but having brought the question fairly before the public, it is neither in my power nor my inclination to shrink from any censure that a due support of it may draw down upon me. I have resisted the propagation of THIS ONE principle of Mr. Hunter, because I believe it to be injurious to

mankind. I have done so supported by the experience of more than twenty years, during which period I have been accustomed to disease on an extensive scale, in various climates, and during the whole of the Peninsular war. If it be proved, however, from practical observation that I am in error, I shall be more willing to abandon my opinions than I am to maintain them. But until that be done, I should be unworthy of that school to which it is my greatest pride to belong; the school in which Mr. Hunter acknowledged he derived the information which enabled him to write his work on inflammation, which, united with his perseverance and genius, have obtained for him the highest place in surgical science; if I did not strenuously resist even his opinions when practical experience appears to demonstrate their error.

On these views of the constitution the basis of the treatment of gun-shot wounds is founded, and in combination with them, other inexpugnable opinions of Mr. Hunter's must never be overlooked: 1*. "That the inflammation which precedes suppuration is much more violent in those cases where it appears to arise spontaneously, than when it arises from any injury done by violence. A suppuration equal in quantity to that from an amputation of the thigh, shall have been preceded by a much greater inflammation than that which is a consequence of the amputation."

"This inflammation would seem to vary somewhat in its effects according to the exertion of that power during its progress; for, in proportion to its rapidity the cause is certainly more simple, and its termination and effects more speedy and salutary; and this idea agrees perfectly with inflammation in consequence of accidents, for there it runs through its stages more rapidly and with less inflammation: necessity appears to be the leading cause here."

When a simple gun-shot wound is received by a person of a good constitution, the necessary effect will be a certain degree

* Page 376, quarto edition.

of inflammation, and which may be violent or moderate according to accidental circumstances of constitution or otherwise; but whatever may be the extent of inflammation, except it run on to gangrene, it is always prone to the suppurative, passes rapidly over the adhesive stage, and proceeds in the most speedy manner to the restoration of the part to its healthy state, provided there is not a sufficient cause to prevent it in the nature of the wound itself, or in some foreign body lodging in it. According to the extent of inflammation will be that of suppuration, generally speaking; and the object to be attained is, to keep the inflammatory action within due bounds, so that the suppuration may be in proportion; for it has been observed that wounds, which have been attended by a moderate degree of inflammation and suppuration, have healed soonest, and with the least inconvenience to the patient. In these cases, adhesive inflammation agglutinating the parts immediately around the track of the ball, seems to have put a stop to the extension of the inflammation; the change of action from the adhesive to the suppurative, which takes place, is in consequence confined to a smaller space; and the remaining necessary actions of granulation, contraction, and cicatrization, are on an equally limited scale. In a perfectly healthy constitution, nature seems disposed to perform her part in general with the least possible difficulty; to be aware, that union by the first intention cannot alone effect a cure, that suppuration must ultimately occur; and in consequence of this intuitive knowledge, proceeds to the desired point with little hesitation on the intervening stages. It appears to me that the fundamental point to reason upon, in cases of simple gun-shot wounds in healthy persons, is this,—that inflammation will ensue, will run on to suppuration, and is rather likely to be in excess than in deficiency. The practice to be pursued consonant to this opinion ought to be that which, even from the beginning, will or may tend to reduce inflammation and the consequent suppuration; I would add, in order to express the opinion more forcibly, to prevent it as much as possible; certain, that, under every cir-

cumstance, enough will take place to maintain the necessary actions and to effect a cure.

An idea is entertained by some, that the whole track of a gun-shot wound must suppurate, and a slough of dead matter be thrown off; but this is an erroneous opinion, taken more as a necessary than a positive fact; for no one has ever seen, from a superficial or deep-seated wound of three inches in length, with two openings, a slough or sloughs of the same extent as the wound; neither can a solid substance, of the size of the opening of entrance, be passed through the wound and out at the exit of the ball, without great pain and inconvenience; and, in many cases, the actual quantity of slough and matter discharged with the dressings is by no means commensurate with the depth to which, or through which, the ball has passed. The practice, until the Peninsular war, was, in almost all cases, to apply poultices to facilitate the separation of the slough, for Mr. Hunter had favoured and inculcated this from principle; but it was soon found on service, on the great scale of warfare, to be impracticable and inexpedient, as well as not proper or beneficial to the patients; and cold water was adopted in their stead*; and, in very many cases, lint and sticking-plaister without the assistance of either.

In discussing a surgical point of practice abstractedly, or divested of all questions of expediency or practicability, it is proper to refer only to the fact, whether, on a fair trial, one mode has been found to answer better than another; and if it be found to be so, that is the method to be laid down as the practical rule, and all others are exceptions under particular circumstances. On a fair investigation, then, by repeated trials, I have no hesitation in saying, that the advantage is decidedly in favour of the treatment by the application of cold water; the inflammation is, in some instances, materially prevented, in many greatly controlled, and, in almost all, very much subdued by it; whilst the suppurative process is not impeded in the generality of cases, in a degree sufficient to inter-

* See the case of Lieut.-col. Creagh, page 22.

rupt the subsequent one of granulation. In all simple cases of gun-shot wounds, id est, flesh wounds, in persons of a healthy constitution, a piece of lint which has been dipt in oil, or on which some ointment has been spread, is the best application at first, to prevent irritation, with two slips of adhesive plaister, placed across, to retain it in its situation. A compress, or some folds of linen wetted with cold water, is then to be applied over it, and kept constantly wet and cold, even by the use of ice, if it can be obtained, and is found comfortable to the feelings of the patient. A roller is of no use, except to prevent the compress from changing its position during sleep, and is, therefore, at that period useful; but as a surgical application it is useless, if not positively injurious, because it binds a part which ought, to a certain extent, to swell, and by pressure causes irritation. Rollers ought not to be applied surgically until after some days have elapsed, and it is inexpedient to employ them in the field of battle, even if they were useful, except where some parts are to be kept in position; because when they are applied in the first instance, they soon become stiff and bloody, are for the most part cut, and are seldom preserved after the first dressing, so as to become useful at the period when the surgical application of a roller is indispensable. I have never yet seen, under any circumstances, from the first battles of Roliça and Vimiera in Portugal until the last at Toulouse in France, a superabundance, not to say a sufficiency, of rollers for the ulterior dressings of the complicated cases; and, as they are unnecessary at first, in a surgical point of view, present appearances are not to be attended to, at the expense of subsequent advantage.

The first dressing need not be removed under this plan for two, three, or four days, as may be found convenient to the surgeon. If dry lint is applied, and which application will be most *convenient* in the first instance on the field of battle, it should be moistened in an *hospital* with warm water; in private life, an evaporating poultice * may be applied, for the same purpose

* An evaporating poultice is made by crumbling some stale bread into a basin, and pouring boiling water upon it. The basin is then to

of facilitating its removal: the reason of this difference is, that a poultice should never be seen in an hospital, unless it is absolutely necessary. It should never be applied, unless no other application will do as well; for, when once poultices become prevailing applications in an hospital, they serve to cover all kinds of negligence. I consider a poultice applied to a compound fracture or an injured joint, to be the precursor of amputation, the cloak for previous or present negligence; and this opinion I may, I believe, venture to say has not been formed lightly, but on as great a degree of observation as has fallen to the lot of most men, either in the navy or army. It so happened, that in the greater number of our serious conflicts, I had a charge in the field, and a principal one of the same men afterwards in hospital, and, therefore, had due opportunities of making a proper estimate on this point. At the last battle of the Peninsular war, viz. that of Toulouse in France, the *practical* arrangement of the hospitals was entirely under my direction, and the great facilities afforded to us, enabled me to carry into execution every opinion I entertained from previous occurrences. On this point, I gave a positive order to all the hospitals in the town, and which I daily visited, that in no instance was a poultice to be applied to any wound without a specific reason, and then, not that a poultice was a good thing in such cases, but that the particular one in question seemed to demand such treatment; and in regard to injuries of joints and compound fractures, they were never applied without the same attention, and seldom without my personal concurrence. Indeed, I should not do justice to the gentlemen employed, if I did not explicitly declare the obligation I was under to them on that occasion, and the sense I now entertain of their friendship, for there was not one who did not fully enter into my views; there is not one of them whose friendship I do not now enjoy; and as to the result, Sir James M'Grigor, the Inspector-general of the Army,

be turned over on a plate, and the water allowed to drain off, when the poultice is ready for use.

now Director-general of the department, permits me to say, that, on no occasion, has the success attending the treatment of these particular cases been greater.

The predilection for poultices has arisen from their good effects in promoting suppuration in spontaneous inflammations terminating in abscess; and it was very natural to suppose that, if a poultice hastened the formation of matter in an abscess, it would in the same manner hasten the suppurative process in a gun-shot wound, in which the due formation of matter, and the separation of the slough, seemed the most essential points. If the formation of matter and the separation of sloughs were all that is required, a poultice would be the best application, and the two kinds of inflammation would be on a par, and the treatment alike; but this is not the case, and it seems to me to be an incalculable oversight to suppose that it was so, after Mr. Hunter had pointed out, as he has done, the very material difference between them, viz. that the inflammation preceding the suppuration after injury, is never so great as when it occurs spontaneously; and that after injury there is less delay in the processes immediately preceding suppuration. The two states of inflammation are by no means under the same circumstances. In the spontaneous inflammation, which is about to form an abscess, the adhesive state is often long and always much more extensive, the quantum of inflammation and of its phenomena is greater, the matter when formed is contained in a sac, and will have (unless it be deep seated) no communication external to it; the more perfect the suppuration, the more readily will the mischief cease, and the part almost heal without the processes of granulation and cicatrization. The formation of matter cannot be prevented, and any attempt at it, after it has been found useless, only does mischief by interrupting the process. After injury, the inflammation, although tending to the suppurative, is not necessarily extensive, the parts around are not thickened to the same extent as in the formation of an abscess; the quantum of inflammation, as known by its four great phenomena, pain, heat,

redness, and swelling, is often trifling; the matter, when formed, is immediately discharged; there is not the same necessity for the formation of the walls of an abscess, and every part is disposed to healthy action, which is not always the case in spontaneous inflammation. Admitting even that the inflammation is still the same, it will, I trust, be conceded, that the state is different, and ought to be treated differently. I consider the inflammation of a simple gun-shot wound to be like the inflammation of a part of importance, in which we always try to have as little suppuration as possible, and we ought to endeavour to effect this by the same means, proportioned to the urgency of the case.

The object of a poultice is to keep a part warm, moist, soft, and to relax it as much as possible, and thereby to augment the facility for the formation of matter, which it generally does; but repeated poulticing often keeps up the irritation on a part through that very relaxation, and renders it totally unequal to support the subsequent necessary operations. It causes the suppuration in an open ulcer to be more profuse, the granulations weak, and lays the foundation for extensive sinuses.

Cold water is, in my opinion, the proper application to gun-shot wounds in persons of a healthy habit of body; it may be applied in many people during the whole progress of the cure with the best effect; and, where it is admissible, it ought to be constantly used, unless in those cases in which simple compress and bandage may be considered sufficient.

Cold water is not however an infallible, or even always an advantageous remedy; there are many persons with whom cold applications do not agree, there are more with whom they disagree after a certain period, and in either case they should not be persisted in. Cold does no good in any stage of inflammation, when the sensation accruing from the first application of it is not agreeable to the feelings of the patient; when, in fact, it does not give relief; for if it produces a sensation of shivering, or an uncomfortable feeling of any

kind, with stiffness of the part, it is doing harm, and a change to the genial sensation of warmth will not only prove more agreeable, but more advantageous. This occurs in general about the period when suppuration has taken place; and cold in such cases is preventing the full effect of the action, which warmth encourages. Fomentations are then proper; and if a poultice be preferred for convenience by day or by night, an evaporating one of bread will be found sufficient. In the spring of the year, the marsh-mallow makes an excellent poultice, and so do turnips, gourds, carrots, &c. independently of oatmeal, linseed meal, Indian meal, or other farinaceous substances. In all those cases where a poultice is resorted to, as much attention is to be paid to the period of removing, as of applying it. It is used to alleviate pain, stiffness, swelling, the uneasiness arising from cold, and to encourage the commencing or interrupted action of the vessels towards the formation of matter; and as soon as the effect intended has been gained, the poultice should be abandoned, and recourse again had to cold water, with compress and bandage. A very good instance of this was seen in the case of the son of the late Sir Richard Croft, who was wounded in the foot at Waterloo. The ball could not be found, although an opening had been made where it was supposed to be, and poultices had been applied to relieve pain and encourage suppuration. In this state, at the end of three weeks he came entirely under my care, on his way from Brussels by Antwerp and the Scheldt to London, and it was my intention to have delivered him over to his father without interference, which I did not think necessary. Being detained, however, a few days at Flushing by contrary winds, I saw that he was uneasy and irritable, both generally as well as locally, that the suppuration was great for the size of the wound, and the parts becoming weak. In consequence of the delay, I changed the poultice for cold water and a compress and bandage; he felt immediate relief,

and from that moment his wound rapidly proceeded to a cure.

The great errors in the use of poultices are, that they are often applied with no precise view, that they prevent more active measures being taken, and that by being continued too long they do a great deal of mischief, weakening the parts, promoting profuse suppurations, and the formation of sinuses. It may be argued, that the abuse of a remedy is not a sufficient cause for its abandonment, and it is incontrovertibly true; but when the abuse cannot be avoided, it comes precisely to the same thing, and the rule I have laid down will be found practically the best; for in every instance in which I have seen any given number of men treated by poultices, and an equal number without them, the latter have always been in the best state. An error may also be committed in the use of cold applications, by making them too general, which causes the patient to take cold, and frequently to suffer from inflammatory affections. The parts only which are injured, and those in their immediate vicinity, are to be wetted, and the rest of the body or extremity should be kept perfectly dry. It may be remarked, that it is seldom expedient to apply cold to the trunk of the body; for if the wounds be simple they do not require it; and if any viscus be affected or cavity opened into, the practice must be otherwise so decided, as to render the aid of wet cloths of little importance. In injuries of the head it is the reverse.

When the sloughs have separated, or what is more commonly the case, when the parts begin to granulate, a compress and bandage will complete the cure, which in simple cases takes place within the first six weeks. A great number are always cured within the first four, and in these cases bleeding is never thought of. Purgatives are occasionally administered, and abstinence is an excellent remedy; but bleeding, purgatives, occasional emetics, and starvation, are remedies of great importance if the patients be irregular in their personal habits, or the inflammatory symptoms run high.

In wounds of muscular parts, inflammation comes on from twelve to twenty-four hours after the injury, and the vicinity of the wound becomes more sensible to the touch, with a little swelling, and increase of discoloration. A reddish serous fluid is discharged, and the limb becomes more stiff and incapable of motion from its causing an increase of pain. These symptoms are gradually augmented on or about the third day, the inflammation surrounding the wound is better marked, the discharge is altered, being thicker; the action of the absorbents on the edges of the wound may be observed; and on the fourth or fifth the line of separation between the dead and the living parts will be very evident. The wound will now discharge purulent matter mixed with other fluids, which gradually diminish as the natural healthy actions take place. The inside of the wound, as the process of separation proceeds, changes from the blackish red colour to a brownish yellow surrounded by a little good pus. On the fifth and sixth days, the outer edge of the separating slough is distinctly marked, and begins to be displaced; the surrounding inflammation extends to some distance, the parts are more painful and sensible to the touch, the discharge is more purulent but not great in quantity. On the eighth or ninth day, the slough is in most cases separated from the edges of the track of the ball, and hanging in the mouth of the wound, although it cannot yet be disengaged, the discharge increases, the wound becomes less painful to the patient, although frequently more sensible when touched. If there be two openings, the exit of the ball or the depending opening is in general much the cleanest, being often in a fair granulating state before the entrance of the ball is free from slough. If the inflammation has been smart, the limb is at this time a little swelled for some distance around, coagulable lymph and serum are thrown out into the cellular membrane, the redness of inflammation now diminishes, the sloughs are discharged together with any little extraneous substances which may be in the wound, and there is often-

times a slight bleeding if the irritable granulations are roughly treated. The limb, on the twelfth and even fifteenth day, retains the appearance of yellowness and discoloration which ensues from a bruise, and which continues a few days longer. The sloughs do not sometimes separate until this period; and in persons slow to action, not even until a later one. The wound now contracts, the centre of the track first closes, and it is no longer pervious. The lower opening soon heals, whilst that made by the entrance of the ball continues to discharge for some time; and, towards the end of six weeks, or sometimes two months, finally heals with a depression and cicatrix, marking distinctly the injury that has been received.

This is the usual course of a favourable wound of muscular parts in persons of a healthy constitution, and which will almost work its own cure without any surgical aid, the system sympathizing but little with the injury. There is scarcely any fever, loss of appetite, heat of skin, or restlessness, very often so little that it is impossible to restrain either officers or soldiers within the bounds necessary to keep every thing in a quiescent state. It is in such cases as are here described, that the practice I have recommended ought not to be departed from.

But this favourable and tranquil proceeding is not to be expected in every instance. The state of constitution, the difficulties and distresses of military warfare, exposure to the inclemency of the weather, or the imprudence of individuals, will frequently bring on a train of serious symptoms, in wounds apparently of the same nature. After the first three days, the symptoms gradually increase, the swelling is much augmented, the redness spreads far from the edges of the wound, the pain becomes severe and constant. The wound remains dry, stiff, painful, with glistening edges. The sensibility is now much increased. The system sympathizes, the skin becomes hot and dry, the tongue loaded, the head aches, the patient is restless and uneasy, the pulse full and quick, there is fever

of the inflammatory kind. The swelling of the part increases from the deposition of lymph and serum in the cellular membrane to a considerable extent above and below the wound, which is in a state of high inflammation; and, instead of being entirely superficial or confined to the immediate track of the ball, is spreading wide and deep in the muscular parts of the limb. The wound itself can hardly bear to be touched, it discharges but little, and the sloughs separate slowly. If the inflammation be manageable, matter begins to be secreted copiously, not only in the track of the wound, but in the surrounding parts; sinuses form in the course of the muscles or under the fascia, considerable surgical treatment is necessary, and the cure is protracted from three to four and even six months, and is often attended for a longer period with lameness from contraction of the muscles or adhesions of the cellular membrane. The parts, from having been so long in a state of inflammation, are much weaker; and if the injury has been in the lower extremity, the leg and foot swell on any exertion, which cannot be performed without pain and inconvenience for a considerable time; the inflammation being readily brought on, and the weak parts forming the cicatrix giving way by ulceration, and forming again a very troublesome sore.

The treatment in a case of this kind is of the same nature as the other, but it must be more active. The patient must be bled, vomited, purged, kept in the recumbent position, and cold applied so long as it shall be found agreeable to his feelings; when that ceases to be the case, and not till then, fomentations ought to be resorted to; but they are to be abandoned the instant the inflammation is subdued and suppuration well established. The feeling of the patient will determine the period, and it is better to begin a day too soon than one too late. If the inflammation be superficial, leeches will not be of the same utility as when it is deep seated; but then they must be applied in much greater numbers than are usually recommended. The roller

and graduated compresses are the best means of cure in the subsequent stages, with change of air, and friction to the whole extremity, which alone, when early and well applied, will often save months of tedious treatment. If the limb becomes contracted, and the cellular membrane thickened, it is only by friction, or pressure with the thumb and fingers (champooing), that it can be restored to its natural motion.

A superficial wound in muscular parts by cannon-shot or shell requires little or no change of treatment, save that attention must be paid in a greater degree that due motion be given to the part in the latter stages, so that the new skin formed may not impede by its contraction the natural action of the limb.

If the ball should have penetrated without making an exit, or have carried in with it any extraneous substances, the surgeon must, if possible, ascertain its exact situation, and remove it and any foreign bodies which may be lodged; indeed, if there be time, every wound should be examined so strictly as to enable the surgeon to satisfy himself that nothing has lodged. This is less necessary where there are two corresponding openings evidently belonging to one shot; but it is imperiously demanded of the surgeon, where there is one opening only, even if that be so much lacerated as to lead to the suspicion of its being a rent from a piece of a shell; for it is by no means uncommon for such missiles, or a grape-shot, to lodge wholly unknown to the patient, and to be discovered by the surgeon at a subsequent period, when much time has been lost and misery endured. A soldier, during the siege of Badajos, had the misfortune to be near a shell at the moment of its bursting, and was so much mangled as to render it necessary to remove one leg, an arm, and a testicle (a part of the penis and scrotum being lost), by which he became so faint that I could not proceed with the examination of the flesh wounds received at the same time. In one of those in the back part of the thigh and buttock a large piece of shell was lodged, and kept up

considerable irritation until it was removed. The man recovered, and has a pension of 2s. 9d. a day.

An officer had a finger shot off, as it was supposed, without the ball doing farther mischief, and the torn surface was made smooth by operation and dressed accordingly; but in a few days it was perceived that greater inflammation had taken place than is usual on such occasions, and on examination it appeared that the ball had passed up under the palmar aponeurosis, and had lodged in the wrist, from whence it was extracted. Too much attention cannot be paid to this circumstance at the moment of injury, and I have already insisted sufficiently on the necessity of position, and other matters, in enabling us to ascertain the course and situation of the ball or foreign body. See page 17. This practice has been duly appreciated from the earliest ages of surgery, before gun-shot wounds were known, but when the use of slings and other instruments of missile warfare caused the lodgment of extraneous substances. It is not then of modern origin, but is as old a precept as any in surgery. Hippocrates, Celsus, and Galen, especially recommended it; and the fathers of military surgery in France and England, Paré and Wiseman, have strenuously insisted upon it.

The advantage of attending to position and the situation of the wounded person, in regard to his antagonist, at the moment of injury, is farther illustrated in a case treated, a few days after the battle of Toulouse, by Dr. Chermside, of the 10th Royal Hussars, then Assistant Surgeon of the 7th Hussars. The soldier, a private of the 61st regiment, received a musket-ball a little below the head of the fibula, which lodged; and he was taken prisoner. Three incisions were made on the inside of the leg, in search of the ball, but in vain, whilst in the hands of the French. Dr. C. having ascertained that the ball was fired from above him, whilst his leg was bent, conceived its course must be obliquely downwards, and near the inner ankle, whence it was successfully extracted. The ball had struck the bone, and its shape was considerably jagged and flattened.

Attention to the remarks that have already been made on this subject, may enable the practitioner to attain a tolerable knowledge of the nature of the injury; but the course of balls being frequently extensive, it is impossible to follow them with any instrument. In the extremities, when it is supposed that the ball is lodged at any given distance, the finger is the best sound, both for ascertaining the direction the ball has taken, and the state of the surrounding parts; and where the finger cannot reach, and circumstances render it advisable, a metallic, or firm elastic bougie, or long silver probe, may be used with some little advantage.

The finger should be gently introduced in the course of the ball, to its utmost extent, in every wound which it is necessary to examine; and in parts connected with life, or liable to be seriously injured, it is the only sound that is admissible. Whilst this examination is taking place, the hand of the surgeon should be carefully pressed upon the part opposite where the ball may be expected to lie, by which it may perhaps be brought within reach of the finger, whereas, by the want of this precaution, it may be missed by a very trifling distance. Whilst the finger is in the wound, the limb may be thrown as nearly as possible into that action which was about to be performed on the receipt of the injury, when the contraction of the muscles, and the relative change of parts, will more readily allow the course of the ball to be followed; if this should fail, attention should be paid to the various actions of the limb, the attendant symptoms arising from parts affected, and what may be called the general anatomy of the whole circle of injury. A muscle, in the act of contraction, may oppose an obstacle to the passage of an instrument in the direction the ball has taken, and especially if it should have passed between tendons or surfaces loosely connected by cellular membrane; as by the side of, or between the great blood-vessels, which by their elasticity may make way for the ball, and yet impede the progress of the sound. When the ball is ascertained to have passed beyond the reach of the finger, the

opposite side of the limb should be carefully examined, and pressure made upon the wounded side, when it will probably be found more or less deeply seated. If the ball should not be discoverable by the finger in the wound, or by pressure on the opposite side, the surgeon should consider every symptom and every part of anatomy connected with the wound, before he decides on leaving the ball to the wise operations of nature, or to proceed to further attempts with longer sounds of other descriptions. Upon this point there has been much discussion, which naturally includes the question of extraction in general; some having decided upon leaving balls unmolested when there was a difficulty in extracting them; others, upon extracting them, except when it was attended with particular danger.

The older surgeons less acquainted with anatomy than those of a later period, were more cautious in the means employed for the extraction of balls than their successors; and although they were equally desirous of removing them, and considered their extraction as a necessary part of the cure, they did not resort to extensive or deep incisions, but rather depended upon the dexterous use of sounds to discover the situation of balls, and of various kinds of dilating and extracting instruments for their removal; and only enlarging the wounds when they could not obtain their object without it. This even they did not do, unless they had discovered the ball, and were certain of removing it, considering it rather a personal disgrace to have made their incision without effect, and thereby increasing the suffering of their patients. The effects of this forcible dilatation, in all cases where balls were lodged, were most sensibly felt, the sufferings of the patients were greatly augmented, and the symptoms that followed these efforts when successful, or otherwise, were extremely severe.

Ambrose Paré, whose surgical career should be the object of imitation of every military surgeon, appears first to have introduced the practice of searching for balls, or other extraneous substances, by means of large and deep incisions;

and this practice, in the hands of some of his successors on the continent, having been found successful in complicated wounds, and less dangerous in simple ones, than the method of dilating by force, by means of forceps or other instruments, was gradually adopted in all cases; and not only in such as required them to make room for the introduction of instruments, but in those in which the ball had passed out, and rendered it unnecessary.

In England the practice of dilatation was not carried to so great an extent. Wiseman, whose surgery of gun-shot wounds is very correct, acknowledges in that part of his treatise on the extraction of bullets, that they often lie quiet in the body without producing any mischief; but that in general they are very troublesome, forming sinuses attended with much pain and inconvenience; and in consequence recommends their extraction, whenever it be possible by incision, without injuring parts of importance. When in muscular parts he admits, that the ball may be sometimes permitted to remain until after suppuration has taken place, but he rather wishes that all considerable wounds appearing likely to form fistulæ, should be enlarged, in order to give free vent to the matter, and when this is not sufficient, he recommends a counter-opening, with the wise precaution of previously trying a change of position and bandage.

It is proper to mention, that before and after the time of Paré, surgeons supposed that gun-shot wounds were poisoned, from the pain, heat, and other usual phenomena of inflammation which ensued, as well as the blackness, and the evil consequences arising from the burning irons, hot oils, and scarifications they employed to get rid of the poison, not to include the gangrene common to hospitals, crowded and conducted as they were in former times. When Paré proved that gun-shot wounds were not poisoned, and recommended a milder and more successful practice, the irons and hot oils were abandoned, but scarifications continued to be used, not only because it had been customary to use them, but because the theories of that

period supposed a stretching of the nervous filaments, causing the febrile and inflammatory symptoms which ensued; and it was supposed, that these would disappear after the cause had been removed: hence the scarifications in every direction.

This practice was continued with little alteration until the time of Mr. Hunter. We find that the Baron Percy, in his Manuel de Chirurgien d'Armée, Paris, 1792, strongly recommends it. He says, page 186, seconde partie, "The first indication of cure is to change the nature of the wound as nearly as possible into an incised one. It ought to suppurate in all its extent; but it is useful to obtain beforehand the discharge of the fluids which are retained in the extremities of the bruised vessels; this can only be accomplished by proper incisions and scarifications, by means of which many disagreeable accidents are prevented, such as tumefactions, abscesses, and sinuses, which are the cause of numerous counter-openings. These incisions must, however, be scientifically made.

"It is a gross deception to suppose that the indication is fulfilled by making large incisions at the entrance and the exit of the ball; they are, on the contrary, very dangerous when made without due precaution: for in dividing too much integument, an opening is made for the protrusion of the muscles beneath, and they do not prevent or remove the tumefaction of the parts. The inflammation makes progress, fever arises accompanied by delirium, and the parts slough or become gangrenous, unless the formation of abscesses, which are unfortunately salutary in such cases, brings relief. To scarify with precision, the finger ought first to be introduced into the wound, and passing the knife on it, the wound should be enlarged from within outwards, as far as may be considered necessary, which prevents the possibility of the skin only being divided, and thereby permitting the muscles to protrude. The more interior parts of the track of the ball should then be scarified in succession. The intention is to remove by local bleeding, the loaded state of the vessels, and if there be any parts within which appear to bind down, or to act like a stric-

ture on the rest, they are to be divided on the finger. When the muscles are covered by aponeuroses, they must always be scarified in different directions, to prevent the strangulation which would ensue from the swelling of the part.

"When a wound has been well scarified in the manner directed, so that a finger can be easily introduced at each orifice, and made to meet, it becomes as it were a simple wound, which will readily heal with ordinary treatment. Sometimes the thickness of the part, as well as the immediate vicinity of some important nerve or vessel, will prevent our proceeding in this manner; and it is in these cases that the anatomical knowledge of the surgeon will enable him to finish with ease and safety, what another could only begin with difficulty and danger."

Mr. Hunter, who wrote about the same period, expresses himself in a far different manner on the same subject, and I cannot do better than oppose the principles of one man to those of the other. He says, page 532, quarto edition, "If a ball pass through a fleshy part, where it can hurt no bone in its way, such as the thick of the thigh, I own, in such a simple wound, I see no reason for opening it; because I see no purpose that can be answered by it, except the shortening of the depth of the wound made by the ball, which can be productive of no benefit. If the ball does not pass through, and is not to be found, opening can be of as little service. If the opening in the skin should be objected to, as being too small, and thereby forming an obstruction to the exit of the slough, &c. I think that in general it is not; for the skin is kept open by its own elasticity, as we see in all wounds; this elasticity, muscles and many other parts have not; and, in general, the opening made by a ball is much larger than those made by pointed instruments; for I have already observed, that there is often a piece of the skin carried in before the ball, especially if it passed with considerable velocity, besides the circular slough; so that there is really in such cases a greater loss of substance; therefore whatever matter or extra-

neous body there is, when it comes to the skin, it will find a free passage out. Nor does the wound in the skin in general heal sooner than the bottom; and, indeed, in many cases not so soon, because the skin is generally the part that has suffered most.

" However, this is not an absolute rule, for the skin sometimes heals first; but I have found this to be the case as often where openings had been made, as in those where there had not, and this will depend upon circumstances or peculiarities; such as the bottom being at a considerable distance, with extraneous bodies, and having no disposition to heal, tending to a fistula; and I have observed in those cases, that the wound, or opening made by the surgeon, generally skinned to a small hole before the bottom of the wound was closed, which brings it to the state it would have been in, if it had not been dilated at all, especially if there are extraneous bodies still remaining; for an extraneous body causes and keeps up the secretion of matter, or rather keeps up the disease at the bottom of the wound, by which means the healing disposition of its mouth is in some degree destroyed.

" Let me state a case of this last description. Suppose a wound made with a ball; that wound (from circumstances) is not to heal in six months, because the extraneous bodies, &c. cannot be extracted; or work out sooner; or some other circumstance prevents the cure in a shorter time; open that wound as freely as may be thought necessary, I will engage that it will be in a month's time in the same state with a similar wound that has not been opened, so that the whole advantage (if there is any) must be before it comes to this state; but it is very seldom that any thing of consequence can be done in that time, because the extraneous bodies do not come out at first so readily as they do at last, for the inflammation and tumefaction, which extends beyond that very opening, generally keeps them in; and if the wound is opened on their account at first, it ought to be continued to the very last. Upon the same principle, opening on account of extraneous bodies at first cannot be of so much ser-

vice as opening some time after; for the suppuration, with its leading causes, viz. inflammation and sloughing all along the passage of the ball, makes the passage itself much more determined and more easily followed; for the want of which, few extraneous bodies are ever extracted at the beginning, excepting what are superficial, small, and loose.

" If the extraneous bodies are broken bones, it seldom happens that they are entirely detached, and therefore must loosen before they can come away; also the bones in many cases are rendered dead, either by the blow, or by being exposed, which must exfoliate, and this requires some time, for in gun-shot wounds, where bones are either bruised or broke, there is most commonly an exfoliation, because some part of the bone is deadened, similar to the slough in the soft parts.

" A reason given for opening gun-shot wounds is, that it takes off the tension arising from the inflammation, and gives the part liberty; this would be very good practice if tension or inflammation were not a consequence of wounds; or it would be very good practice if they could prove, that the effects from dilating a part that was already wounded were very different, if not quite the reverse of those of the first wound; but as this must always be considered as an extension of the first mischief, we must suppose it to produce an increase of the effects arising from that mischief; therefore, this practice is contradictory to common sense and common observation.

" They are principally the compound wounds that require surgical operations, and certain precautions are necessary with regard to them, which I shall here lay down.

" As the dilatation of gun-shot wounds is a violence, it will be necessary to consider well what relief can be given to the parts or patient by such an operation; and whether, without it, more mischief would ensue; it should also be considered, what is the proper time for dilating.

" But it will be almost impossible to state what wound ought, and what ought not to be opened; this must always be determined by the surgeon, after he is acquainted with the true

state of the case and the general principles; but from what has been already said, we may in some measure judge what these wounds are that should be opened, in order to produce immediate relief, or to assist in the cure: we must have some other views than those objected to, we must see plainly something to be done for the relief of the patient by this opening, which cannot be procured without it, and if not procured, that the part cannot heal, or that the patient must lose his life.

"The practice to be recommended here will be exactly similar to the common practice of surgery, without paying any attention to the cause as a gun-shot wound."

In another place he says, "It is contrary to all the rules of surgery founded on our knowledge of the animal economy, to enlarge wounds simply as wounds; no wound, let it be ever so small, should be made larger, excepting when preparatory to something else, which will imply a complicated wound, and which is to be treated accordingly; it should not be opened because it is a wound, but because there is something necessary to be done, which cannot be executed unless the wound is enlarged"

Mr. Hunter wrote from his knowledge of principles, unbiassed by any particular theory, and from having had some opportunities of practice; and the experience acquired during the Peninsular war, by army surgeons, proves that his opinions were correct as far as they relate to wounds in muscular parts; but he at the same time laid the foundation for a practice equally, if not more, dangerous, viz. that of neglecting dilatation under circumstances in which it was absolutely necessary: a practice which this great man by no means had in contemplation when he wrote, nor which he could foresee was likely to follow from his work.

Mr. John Bell has quoted these same opinions of Mr. Hunter, in the third edition of his Discourses on Wounds, 1812; and endeavoured to refute them, by bringing forward the old arguments used on this occasion. This was excusable in the two first editions, because Mr. J. Bell had had no

practice of his own, and little opportunity of inquiring into that of others; but it is not so in the third, because at that period the war in the Peninsula had afforded many opportuuities of judging to which the preference should be given, and it was Mr. Bell's duty to have ascertained the fact before he wrote, and taught a practice which all those who knew any thing about the matter, had abandoned.

The cause of so much error on the part of Mr. John Bell and others who have followed him, was, that they conceived the wound must inflame (in which opinion they were right); and that the whole limb must inflame also, in which they were totally wrong; having reasoned from theory, probably on an individual case, and not from actual observation made on many; for I have shown that wounds, passing deep through muscular parts, do not usually cause inflammation in the manner supposed, and that it may in general be subdued by more mild treatment than deep scarifications. As to simply dilating the mouth of the wound, as it is termed, by cutting through the skin, it is too absurd to argue upon, and those who say it gives no pain have only to make the experiment on themselves to be thoroughly convinced of their error. That the *eschars*, as they are termed, were formerly very large, cannot be doubted, because we find it so repeatedly stated to be the case by different authors; but as they are not so now, we can only suppose they were caused in the greater number of instances by their own injudicious proceedings; and that, whilst they were labouring hard to prevent mischief, they were actually giving rise to it.

The practice during the Peninsular war was, never to dilate without a precise object in view, which might render an additional opening necessary. This opening must always, consistently with this principle, have been carried through the fascia of a limb, and was truly a dilatation, whilst those incisions which were formerly made through the skin, or indentations in the edges of the fascia, were entirely abandoned. A wound was never then dilated, neither ought it to be dilated, because it

may at a more distant period become necessary. The necessity must first be seen, when the operation follows of course. I know not a stronger instance exemplifying this, than that of a wounded artery, which all admit to be a fair case for dilatation. Suppose then, that a man be brought for assistance with a wound through the thigh, in the immediate vicinity of the femoral artery, and which, he says, bled considerably at the moment of injury, but which had ceased; is the surgeon warranted in cutting down upon the artery and putting ligatures upon it on suspicion? I believe every man in his senses will answer, no; the surgeon ought to take the precaution of applying a tourniquet loosely on the limb, and of placing the man in a situation where he can receive constant attention in case of need; but he is not authorized to proceed to any operation unless another bleeding demonstrates the injury, and the necessity for relieving it. By the same reasoning, incisions are not to be made into the thigh on the speculation that they may be hereafter required.

If the confusion which has enveloped this subject, be removed, and bleeding arteries, broken bones, and the lodgment of extraneous matter, be admitted to be legitimate causes for dilating wounds, as I believe Mr. Hunter and all other reasonable men have admitted, the discussion and the arguments in favour of primary dilatation, in other cases, must fall to the ground.

In stating this, I by no means wish to undervalue incisions, when made at proper periods; but I wish to restrict them to such periods, and when the necessity for them has become obvious. Mr. John Bell has supported his opinions by cases in which dilatation was necessary, in consequence of general inflammation of the limb beneath the fascia. He has improperly considered these cases as examples of a general rule, instead of being exceptions to it; but taking, for the sake of argument, his strongest case, let us see what it will prove. Page 197, octavo edition, he says, "there is one case which stands out very pro-

minent from all the rest, where the fascia was four times divided, always with perfect relief; but always, as the fascia healed, the contraction of the arm, the spasmodic disease of the whole system, the restless nights, fearful dreams, pain, fever and weakness returned; till at last, by a random stroke, rather than by any well-conceived design of the surgeon, the fascia was fairly cut across, at the place where it is braced down by its connexion with the long tendon of the biceps muscle, and then only, viz. at the fourth incision, the patient was entirely released. 'Now,' says she, 'you have indeed cut the cord which bound my arm,' and she tossed her arm freely and with great exultation. In short, this is a case on which I would insist much, for were I to detail, at full length, the circumstances of it, these four successive operations would be found to resemble rather four regular experiments, contrived for the very purpose of proving how dreadful the distress arising from a tense fascia is, and how sure the relief is every time that the fascia is opened; and how surely the distress returns every time that the fascia is allowed to close; and how perfect the relief is whenever the fascia is decidedly and fairly cut across. In short, with such analogies before him, no surgeon, however averse from the dilatation of gun-shot wounds, can refuse his assent to this second rule, 'that whenever we dilate the mouth of a gun-shot wound, the incision should pass through the fascia as well as through the skin,' and that whenever the symptoms of a tight fascia come on, we should be careful to open the wound anew, and to make the fascia quite free."

In this case, in which extreme inflammation beneath the fascia took place, four incisions were made without affording perfect relief; and it is declared they were not made in the right place, or sufficiently extensive, although the state of the limb and of the system indicated the necessity for some relief being given. If, then, they were not made in the right place, or to a sufficient extent, when the state of the limb pointed out the mischief, was it likely they would have been

more advantageously made before any such indication occurred? The answer must be, certainly not; but it may be said, that if they had been properly made they might have prevented the mischief altogether, which is merely begging the question, for in hundreds of similar cases no such mischief has taken place when no incisions have been made. At last the surgeon, by a *random* stroke, cut the aponeurosis of the biceps muscle, and the patient became instantly at ease, which part of the story is peculiarly insisted upon by him and others; but if this is to be applied to practice and imitated, I know not any other inference that can be drawn from it, and whenever I have heard the case quoted by Mr. C. Bell, I never could draw any other, but that the aponeurosis should have been cut sooner, and of course, that in similar cases of injury the surgeon should by a stroke, equally, I believe, in surgery as *random* as the other, cut the aponeurosis of the biceps. Unless it means this, it does not bear upon the question of incising wounds immediately on the receipt of the injury, which it is intended to support. That the incision was proper at the period alluded to, is demonstrated; it might have been judicious to have made it earlier; but that because a person has received an injury on the arm, which might give rise to inflammation, the aponeurosis of the biceps should be cut, is really absurd. It will be said, it is only meant that something must be cut; but in this case it appears cutting the aponeurosis alone gave permanent relief: it was that part, then, only which should have been cut, and as there could be no proper indication for this at the moment of injury, the inference I have drawn is, I apprehend, the true one; and wounds, although likely to give rise to inflammation under fasciæ, are not to be dilated at *random*, to prevent what may never occur, but when the occurrence of the inflammation shows the necessity for an operation, the surgeon will do it with precision, and not put his patient to the pain of several useless incisions, from the simple circumstance of

not knowing where to cut, or what to do, unless it be that he must do something.

The error has arisen, as I have already stated, from supposing that when a ball passes through the thigh, the whole limb must inflame in all its extent and depth, which is, on the contrary, seldom the case; for it often happens, that the inflammation is very moderate, and when the patient has been properly treated, even slight. I admit, however, that in some cases, the inflammation is deep and extensive, that matter forms beneath or between the muscles, that the usual inflammation around the track of the ball has been much exceeded, and suppuration to a greater extent has taken place. Admitting this, I inquire if it has occurred because the fascia was not divided, and the reply must be in the negative; for, if it was the cause in this case, it must have had equal influence in others, and all cases of a similar nature would become affected in the same manner, which is not the fact. The inflammation, then, is determined principally by the state of constitution of the patient, or perhaps by some accidental circumstance in the nature of the wound; it extends between the muscles, and is fully developed, before the fascia can act by causing the pressure; for the fascia is nearly passive; it is the swelling of the limb, one of the phenomena of inflammation, which causes the pressure, in like manner as in strangulated hernia it is the swelling of the intestine which causes pressure against the edge of the ring, and the mischief which we wish to obviate. After the inflammation has taken place, it may be, and is increased, from the part being unable to swell to its full extent, and acute pain, throbbing, startings, fever, and delirium, are the consequences. These symptoms, however, only come on several days after the receipt of the injury, and require as much medical as surgical treatment; for it is quite a mistaken notion, that the surgeon has but to take up his knife, and make a large incision through the fascia, and all will be removed. The inflammation which began before the state of the fascia interfered with

it, is yet to be treated; the derangement of system constituting fever, which has taken place, may be still more dangerous than the local injury, and it will generally be so, if the patients have been subject to any endemic disease of the country, or if any peculiar kind of fever prevails. The maxim which obtains with many surgeons, that the effects will subside, if the original or exciting cause be removed, is erroneous, and more discreditable to surgery than any other with which I am acquainted; for, when diseased or irregular actions have fairly taken place, they will often continue, and run on to the destruction of the patient or part, although the exciting cause be entirely removed. One of the strongest instances of the impropriety of this maxim, may be drawn from the treatment of strangulated hernia. Take, for example, a recent case of hernia, strangulated and in a state of high inflammation; relief is only to be obtained by the knife, and the operation is successfully accomplished, i. e. the stricture is taken off the intestine. If the surgeon, as is sometimes the case, thinks he has done his duty, and quits his patient under the impression that nothing more than a cathartic or enema is necessary, he fails as a scientific practitioner, becomes a mere dissector, and his patient often loses his life. The part is in a state of high inflammation, and the removal of the stricture upon it, only takes away one cause tending to increase the inflammation, but does little towards the diminution of that which has already taken place, provided it be to any extent. In an early stage nature may be able to act for and relieve herself after the obstruction has been removed; but in a later one, when the inflammation is fairly established and running on towards gangrene, it is in the same state as any other common inflammation, and requires the same energetic mode of cure. When, then, I read, and have heard it said, that bleeding is of little or no use in strangulated hernia, of recent origin in young robust persons, or even in others, neither before nor after the operation, I am obliged to confess with regret, that surgery is never more degraded, than when it appears to be

adorned with greatest splendour; that in no instance does surgery become so entirely an art as in this, where it especially deserves to be considered as a science. I have at this moment a preparation before me, in which the operation was successfully performed, but the patient was lost for want of medical treatment; and I firmly believe that the greater number of cases which are lost without mortification taking place, are lost from the same cause; but this is not peculiar to the operation for hernia. It was very common a few years ago, after all the great operations for amputation, and in many others of equally dangerous tendency.

When, then, inflammation takes place in a wounded limb, and which will only occur after a few days, and there is every appearance of its becoming serious, blood is to be drawn generally, and cold or hot applications are to be made use of according to the indications which have been laid down; an emetic and purgative are to be administered, and nauseating doses of the antimonium tartarisatum to be prescribed, with saline draughts, or other vehicle which may be at hand, or be considered advisable. Leeches will be found of great service; and if, on introducing the finger, the parts seem tense, or indeed whether they do or not, if the inflammation, pain, and fever run high, an incision is to be made by introducing the knife into the wound, and cutting for the space of two, three, or four inches, according to circumstances, in the course of the muscles, and carefully avoiding any parts of importance. The same should be done at the inferior or opposite opening, if mischief be seriously impending, not so much on the principle of loosening the fascia, as on that of taking away blood from the part immediately affected, and of making a free opening for the evacuation of the fluids effused. This I have frequently done with the most marked success, and the propriety of the practice must be so obvious, that it is unnecessary to support it by any instances *. I wish, however, to

* Dr. Hennen, in his excellent work on Military Surgery, Syphilis, &c. has given a good illustration of this: see page 70, et seq.

mention, that it is no less an advantageous practice in the subsequent stages of gun-shot wounds, where sinuses form, and are tardy in healing. A free incision is also very often serviceable, when parts are unhealthy, although there may not be any considerable sinus. Upon the necessity of it where bones are broken, there is no occasion to insist; and of the advantages of the practice of dilatation in such cases and stages, it is impossible to be too commendatory.

A punctured wound made with a lance or bayonet is also a contused wound; for no instrument, however sharp it may be, cuts from direct pressure, but from having a certain degree of drawing motion combined with it, a fact clearly demonstrated by the possibility of closing the hand on the edge of a well-set razor, without receiving any injury from the direct pressure made on it. When a bayonet is thrust into the body it is by direct pressure; and when to any depth it passes through various textures, endowed with different qualities and sensibilities, from which circumstance the peculiarities arise which have been observed in punctured wounds. In an incised wound, if the two sides of it be brought together, they will frequently unite, because there is no obstacle in general to prevent it. In a contused superficial wound, this cannot take place, for neither side is capable of taking on the necessary action, yet little mischief ensues, because, being a superficial wound, there is a sufficient facility for the discharge of any matter that may be secreted; and that matter must be secreted is a necessary consequence of union not taking place.

In a punctured wound of little depth, or only through the skin and cellular substance, it is seldom any inconvenience ensues, because the matter formed can be pressed out without difficulty, and the part heals up slowly but surely under the precaution of daily pressure; perhaps it heals in a shorter period than an incised wound of the same length and depth, which is left to the operations of nature, defended only by a piece of lint to prevent irritation. A punctured wound extending to a considerable depth, labours under greater disad-

vantages, and generally in proportion to the smallness of the instrument, and the differences of texture through which it passes. When the instrument is large, the opening made is in proportion; and does not afford so great an obstacle to the discharge of the fluids poured out or secreted, as when the opening is small; lance wounds are therefore less dangerous than those inflicted by the bayonet. When a small instrument passes deep through a fascia, it makes an opening in it, which is not increased by the natural retraction of parts, inasmuch as it is not sufficiently large to admit of it, and which opening, small as it is, may be filled or closed up by the soft cellular membrane below, which rises into it, and forms a barrier to the discharge of any matter which may be secreted beneath. If the instrument should have passed into a muscle, it is evident that if that muscle was in a state of contraction at the moment of injury, the punctured part must be removed to a certain distance from the direct line of the wound, when in a state of relaxation, and vice versâ: the matter secreted, and more or less must in almost every instance be secreted, cannot in either case make its escape, and all the symptoms occur of a spontaneous abscess deeply seated below a fascia. That inflammation should spread in a continuous texture is not uncommon; that matter when confined should give rise to great constitutional disturbance is, if possible, less so; but that this disturbance takes place without the occurrence of inflammation, or of the formation of matter, I deny; and of course conclude, that there is no peculiarity in punctured wounds, that may not be accounted for in a satisfactory manner. These effects have been attributed to injuries of nerves, but without sufficient reason; and those who have seen locked jaw follow a very simple scratch of the leg from a musket-ball, are not surprised at any symptoms of nervous agitation that may occur after punctured wounds.

The reason that these unpleasant symptoms do not often follow gun-shot wounds is, that the orifice is sufficiently large, and the track of the ball sufficiently open throughout, to allow

of a free discharge of matter, and when mischief does take place, principally from constitutional causes, it is much of the same nature in both. As a punctured wound cannot be changed into an incised one by incision, and the object of it, which would be union by the first intention, cannot be effected, an incision, in the first instance, may do harm, and will often be unnecessary; for many bayonet wounds through muscular parts heal with little trouble, and it is time enough to act when assistance seems to be required. Cold water should be used at first; care should be taken not to apply a roller or compress of any kind over the wound, and the matter should be frequently pressed out. When suppuration is established a roller should be applied above and below the wound, and an evaporating poultice upon it, if cold be found uncomfortable.

The observations I have already made on the general and local treatment of inflammation and suppuration beneath fasciæ, apply in these cases, and do not require repetition. I may be permitted to give one caution, that whatever is done, should be done effectually.

A ball will frequently strike a bone, and lodge in it, without causing a fracture of the limb; and instances are on record, and preparations are shown, in which little inconvenience resulted from them; but these are exceptions only, and are sadly counterbalanced by the results of other analogous injuries. If a ball lodge in the head of a bone, and is not removed, it generally causes caries of the bone, disease of the joint, amputation, or death. If in the shaft of a long bone, necrosis for the most part follows, with months and years of misery. On a flat bone, caries is equally the result, and if it be surrounded by large muscles, sinuses form in various directions, contractions of the limb take place, and the patient drags on for years careless of life and ready to submit to any thing to obtain relief. Of this number was Captain Pring, of the 27th regiment, who was wounded at the first and unsuccessful siege of Badajos, in 1812, by a musket-ball, which passed directly in and lodged in the ilium, a little above the acetabulum, and

close to the lower head or origin of the rectus muscle. The ball could not be, or was not, discovered at the moment of injury, but its situation was ascertained after suppuration had taken place. In this state he went to England, and, on his arrival in London, consulted Mr. Astley Cooper, who recommended him to go into the country and recover his health. On some improvement taking place, a surgeon endeavoured to fix a patent cork-screw in the ball, in order to draw it out; but the experiment failed, although the screw entered and brought away some portions which it had broken up. He now submitted to his fate for seven years, when, finding his health declining, he came again to London, and consulted me. The ball could now be readily felt with the probe, but the finger could not be introduced; I therefore enlarged the sinus by the use of sponge-tent enclosed in thin bladder, to prevent irritation, and the ball could then be felt imbedded in the bone, the lower edge being rather raised, and the surface rough from the action of the screw. I had no doubt of the propriety of removing it, the only question was as to the manner; and in consultation with Mr. Cline and Mr. Astley Cooper, it was decided that an incision should be made to the bottom of the wound, extending from its upper edge three inches in length, towards the edge of the ilium. The wound was opened to a sufficient extent to allow of the easy application of any instrument; and Mr. Cooper, availing himself of the circumstance of the raised edge of the ball, got the point of a hook under it, and by using the curve or bowl of it as a lever, lifted and loosened the ball a little from its bed, and subsequently extracted it with the forceps. There was very little blood lost, and we had every hope that the patient would recover. For some time this prospect appeared likely to be realized, but at length irritation came on, matter formed among the muscles, his health declined, the abdomen swelled, the extremities became anasarcous, and hope was extinguished. He now went to Devonshire, and shortly after died; and although his friends promised that he should be opened, in order to

ascertain whether the injury or disease had communicated with the cavity of the pelvis, it was not done. The impression remains on my mind, that this ball might have been extracted at a much earlier period, when the bone would have been less diseased. It is true it was then much more deeply seated, from the greater size of the muscles; but this should not, in my view of the case, prevent an operation, where there is little danger of hæmorrhage.

After the battle of Albuhera, I removed two balls which were sticking in bone; one in the ilium, close to the crest, the other in the outside of the femur; and both cases did well with little exfoliation. It was accomplished by raising them up with a sharp-pointed instrument, like a chisel; but if the ball be fairly imbedded in the bone, as it very often is in the bones of the cranium, it cannot be raised in this way, and a trephine must be applied. It may be laid down as a general rule, that a ball should never be allowed to remain in a bone, and, when on the subject of fractures, I shall give several unfortunate instances of the bad effects of allowing them to do so. This rule is not, however, entirely devoid of exceptions, as the following case will show.

Lieutenant-colonel Dumaresq, Aide-de-camp to Sir John Byng, was wounded at the battle of Waterloo by a musket-ball, whilst in the act of turning round, after having made a successful charge with some advanced light infantry at the farm of Hougomont; the ball passed in through the scapula, penetrated and was lost in the chest. The symptoms of thoracic inflammation were almost irrestrainable, and he barely escaped with life. A swelling was then discovered in the axilla, and it is now fully ascertained to be the ball, which lodged in the rib, I should suppose without destroying the periosteum, and which has formed a quantity of bony matter around it. At one time an operation for its removal was talked of, but I always dissented from such a proceeding, and he now enjoys good health, although occasionally subject to spasms in the chest.

In making incisions for the removal of balls in the vicinity of large vessels, the hand should always be unsupported, in order to prevent an accident from any sudden movement of the patient. This caution is more necessary on the field of battle, where many things may give rise to sudden alarm. At the affair of Saca Farte, near Alfaiates in Portugal, I stationed myself behind a small watch-tower, and the wounded were first brought to this spot for assistance. A howitzer had also been placed upon it, being rising ground, and at the moment I was extracting a ball situated immediately over the carotid artery, the gun was fired, to the inexpressible alarm of surgeon, patient, and orderly, who wheeled in every direction. From my hand being unsupported, no mischief ensued, and the operation was afterwards completed. In many cases of this kind about the neck, where the ball has penetrated deep, and lodged, and it becomes necessary to cut down upon it in the vicinity of great vessels, or nerves, the surgeon may (when he is not very confident) make use of a flexible tube with a stilet, or even Pouteau's trocar, the stilet of which may be pushed on after the point of the tube is distinctly felt beneath the skin, at the proper place for making the incision, which can then be duly enlarged and with less danger.

It often happens, that a ball will be discovered on the opposite side of a limb through which it has nearly penetrated, but had not sufficient power to overcome the resistance and elasticity of the skin. In cases of this kind, and particularly when the ball is at the distance of an inch from the surface, it has been recommended to allow it to remain, rather than to extract it immediately, on the supposition, that this additional opening might be the cause of a great increase of inflammation; but this was merely a supposition, which has not been realized in practice. I have cut out a great number of balls under these circumstances, and have never found any inconvenience ensue: on the contrary, the minds of the sufferers have been much relieved by the removal of the ball, for with its retention there is always connected an idea of dan-

ger. By removing it an opening is obtained for the evacuation of any matter which may be formed in the long track of such a wound, and any other extraneous bodies are more readily extracted.

I cannot, however, help suspecting that the direction must have been given, from the consideration of a different kind of case; we will say, for instance, where the ball has penetrated half through the thick part of the thigh in such a direction that it cannot be readily removed by the opening at which it entered, or that, from the vicinity of the great vessels, it may be considered unadvisable to cut for it in that direction. The question then is, whether or not an incision should be made on the opposite side to the depth of three or four inches, in order to extract it? I have no hesitation in saying, that if the ball cannot be distinctly felt by the finger through the soft parts, it ought not to be cut upon; for, an incision of considerable extent will be required to enable the surgeon to extract it: much pain will be caused, and higher inflammation may follow than would ensue, if the wound were left to the efforts of nature alone, by which, in a short time, the ball would be brought much nearer to the surface, and might be more safely extracted. It frequently happens, that after a few days, or weeks, a ball will be distinctly felt in a spot where the surgeon had before searched in vain for it. The wound will frequently heal up without any further trouble, the ball remaining without inconvenience in its new situation, and the patient not being annoyed by it, does not feel disposed to submit to pain or inconvenience for its removal.

A very strong reason for the extraction of balls during the first period of treatment, if it can be safely accomplished, is, that they do not always remain harmless,but frequently give rise to distressing or harassing pains in and about the part, which often oblige the sufferer to submit to their extraction at a later period, when their removal is infinitely more difficult, and may be more dangerous, than at the moment of injury.

Nothing appears more simple than to cut out a ball

which can be felt at the distance of an inch, or even half an inch below the skin; but the young surgeon often finds it more difficult than he expected, because he makes his incision too small, and cannot at all times oppose sufficient resistance to prevent the ball from retreating before the effort he makes for its expulsion forwards, either with the point or the handle of the instrument, or the forceps. The ball also requires to be cleared from the surrounding cellular substance to a greater extent than might at first be imagined, for all that seems to be required is, that a simple incision be made down to the surface of it, when it will slip out, which is not always found to be the case.

When a ball has been lodged for years, we find that a membranous kind of sac is formed around it, which shuts it in as it were from all communication with the surrounding parts, and in some instances it seems to do so, and the patient suffers no sort of inconvenience from its retention. In other instances, it frequently becomes necessary to extract a ball which has been lodged for years, when the membranous sac will often be found to adhere so strongly to the ball that it cannot be got out without great difficulty, and sometimes not without cutting out a portion of the adhering sac. Some persons may be perhaps a little incredulous on this point; but they must bring to their recollection, that Mr. Hunter found no great difficulty in inducing the comb of a cock to adhere to a tooth, which in some of the instances was equally an inanimate body; and that nothing can withstand the testimony of facts. During the last winter I cut out two balls which had been lodged for several years; one from an officer of the Rifle Brigade, which had lodged under the pectoral muscle; the other from an officer of the 5th regiment, which had been lodged deeply in the parietes of the abdomen. The first was got out with difficulty in consequence of the adhesion; Assistant-surgeon Robson of that corps was present. In the second operation I was assisted by Staff-surgeon Lindsey. The sac surrounding the ball was so close to the peri-

toneum, that there was some danger of injuring it, and it adhered so firmly to the ball, that, after several attempts made in vain to separate them, I was obliged, as the readiest method, to remove a portion of the sac attached to it. In this state I showed it at my evening lecture to all the gentlemen attending, and it is still in my possession. I do not mean to say that this kind of union takes place in every instance, but merely to relate a particular fact, and to state the greater difficulty attending the extraction of balls which have been lodged for years.

It often occurs that a ball lodges and cannot be found, especially where it has struck against a bone, and slanted off in a different direction; and if the ball should lodge in the cellular membrane between two muscles, it often descends by its gravity to a considerable distance, and excites a low degree of irritation, which slowly brings it to the surface, or terminates in abscess. To encourage this, poultices are generally recommended, but are not in my opinion serviceable; on the contrary, they rather appear to disturb and delay the operations of nature; and I usually confine myself to the application of flannel until sufficient indications arise to authorize an incision, when the ball will generally be found at the bottom of the abscess. Among a variety of cases of this description, that of Colonel Ross of the Rifle Brigade is sufficiently remarkable. He was wounded at the battle of Waterloo by a musket-ball which entered at the upper part of the arm, and injured the bone. More than one surgeon had pointed out the way by which it had passed under the scapula, and lodged itself in some of the muscles of the back. About a year afterwards, I extracted it close to the elbow, the ball lying at the bottom of an abscess, which was only brought near the surface by the use of flannel, and by desisting from all emollient applications.

I wish now to draw attention to a state of gun-shot wound which I have not often seen, but which is highly dangerous, infinitely more so than those I have been noticing, in which

the inflammatory stage runs on to the suppurative. It will, perhaps, be best explained by a case.

After the battle of Albuhera, Mr. Curby, Assistant-surgeon of the 29th regiment, drew my attention to the case of a man as something peculiar, whom I had seen with him the day before with a shot through the thigh, and who died after a short illness the following morning. In the evening he had complained of pain, which had increased so much on the last visit as to demand particular attention, and fomentations and an opiate were ordered. The pain, it was reported, continued during the night, and in the morning early he died. The body was carried away, and no examination was made.

On the retreat of the army from Fuente Guinaldo in 1812, a smart affair took place at the convent of Saca Farte, between the advance of the French, and the cavalry and the fourth division of the British army under Sir L. Cole, to which I belonged. The wounded accompanied me to Sabugal, on the heights near which we offered battle. Among them was a man, a stout handsome soldier, who had been shot through the right thigh, the ball entering below the femoral artery, passing through and outwards close to the bone; this wound went on remarkably well for near a fortnight, so much so that the man had actually got up and walked about. I saw him at one o'clock, and, as he was standing, desired him to keep himself quiet; he answered, he felt quite well. In the evening, Mr. Mahoney, now Surgeon of the Fusiliers, who occupied the same quarters with me, reported that the man was suffering some pain, and that he had ordered him an opiate and a poultice. He died early in the morning, having complained a good deal in the night, but not sufficiently to induce the orderlies to call Mr. Mahoney, until symptoms of approaching death alarmed them. I examined the limb carefully within twenty-four hours of the man's being in comparative health. On the day previous to his death, the wound looked favourably, there was little or no inflam-

mation, the limb was soft, and he was capable of walking, and conceived himself comparatively well. Inflammation came on in the night, internally, deep, and hardly affecting the skin with redness: on dissection the thigh appeared swelled, although not particularly so, but on cutting deeply through the fascia in the course of the wound, the whole thigh seemed so stuffed, or gorged with blood, that the texture of the parts, muscular as well as cellular, was soft, and readily giving way to a moderate pressure of the fingers; I can only compare it to the appearance of a part just falling into a state of gangrene.

I lost a French prisoner precisely in the same way, after the battle of Salamanca; and Mr. Knight, late Inspector-general of the medical department of the Army, informs me, that at the Helder, in 1799, his attention was drawn to a case of the same nature, which terminated fatally; and, on dissection, the appearances gave him the idea of a part which had fallen, or was immediately about to fall, into a state of gangrene. It is not easy to say with precision, when a case of this description, which is so exceedingly rapid in its course, is cured, or rather prevented; I am almost certain I have lost others, and I think I have saved some. In either way the cases are very rare: after the battle of Toulouse, where the strictest attention was paid to every thing peculiar, there was not one. It would appear that this attack, which runs so rapid a course, is one of inflammation of the most acute kind, tending to gangrene: and the means of relief must be proportionably active. The indications, in an affection of this nature, seem to be two; to relieve the part locally, and the system generally. The first is to be fulfilled by the application of leeches in great numbers, after an incision has been made into the part; the bleeding from which, so long as it lasts, will afford material relief. On introducing the finger into the wound, after the inflammation has begun, the part feels tense and painful, and the incision gives ease, not so much from relieving distention, for, after all, the separation of parts

is trifling, but from the loss of blood drawn immediately from the seat of inflammation. General depletion is then to be resorted to, and one effectual bleeding, so as to cause syncope, will be most serviceable. I have found warm applications to the part more agreeable than cold. Where sixty or eighty leeches cannot be procured, we must rely more on general blood-letting.

I am aware that some persons may think they can see nothing different in these cases and observations from the preceding ones; if so, it arises from my manner of noticing them, not from their want of peculiarity: and when such a case is once seen to run its course, it will not make less impression on the mind of the observer than it has on mine.

I have hitherto mentioned the treatment of gun-shot wounds only as relating to a state of healthy inflammation; but the habits and constitutions of many do not admit of this taking place, and it assumes a different character, and requires a different treatment. In healthy phlegmonous inflammation, we act decidedly to command, as it were, results. In bad habits, or where the inflammation is not healthy, exclusive of spontaneous inflammations, which may be different from either, we act according as circumstances present themselves. The phlegmonous and erysipelatous inflammations may be considered as two extremes of a scale, admitting between them of many modifications, and we find that even the true erysipelas is itself a very different disease, and requires a very different treatment, according to the state and habit of the patient, the season of the year, especially in warm climates, and the nature of any other prevailing or epidemic disease.

Phlegmonous inflammation has been supposed principally to affect the cellular membrane, erysipelas the skin; pathologists are, however, by no means disposed of late to confine either kind of inflammation to that texture which is considered most proper to it; and we occasionally read of the erysipelatous inflammation attacking the serous and mucous membranes of the body, as well as being communicated by contiguity to the

cellular texture: facts which deserve particular attention, as they lead to more decided modes of treating this complaint, which of all others, since the time of Hippocrates, Galen, and the Greek physicians, has afforded the greatest difference of opinion. The phlegmonous has been called healthy inflammation; because, whenever the restoration or repair of parts is to be accomplished, nature avails herself of this mode of performing it, and, through it, the other necessary actions are set up and completed. The erysipelatous has been called the unhealthy inflammation, because its tendency is directly the reverse, interfering with and putting a stop to all the actions which may be going on for the restoration or repair of parts, and not unfrequently causing, or terminating in the destruction of the part itself, by gangrene and sphacelus, attended by a greater degree of general debility than is compatible with the well-doing of the patient, or warranted by the extent of the inflammation. In order to contrast the two inflammations more strongly, it may be said, the phlegmonous inflammation terminates, with a few exceptions, in resolution, or suppuration; the erysipelatous, in effusion or gangrene: terminations, which are found directly opposed to those of phlegmonous inflammation, with reference either to the restoration of parts or the continuance of life. It is not surprising then, that, considering erysipelas as an unhealthy inflammation when a local complaint; and as dependent on an unhealthy state of the system when an idiopathic disease, practitioners should treat it according to the ideas they happen to entertain of its nature, rather than according to the peculiar symptoms which may attend each of its several modifications: that this disease should, in fact, be treated, in many instances, empirically rather than rationally. We find that many persons treat erysipelas by bark and acids as specific remedies, from the commencement of the complaint; but let the inflammation only be communicated to the membranes of the brain, and they direct blood to be drawn. It is true, in some other instances, the bark is continued and the patient dies, as it is termed, incu-

rable; but fortunately these cases are daily becoming more infrequent. Now, in the instance alluded to, if bark was an appropriate or specific remedy in erysipelas affecting the skin of the head, it ought to be equally proper when the inflammation has extended to the membranes of the brain, or it must be admitted that erysipelas is a very different disease, when affecting the skin and serous membranes of the same person and at the same time: an admission which will not be made. If we take the other side of the question, it comes precisely to the same thing. In a case, then, of this description, one of the two remedies was improper, or the patient recovers in spite of both, or, to say the least of it, one or other did no good, if it did no harm, and it is immaterial to my present argument which of the two may be considered the useless remedy.

It appears to me that this disease has been viewed, and considered by many persons on the same narrow principles as the question of the propriety of immediate amputation, in cases where an operation of that description must be the result of an injury. Most authors who have written on it, have done so more with immediate reference to a particular kind or species of erysipelas, than to the disease generally; to that which has prevailed in their immediate neighbourhood, rather than to the country at large; or, they have given the history of some particular epidemic. In whatever manner the fact be accounted for, the discrepancy of opinion as to the treatment of erysipelas is remarkable, and can only be understood by taking enlarged views of the disease; for, if it be inquired into through one medium, one method of treatment only will be admitted. If we refer to ancient authors, we find that Celsus recommended bleeding almost indiscriminately, whilst Galen never drew blood. Ætius placed his reliance on purgatives, Paulus Ægineta only where bleeding could not be performed. The Arabians also relied on purgatives; Ambrose Paré on both; our own countryman, Sydenham, on bleeding and refrigerants; whilst later practitioners have placed their entire confidence in cinchona as a

specific. It is true that some more modern physicians have ventured to revive the practice of the ancients in certain cases; but the general feeling at present is decidedly in favour of bark as a remedy in all cases of erysipelas, and the authority of very great names is often brought by students in support of it *.

In order to understand this, to render it consistent with the views entertained of other diseases, it will be necessary to take a variety of circumstances into consideration; and unless this be done, I do not apprehend, the great diversity of opinions and practice which exists at present, can be reconciled, and the disease be made appear to be treated rationally and not empirically. When I hear, or am asked the question, How do you treat erysipelas? I consider the inquirer much on a par with him who asks me, how I operate for cataract, neither complaint having any specific mode of treatment, but a general one, dependent on the state of the parts affected, the constitution and age of the patient, not to exclude peculiar predisposition or diathesis, or the presence of any prevailing or epidemic disease.

I am disposed to believe, that a good deal of error has arisen from considering erysipelatous inflammation as directly opposed to the phlegmonous, and that the term unhealthy, which has been applied to it, has led to the supposition of an unsound and weak state of the constitution, in all instances, instead of its being present only in the greater number; and that some peculiarity of constitution quite independent of its powers, may determine the nature of it, after a disposition for inflammation has been formed. That derangement of the primæ viæ can do this, Dessault, in his Surgical Journal, has amply proved, and no one is disposed to dispute it; that particular idiosyncracy can induce it, is, if possible, better sub-

* Those who are desirous of consulting or learning the opinions of the more ancient authors, will do well to read Dr. Weatherhead's work on the Diagnosis between Erysipelas and Phlegmon, and Dr. Wilson Philip's Treatise on Fevers. Ploucquet will supply the names of the remainder.

stantiated, and that many hidden or obscure causes are equally capable of producing this peculiar inflammation, is, I think, fully established in the minds of most practitioners. According to this opinion, erysipelatous inflammation may occur in persons of the soundest and most healthy constitutions, without general or local defects, the particular kind of inflammation as to local characters being determined by some peculiarity of habit, general or acquired; whilst the constitutional symptoms are in like manner determined by the peculiar state of the constitution. The erysipelatous inflammation, in a case of this kind, ought not to be opposed to the phlegmonous under the denomination of unhealthy, for it is equally as healthy in this instance, as any spontaneous phlegmonous inflammation, and the treatment should be similar, with reference to the great outline of the practice, due attention being paid to the nature of the peculiarity giving rise to the complaint. Every deviation from a healthy state of the system causes a shade of difference in the constitutional symptoms and treatment of erysipelas, in the same manner as the state of constitution, in cases of common febrile excitement, exerts its influence on the symptoms causing those varieties of difference which may be observed from synocha to typhus gravior. Erysipelas is then, in my opinion, to be treated according to the same principles as fever, according to the symptoms as dependent on the state of the constitution, and not with reference only to the name and local characters of the disease. Erysipelas, like all spontaneous inflammations, is in most instances much more of a constitutional than a local disease; it is frequently so in cases dependent on external violence, and the local treatment is often as changeable as the general, whilst it ought always to be regulated by it: hence the great discrepancy of opinion, as to local applications; some persons using cold, others preferring hot, and a third party denying both, and abstaining altogether from any applications. I cannot say that I have reason to coincide with either party, although I agree with the whole. The only difference is as to the peculiar case, and period for resorting to

them. Whenever the constitution has been good, and the fever inflammatory, I have almost always used cold applications with advantage; of these I have found the liq. ammon. acetatis, in the proportion of one part to three or four of water, or with a small quantity of spirit, very useful; and when I have ordered a poultice and stimulant ointments to the wounds, the lotion has been freely applied to the surrounding parts. The decoctum cydonii is also a good remedy especially in the erysipelatous inflammations of children, cooling and preventing by its mucilaginous nature, the chafing of parts, as well as irritation. Vinegar and water has also been found useful, and more rarely the liquor plumbi subacet. dilutus. But when the constitution of the patient has been bad, or the fever partaking of the nature of typhus, I have found warm fomentations of poppy-heads, &c. with a small quantity of spirit, the best and the most comfortable application. Flour has been much recommended, as well as other absorbent powders, upon the principle of their absorbing any irritating secretion which may take place; I cannot say I have seen any benefit derived from it, except in the later stages of the complaint when on the decline, and in the erythematous affections of old people, in which it seems to be of considerable service. In cases of erysipelas supervening on injuries of the head, I have generally followed the method first recommended, after an emetic had operated, and with due constitutional treatment. In the extremities, warm fomentations and poultices (the stale beer or fermenting from preference) have been most frequently found useful.

Erysipelatous inflammation is said to be common in all cases of lacerated wounds, and, therefore, of frequent occurrence in gun-shot wounds; but this is not the fact, for gun-shot wounds are, for the most part, inflicted on persons of good constitutions, and the inflammation, although often in excess, is generally healthy; and if a computation be made, it will not be found that the erysipelas is more pre-

valent in a given number of gun-shot wounds than in the same number of any other kind of injuries.

The erysipelas phlegmonodes, as it is termed, or that state in which the inflammation extends to the cellular membrane and forms an abscess, with little adhesive inflammation around it, so that the fluid secreted is not contained in a proper sac, but rather diffused through the part, giving to the finger the sensation of a partially circumscribed swelling, is by no means an uncommon complaint; and if the presence of matter regulates, or decides, the name of a disease, it may be said to be of very frequent occurrence, to be present in almost every case that does not terminate in mortification, and in which the inflammation extends deeper than the skin. The disease, as its name implies, partakes of the nature of phlegmon and erysipelas, inclining sometimes to the one, sometimes to the other, according as it is influenced by the state of the constitution and the strength of parts. The manner of terminating seems also to be regulated by the same influence. If the inflammatory action be high, and the constitution good, matter will be formed, and the cellular substance in which this occurs will slough; the same thing takes place if the power of the parts be deficient, and the accompanying fever be of a typhoid type; whilst, if the inflammatory action be moderate, and the strength of the parts equal to the action, whether they be of an inflammatory tendency or otherwise, the cellular substance in which matter is formed will not slough; but a serous discharge will take the place of pus for a few days, and the part in which the matter was retained will gradually recover itself without further trouble and inconvenience, although the matter by no means approached the surface when the opening was made for its evacuation. A gentleman came under my care some time ago in consequence of two open buboes. He was naturally of a good habit of body, but had been trifling with himself in the country, and three days after he arrived in town, erysipelatous inflammation took

place, and extended from the sores, down the thighs, over the lower part of the abdomen, and behind the trochanters. The febrile symptoms were those of synochus, and the disease apparently dependent on derangement of the primæ viæ. It was treated by purgatives, diaphoretics, and latterly cordials and opiates; matter formed, however, in considerable quantity, and was evacuated in the form of good pus, in three different places, viz. over each trochanter and in the middle of the left thigh. The openings were made as soon as any fluctuation could be discovered, and the lancet was pushed in to near the depth of an inch. After the second day the discharge became serous, the swelling of the part gradually diminished, and the openings closed up in a few days without further trouble. This case is related as illustrative of the state to which it applies, and in contrast to the following:—A poor woman, about the middle age of life, applied for advice in consequence of an erysipelatous inflammaton of the whole lower extremity of the right side, of several days continuance. The limb was greatly swelled, the inflammation was of a dark red colour, and gangrene was evidently to be feared; the febrile symptoms were also of a typhoid type. Warm spiritous fomentations were ordered to be kept to the parts, and to be frequently changed. Bark in substance, with the tincture and extract, and twenty drops of the spiritus ætheris sulph. comp. were administered every two hours, and a moderate quantity of wine. Under this treatment, matter formed first near the ancle, and in succession of formations for several days as high as the groin, large sloughs coming away from each opening, requiring great attention, in the after-treatment, to the steady application of compression. In this case, which took a considerable time to effect a cure, the matter certainly first formed in the cellular membrane above the fascia, although that soon became implicated, and on the sloughs separating the muscles were laid bare. The last formations gave less

trouble, in consequence of being opened as soon as the fluctuation of matter could be distinguished in the slightest degree, and the partially circumscribed swelling indicated the seat of the mischief. Previously to these signs being discoverable, I cannot, from personal experience, recommend that openings should be made, because it is possible that they may be made unnecessarily, and in complaints which do not require them. Mr. Hutchison, in his Practical Observations in Surgery, has recommended, in cases where there is much tension, and the formation of matter impending, that several longitudinal incisions, of an inch or an inch and a half in length, be made into the inflamed parts and through the fascia, which he thinks act as drains to the part if any fluid be effused, relieve the congestion of blood in the vessels, and often arrest the progress of the disease itself. The practice is certainly not consonant with our usual ideas on this subject; but as Mr. Hutchison has tried it in several instances with success, and is a competent judge of the disease, and, therefore, not likely to be mistaken, it ought to have a further trial, whenever proper opportunities offer themselves, and there can be less hesitation in cases of gun-shot wounds, as there are already one or two openings.

In the 48th number of the London Medical Repository, in a paper on "the Use of the nitro-muriatic Acid Bath in several Diseases," I have related the case of a soldier who was cured of several scrofulous ulcers by the use of the bath, and was shortly afterwards attacked by erysipelas of the head, extending over the whole body in a very alarming manner. This man's life was only saved by very large and repeated bleedings and warm fomentations, yet there was no reason to believe, from his previous history, that any inflammatory complaint, and especially erysipelas, would have required such very decided treatment.

I am at this moment attending three different cases, in one of which I have bled largely, in the other given bark and acids, in the third, camphor, diaphoretics, the carbonate

of ammonia, and even brandy. It would be useless then to multiply examples in explanation of a subject which no one can mistake, who is not so obstinately wedded to one opinion, as to be determined not to change it. In all cases of gun-shot wounds, in which erysipelas supervenes, the treatment is to be regulated by the symptoms, and I believe the same principles ought to be applied to it in every circumstance or situation of life in which it may be met with.

There is an inflammation which I have seen several times occur in gun-shot wounds which I do not perfectly understand, and which, as it is attended by peculiar and fatal circumstances, deserves particular attention. It is not common, seldom more than one or two cases occur in an hospital of a thousand men, and they generally take place after the first ten days.

My attention was first drawn to it after the battle of Albuhera, in consequence of losing three men very suddenly, whose death I did not expect, having seen them in the evening; and in all the three cases, on finding their places vacant in the morning, was informed on inquiry that they had died during the night, and had been carried away. The death of the first did not attract my attention; that of the second left an impression which made me attend more particularly to the third, and to consider the affection as something peculiar. Two cases occurred after the battle of Salamanca, and one at Toulouse. I did not see a case among the wounded at the sieges of Ciudad Rodrigo, Badajos, or Burgos, the wounded at the battles of the Pyrenees only came under my direction at a period later than I have known it occur, neither did I see one at Brussels or at Antwerp after the battle of Waterloo. It is very possible some may have occurred; but which escaped my observation.

This inflammation makes its appearance after the first ten days in every case, and in all that I have seen the injury was in the upper extremity. The wound, from being only a simple one without fracture, begins to swell and to become painful, and the swelling increases. The redness, which is

of a pale colour, more resembles the phlegmonous than the erysipelatous inflammation, whilst the skin has a shining, glossy appearance, and the tumefied parts retain in a slight degree the impression of the finger, although the accomplishment of it gives great pain, and to a certain extent is resisted by the firmness of the parts below. The pain is not greater than in other cases of inflammation, and is rather burning than throbbing. The constitution sympathizes at first only in a moderate degree. The swelling and shining appearance continue to extend up to the axilla. The patient can sit up and wash his own arm (in two instances they walked about), and neither his countenance nor pulse indicates the near approach of dissolution, which in five or six cases took place a few hours after the last visit, when the appearances were such as I have described. In the five fatal cases, I could only learn that they got worse during the night, that is, the pain increased, difficulty of breathing came on, and death. In all, this took place the day after the swelling had reached the axilla; and in the fifth case, the result appeared to me so certain at the same period of time, that I desired the orderly to take care that if the man died during the night he should not be removed. This direction seemed to surprise the orderly, who had no suspicion that the man would die; but his first salutation at half past five in the morning, when I came into the hospital, was, "Sure, Sir, the man is dead." I relate the case in this manner to draw the attention more strongly to the impression it had made on my mind, that the complaint may not be overlooked on future opportunities offering themselves, and that it may not too hastily be considered as a common case of erysipelatous or œdematous inflammation. The three first cases were not examined after death. In the fourth I could discover nothing particular beyond inflammation of the veins, especially those leading to the axilla, the axillary vein being also inflamed, to which I attributed the man's death without considering it very peculiar, being of frequent occurrence in fatal cases after amputation. In the fifth, the man died of effusion into the chest on the same side as the injury

of the arm, the whole of which was much enlarged and had been highly inflamed, but the great veins were not affected as in the former instance.

The sixth case occurred after the battle of Toulouse, in the Caserne de Calvete hospital, under the direction of Staff-surgeon Boutflower, and the immediate charge of Mr. Franklyn, now Surgeon of the 37th regiment, to whom I pointed it out at its commencement as of very dangerous tendency, and it was from that moment an object of particular attention. The man was bled, purged, vomited, and diaphoretic remedies were administered, composed of calomel, antimony, and principally opium. Poultices were applied to the wound, and cold applications to the remainder of the limb. The arm swelled nearly up to the axilla, and I fully expected it would have taken the same course as the others, but it did not do so; the inflammation gradually subsided, the arm diminished, and reassumed its usual appearance; the exact time I cannot mention, having lost the particulars of the case. During this process the man's health declined, he suffered an attack of fever, became afterwards jaundiced, and died under symptoms of diseased liver. There was nothing wrong at his death about the arm which had been inflamed.

It is from this termination that I have been induced to give the caution not to mistake the disease for a common case of unhealthy inflammation; and even admitting that it should be hereafter proved to be so, there will still be something very peculiar in it and deserving investigation.

I am disposed to hazard a conjecture, that it was effusion in the chest, which carried off the first three patients; that the inflammation of the veins of the arm in the fourth was an accidental occurrence, although of this I am by no means positive. The treatment to be adopted, should be that which was made use of in the last case, and which proved successful in removing the inflammation, although the patient subsequently died from fever and visceral disease.

The last result of inflammation that I shall notice is mortification; a term which has been applied to such very dif-

ferent states, that it is necessary to consider it as applicable only in a general manner, to a part deprived of life, in order that the name of the complaint may have no influence on its treatment. The death of a part of the body is, then, in modern surgery, denominated sphacelus, or mortification; and the term gangrene, which has been sometimes considered as synonymous, is restricted to the states immediately preceding it, in which some marks of vitality continue; but the word gangrene is not sufficiently expressive of the different peculiarities of each, and a further subdivision has been adopted into humid, dry, and traumatic. Humid gangrene *, when the death of the part has been preceded by a great deposition of fluids in it, and followed by putrefaction and general decomposition. Dry gangrene, when the death of the part has been preceded by little or no deposition of fluids in it, and followed by a drying, shrivelling, and hardening of the part, nearly in its natural form and shape, with few signs of putrefaction. Traumatic gangrene †, when it is produced by, or is the effect of external injury, and partaking generally of the nature of the first species, although admitting of some difference in its treatment. Surgeons have also sometimes bestowed the names of chronic and idiopathic gangrene, on certain states depending on internal causes, or which have occupied a considerable time without any great developement of disease.

These terms, however comprehensive they seem to be, are not, I apprehend, sufficiently explicit; they indicate only the immediate state of the part, without alluding to the cause, or, if they do convey some idea of the cause, it is more likely to be a false than a correct impression. Gangrene being a disease from which we can reasonably expect nothing but the death of the part, the actual state in which it may be when such occurrence takes place, is of little consequence, except as far as regards its connexion with healthy parts, and the state

* Quesnai's Traité de la Gangrène, Paris, 1749.

† By the Baron Larrey, Mémoires de Chirurgie Militaire, tome iii. page 141.

of the constitution. The Baron Larrey, fully aware that the terms humid and dry gangrene did not sufficiently indicate the state of either, added to them the traumatic, with the view of designating a species in which the state of the constitution, and of the neighbouring parts, should in general be supposed to be sound, although the gangrenous part might partake, in appearance, of the nature of the other species, and in which a different mode of treatment might be adopted. I have here, then, given to the Baron's species the most extended sense it is capable of receiving; yet, it appears to me to be still objectionable, because neither the state of constitution nor of parts, nor the surgical treatment, are at all times alike, nay even frequently differ most essentially in a very short space of time.

To convey to the mind of the surgeon a strong impression of the nature of the disease he has to contend with, as well as of the proper treatment of it, I have been in the habit, in my lectures, of making an additional distinction of constitutional and local gangrene, including the humid and the dry under either, as it might happen that the constitution was or was not materially affected; preventing, in consequence of this distinction, the mind of the surgeon wandering from the consideration of the main facts before him; and founding on it a practice essentially different, in many instances, from that which is usually received, whilst it elucidates or removes any discrepancy of opinion, which may have existed on some points of material importance.

By the terms constitutional humid, and dry gangrene, I do not alone mean gangrene which has originated, as it may be termed, idiopathically; but in which the constitution or system at large is, or has become affected either primarily or secondarily. By local humid, and dry gangrene, I understand a state of disease of a particular part, by which the constitution or system at large has not been implicated, or only sympathizes in a degree which is not felt to be generally detrimental to its powers of originating and maintaining actions, which may be subsequently required for the safety of the whole.

Mortification, or the actual death of a part, is admitted by all authors to occur from a variety of causes, and more attention has been paid to discriminating these, than to ascertaining their effects, or the manner in which they are produced. It appears to me, that, in the consideration of gangrene, the cause is comparatively of little importance, provided the effect produced on the system at large be attentively considered. The surgeon, in applying all or any of his curative means, adapts them to the state of the constitution and the parts in the vicinity of the disease or injury, rather than to the affected spot itself. Gangrene may take place from excess of inflammation, arising spontaneously, or from external violence, constituting what has been termed the acute humid gangrene, in which case it is the last result of incurable inflammation of the part, every attempt at its suppression, made, either generally or locally, having failed; every effort of nature being insufficient to prevent a termination, which she seems evidently to consider as most destructive. In making these efforts, nature frequently exhausts herself, and if the powers of the constitution be bad, she yields at once to the further encroachment of this destructive foe to life, and the death of the whole rapidly follows the death of a part. Gangrenous inflammation always shows a weakness of part, whilst it may not demonstrate any of the constitution; in which case, the gangrene ceases with the destruction of the weakened part, and the separation between the dead and the living is duly effected. This will take place whether the inflammation be of a phlegmonous or of an erysipelatous nature, although it is more likely to occur in the former than in the latter, and more frequently, in proportion to the smallness of the extent of the mortification, or the importance of the part affected. When mortification takes place from excess of inflammation, in a person of sound constitution and of parts, it is only after a very great effort of nature to prevent it, as demonstrated by every symptom; and we often find that the pulse keeps up some time after the gangrenous inflammation has commenced. The efforts of nature have here

been too strong for the powers of the part weakened by disease; we accordingly endeavour to moderate them in the first instance by venesection, cathartics, and diaphoretics, and to allay irritation on the part by the appropriate remedies. When mortification has, however, taken place, we find that the constitution becomes immediately sensible of it, not by means of the absorbents taking up the gangrenous particles, as Baron Larrey supposes, but through the nervous and sanguiferous systems, which have been principally implicated in the disease, and have been entirely the instruments by which nature has attempted to effect its suppression. The pulse sinks, the countenance becomes anxious, the shock which has been sustained is perceptible, and the surgeon now endeavours to revive the drooping efforts of nature, which have been vanquished in the struggle. If the powers of the constitution have been fundamentally good, nature is able once more to rally, and although the part is completely irrecoverable, still she is capable of surrounding it, as it were, with a line of circumvallation, preventing the further encroachments of the disease, until, by renovated efforts of a slower but surer nature, she is able to cast it off altogether. But if the powers of the constitution have been bad, it is precisely the reverse, nature seems to have completely exhausted her strength in the struggle, and to be totally unequal to further resistance. As water which is capable of being cooled below the freezing point without congealing, and remaining in this state for some time, on the slightest agitation, freezes almost instantaneously in every direction; in like manner does nature resist the encroachment of mortification, but with such loss of the principle of life, that when overcome, the deprivation of the remainder takes place almost as suddenly as the congelation of water cooled below the freezing point; the progress of the mortification along the limb is comparatively as rapid, the pulse immediately sinks, pain ceases, the skin becomes cold, perspirations break out, the countenance is inexpressibly anxious, and death soon closes the scene. In such a case, fully aware as the surgeon ought to be, from his

general knowledge, of its true state, instead of endeavouring, as in the preceding one, to diminish what he considers the irregular or ill-adapted efforts of nature, he ought to sooth and support them, so that they may not be expended on the first and ineffectual struggle, but preserved as unbroken as possible for the succeeding attempt at restraining the disease within reasonable bounds, and of subsequently casting it off.

Amputation of a member affected by mortification, under such circumstances, is forbidden, and wisely so by all modern surgeons; the operation having been found in most cases useless, if not directly detrimental; the same action taking place on the stump, in consequence of the reduced or bad state of the powers of the constitution, which second attack has almost invariably been fatal; and the patient thereby deprived of the chance which might have existed of nature being equal at a subsequent period to throw off the mortified part. The operation of amputation is an injury that the powers of the constitution are incapable of bearing, they are now unequal to maintaining, and barely of originating the actions necessary for the recovery of the part. Inflammation scarcely commences before it ceases in the death of the part, the presence of it being shown not by its usual phenomena of pain, heat, redness, and swelling, but by a greater degree of white doughy tumefaction, of uneasiness, rather than pain, which is more general than local, accompanied by little or no increase of heat or redness; certain forerunners of death. If the operation should have been performed on a person of better constitution and powers, the stump may go on well for a day or two, and then actual gangrenous inflammation supervene, as in persons of deficient powers, which will be followed by death. The axiom in surgery is then a good one, "that whenever the constitution of the patient is implicated, whenever the powers of nature are considerably exhausted, the operation of amputation should not be resorted to until the line of separation is fairly established." Amputation in this state is performed only when a part of a limb is completely destroyed, it is done

to shorten and relieve the operations of nature, and to render the remaining portion of it more serviceable, or useful to the patient. It is consonant to reason that this injury, which is intended to be a beneficial one in its result, should only be committed, when nature has so far recovered from the preceding struggle, as to be able to set up and support the new actions required of her; and the appearance of the line of separation is a fair proof of her capability to do so.

In cases of what is termed chronic, idiopathic, or dry gangrene, the disease is admitted to be the effect of constitutional derangement, whether it be caused, as it may reasonably be supposed to be, by improper food, such as rye in a state of what is called cockspur, or by the French ergot de cocq, or by some less obvious cause producing that species which Quesnai* and Mr. Pott† have so ably described. For a compen-

* "There is nevertheless a dry gangrene which commences with a kind of external and superficial inflammation, but without swelling. The gangrene which ensues is always accompanied in its progress by a similar inflammation which precedes and announces its approach. It supervenes upon this inflammation so rapidly, that time is not given for the formation of matter, the appearance of which is the only mark of a cessation of the gangrene, and a proof that the arteries retain sufficient power to enable them to perform their proper functions."

"Dry gangrene is preceded and followed by considerable changes in the colour of the part. In general, the part which is about to suffer, becomes red as if a little inflamed, but without swelling, tension, or any particular increase of heat; the skin and flesh often become even firm and slightly œdematous at the spot where the redness resembles that of a slight erysipelatous affection. This brightness soon becomes tarnished, and quickly degenerates into a livid colour, and lastly to blackness. As this redness advances, the progress of the mortification is foreseen, and a tolerably certain prognosis of its state may be formed from the changes which are observed in the colour of the inflammation."

† Mr. Pott's account of dry gangrene attacking the toes is as follows: "It is very unlike to the mortification from inflammation; to that from external cold, from ligature or bandage, or to that which proceeds from any known or visible cause, and this as well in its attack as in its progress. In some few instances it makes its appearance

dious account of the first species, the work of Dr. Thomson on Inflammation may be consulted, the disease having been seen but once in England, and was then described by Dr. Woolaston in the Philosophical Transactions for 1762. Being universally admitted to be constitutional diseases, amputation has been forbidden on the same principles and for the same reasons as in the preceding states of humid gangrene.

with little or no pain; but in by much the majority of these cases the patients feel great uneasiness through the whole foot and joint of the ankle, particularly in the night, even before these parts show any mark of distemper, or before there is any other than a small discoloured spot on the end of one of the little toes.

"It generally makes its first appearance on the inside, or at the extremity, of one of the smaller toes, by a small black or bluish spot. From this spot the cuticle is always found to be detached, and the skin under it to be of a dark red colour.

"If the patient has lately cut his nails, or corns, it is most frequently, though very unjustly, set to the account of such operation.

"Its progress in different subjects, and under different circumstances, is different; in some it is slow and long in passing from toe to toe, and from thence to the foot and ankle; in others its progress is rapid, and horridly painful. It generally begins on the inside of each small toe, before it is visible either on its under or upper part; and when it makes its attack on the foot, the upper part first shows its distempered state by tumefaction, change of colour, and sometimes by vesication; but wherever it is, one of the first marks of it is a separation or detachment of the cuticle.

"Each sex is liable to it; but for one female in whom I have met with it, I think I may say that I have seen it in at least twenty males. I think also that I have much more often found it in the rich and voluptuous, than in the labouring poor; more often in great eaters than free drinkers. It frequently happens to persons advanced in life; but is by no means peculiar to old age. It is not, in general, preceded or accompanied by apparent distemperature either of the parts or of the habit. I do not know any particular kind of constitution which is more liable to it than another; but, as far as my observation goes, I think that I have most frequently observed it to attack those who have been subject to flying, uncertain pains in their feet, which they have called gouty; and but seldom in those who have been accustomed to have the gout regularly and fairly. It has by some been supposed to arise from an ossification of the vessels; but for this opinion I never could find any foundation but mere conjecture."

The descriptions given of humid and dry gangrene seemed for a long time to satisfy the minds of surgeons, and the practice resulting from them prevailed and obtained so generally, that it was considered, every kind of gangrene which could occur, must fall within the limits of one or the other. The Baron Larrey, perceiving that both the theory and practice admitted of exceptions, added that species of gangrene resulting from wounds which he called traumatic; but as his ideas and mine do not quite coincide, I shall notice his opinions more at length. "When gangrene," he says, "arises from external mechanical causes which affect directly the vitality of parts, it is constantly preceded by inflammatory swelling, erethismus, and a greater or less dilaceration of the capillary system of vessels. The injured parts become tumefied by the vital actions of those textures which as yet are not totally deprived of life; the epidermis is detached, and forms phlyctænæ, which are filled with a serous fluid, the cutis is softened, acquires a blackish hue, and putrefies: the cellular membrane and other textures are decomposed, from which decomposition a superabundance of fluids is derived, which have caused the name of humid gangrene to be given to this species. We find, however, in the midst of this putrefactive mass, and especially when the affection is not complete and the commotion has not been very violent, some muscles, arteries, and nerves, still in possession of a part of their living powers, and resisting to a certain extent the tendency to gangrene."

"Spontaneous gangrene generally shows itself in the most remote parts of the body, or in those in which the vital powers are weakest, such as the feet, the nose, the ears, and the fingers; whilst the traumatic gangrene may appear in any part that has been injured. In the first case it is a *deleterious substance* which invades parts most distant from the centre of life; in the second, the injured parts have suffered only a relative disorganization. In either case the different textures of the part are struck with death; but as the vessels in dry gangrene had not undergone at first any alteration, they are less dis-

tended than in traumatic gangrene, and more especially if it be the effect of cold, or the sufferers have been enfeebled by previous disease. The part blackens, and instead of swelling, as in traumatic gangrene, it shrinks, dries, and sometimes hardens, constituting dry gangrene, which only differs from the traumatic in there being no extravasation or congestion of fluids. The reason of this in dry gangrene is, that the vessels are uninjured, whilst in the traumatic they have been ruptured. Dry gangrene is more readily arrested, because the different textures of the part being supplied with vessels and nerves having direct communication with the centre of life, are better able to resist the morbific infection. It forms a circumscribed inflammatory line which separates the sound from the affected parts, and prevents the propagation of the gangrenous principle in consequence of the closing of the mouth of the sanguiferous and absorbing vessels by adhesive inflammation. In this case no inconvenience results from waiting until the mortification is arrested before amputation be performed. It is not the same with traumatic gangrene, which spreads with great rapidity along the whole of a member, affects the trunk, and kills the sufferer with little delay. It may readily be conceived, that the parts immediately above the gangrenous spot, retain sufficient power to render them capable at the same time of absorbing the gangrenous principle, and of participating in the same inflammation and erethismus which precede it. In this manner the progress of the disease, and the impossibility of arresting it, are explained. In addition to this local continuous inflammation, the disease is propagated by metastasis of this gangrenous principle, either by the cellular texture, or by one of the vascular systems, to the brain, which soon become affected, the intellectual faculties are impaired, the animal functions are weakened, great anxiety and delirium supervene; and if the contagion continue to be propagated, the patient is destroyed. On opening the bodies of persons who have died under these circumstances, the arteries of the brain and the heart have been found full of liquid black blood, highly carbonized."

"In dry or spontaneous gangrene, absorption is accomplished with more difficulty, the disease remains latent for a greater or a less time, and it is not uncommon to see a mortified part thrown off by the efforts of nature alone, the general functions of the body being little altered."

At page 152 he says, "It is easy to conceive from what has been said, that in traumatic gangrene it would be dangerous to wait until the line of separation be formed before we amputate, because putrefaction is communicated without obstacle not only by contagion, but by absorption, or transudation from the part first *infected* to the rest of the limb. Whatever, then, authors may say to the contrary, amputation should be resorted to, as soon as the death of the part, and the consequent loss of the limb, is demonstrated. The supervention of gangrene on the stump is not to be feared as in spontaneous gangrene, in which the line of separation is not established, because traumatic gangrene is only propagated by absorption, and an affection of the different textures, which swell in consequence of the continuity of vessels along which the disease successively passes. In fact amputation, done at the proper place, arrests its progress and prevents a fatal termination of the disease: it destroys at once the propagation of the gangrene by contagion, and, by cutting across the nerves and vessels, relieves them from any fluids which may be stagnated in them; their natural action is re-established, and the parts are soon restored to a healthy state. The efforts of nature are to be seconded by bark, wine, tonics, &c." The Baron Larrey supports his opinions by the relation and notices of several successful cases of amputation, in which the gangrene was spreading when the operation was performed. The theory on which they are founded appears to me to be exceedingly defective. He considers this humid or traumatic gangrene as a deleterious principle, which is capable of spreading by infection or contagion, and is consequently irresistible; whilst he supposes, on the contrary, that the gangrene which arises from

cold *, when it reaches sound parts, becomes a stimulant, and induces the vessels to act in order to separate the dead from the living parts; an hypothesis which is entirely imaginary, supported by no known principles, and invented apparently to account for a difference which he could not otherwise explain. In the first place, it has not been demonstrated that any contagious or deleterious principle exists in gangrene which occurs, as in some of his cases, in twenty-four hours, or two or three days, after an injury which has destroyed the life and sensibility of a part. Gangrene or mortification is, under such circumstances, in its most simple form, that of a sudden deprivation of the life of a part which *cannot* possess any deleterious qualities until putrefaction takes place, which can only occur at the end of two or three days from the receipt of the injury, and then under more favourable circumstances than from any other cause. If, then, mortification arising in this manner as the result of sudden death, is capable of generating a deleterious principle, it is not possible to conceive that any other kind can be free from it, or that it can generate several or even two kinds of principles; one that shall be destructive to the powers of life, the other merely stimulant, and inducing them to healthy action. The reasons on which the Baron Larrey founds his practice, in either kind of gangrene, I consider to be erroneous; and I do not indeed think he has given to the subject all the developement it is capable of receiving.

Traumatic gangrene may, in opposition to the opinion of the Baron Larrey, be of two kinds, humid and dry, or both species may obtain in a limb at the same time, but under particular circumstances.

A cannon-ball, striking a limb, destroys the life of the part, in a greater or less degree, according to the extent of the injury effected; if the blow be received on the middle of the leg, the bone broken, the arteries divided, or rendered incapable of carrying on the circulation, mortification takes place in the foot, because it is deprived of its usual support; it

* See his Memoir on Gangrene arising from Cold, tome iii. p. 60.

is possible, however, that this may not follow immediately, as it may not be entirely deprived of blood, which passes into it in small quantity from the parts above, connecting it with the rest of the extremity. The parts immediately above those actually struck by the ball have received a very considerable shock, and their sensibility is much impaired; and, when any action takes place in them, they will sometimes be found unequal to sustain it, and, as the action attempted to be set up is inflammation, the failure of support causes it to fall into gangrene. It is, however, a failure of support not from want of power in the constitution, exhausted by a serious struggle, but from incapability of the parts to maintain it. The extent to which this debility of parts may extend is uncertain, and the limits to the mortification must be so likewise, if left entirely to nature, it is evidently a struggle on the part of the constitution to reanimate the drooping powers of the part, which are unable to bear the assistance attempted to be afforded them. Inflammation then precedes the mortification, the limb swells, and has every appearance, above the wound, as the disease advances, of humid gangrene. It began as a local disease, the part being simply unable to live, and nature having received a shock, as I conceive, entirely through the nervous system, and not by the absorbents, endeavours by means of an additional supply of blood (as she invariably does in every case of injury), to recover the parts in jeopardy, to renovate their strength. If the parts are capable of bearing this, healthy inflammation is established and the mortification ceases. The disease is, from the moment inflammation is *established*, no longer local, the constitution is beginning to be implicated; and, if the struggle be continued, it becomes a case of mortification, dependent, according to my principles, on constitutional causes. Nature seems to suffer in the deprivation of the principle of life whenever she becomes sensible of the death of any part of the body, and in a greater proportion than would seem to be commensurate with the supply of that part in a state of health; she becomes weak-

ened, of course, more by the death of a part than by its amputation, and upon a principle connected with life, which we cannot explain. When the inflammation commences, the great point for observation is, whether the power of the part can or cannot maintain and carry it on to the healthy, adhesive, and ulcerative stages. If nature can accomplish this, she ought not to be interfered with; but if it appear that the part is incapable of supporting the efforts of nature, or, what is worse, that she is incapable of making them; is she to be allowed to exhaust herself in a fruitless struggle, or is assistance to be given, the instant the inability of the part is seen, and just as the powers of nature are displaying themselves? I have no hesitation in saying, that the disease is yet a local one, nature is only showing what she will do if properly seconded; and that, if her efforts are directed to sound parts, capable of sustaining them, she will be able to make a sufficient and successful struggle. Amputation, then, is to be performed in sound parts, to which the usual efforts of nature will be directed; and, if they be unbroken, or only impaired by the previous injury, the result will be fortunate; but the inflammation will not be sufficiently powerful to be able to stop at the adhesive stage, union will not take place to any extent in the stump; suppuration should therefore be encouraged as a natural consequence, and no more adhesive straps should be applied than may be sufficient to keep the parts together, so as to prevent retraction. Warm fomentations and poultices should be preferred to cold applications, and the ligatures should all be cut short.

It sometimes happens, that a cannon-ball strikes a limb, and, without apparently doing much injury to the skin, so completely destroys the internal textures, and deprives them of life, that gangrene takes place without almost an effort on the part of nature to prevent it. This kind of injury was formerly attributed to the wind of a ball; but the opinion was abandoned from a total want of any positive evidence in support of it, whilst much negative evidence can be brought

against it. It was next supposed, by Mr. Ellis, to depend upon electricity generated by the passage of balls through the air; but this hypothesis is in precisely the same circumstances as the other; indeed every thing would tend to prove that both are without the slightest foundation. The Baron Larrey has hazarded a conjecture which seems nearer the truth; for, after having seen the end of the nose, an ear, the hat, the sword, the great coat, and all parts of the body grazed, and even carried away by cannon-balls, without these effects following, it is impossible to conclude that either the wind of the ball, or the electricity collected or generated by it, is capable of producing them, more especially, as the shot causing such mischief has always been observed to be a spent ball, or deprived of the greatest part of the force with which it was impelled. He says, "a cannon-ball is propelled at first with a rectilinear movement, and if, during this part of its course, it strikes against any part of the human body, it carries it away; but the ball, after having traversed a certain distance, undergoes some change of motion in consequence of the resistance of the atmosphere and the attraction of the earth, and turns on its own axis, in addition to the direct impulse received from the explosion of the powder. If it should strike any part of the body when the velocity with which the ball is passing is greatly diminished, it does not carry it away as in the preceding case, but, in consequence of its curvilinear or rolling motion, it turns round the part, in the same manner as a wheel passes over a limb, instead of forcing a passage through it. The soft elastic parts, such as the skin, and cellular membrane, yield, whilst the bones, muscles, tendons, arteries, &c. offering a greater degree of resistance, are either bruised or ruptured. If the ball should strike one of the cavities of the body, the viscera suffer in like manner."

The patient, after an accident of this kind, is brought to the surgeon, sensible of having received a severe blow on the part affected; which does not show much external sign of injury, the skin being often apparently unhurt or only

grazed, the motion of the part is lost, and it is insensible, the bone or bones may or may not be broken; but in either case, the sufferer, if the injury be in the leg, is incapable of putting it to the ground. After a short time the limb changes colour in the same manner as when severely bruised, and the necessary changes rapidly go on to gangrene. The limb swells, but not to any extent, and more from extravasation between the muscles and the bones than from inflammation, which, although it is attempted to be set up, never attains to any height. The mortification which ensues tends to a state between the humid and the dry, and rather more to the latter than the former. These cases are not of frequent occurrence, and are not commonly observed until after the blackness of the part, and its want of sensibility and motion, attracts attention; for the patient is generally stupified at first from the blow, and the part or parts about the injury feel benumbed. I made this kind of case an object of particular research after the battle of Waterloo, but I could find only one among the British wounded. The man stated that he had received a blow on the back part of the leg, he believed, from a cannot-shot, which brought him to the ground, and stunned him considerably. On endeavouring to move, he found himself incapable of stirring, and that the sensibility and power of motion in the limb were lost. The leg gradually changed to a black colour, in which state he was carried into Brussels. When I saw it, the limb was black, apparently mortified, and cold to the touch, the skin was not abraded; the leg was not so much swelled as in cases of humid gangrene; the mortification had extended nearly as high as the knee, there was not any appearance of a line of separation, and the appearances of inflammation were so slight, that amputation was performed at my request by Mr. Campbell, now Deputy Inspector of Hospitals, immediately above the knee. On dissecting the limb, I found that a considerable extravasation of bloody fluid had taken place below the calf of the leg, and that in the cavity thus formed some ineffectual attempts at suppuration had been made. The periosteum was separated

from the tibia and fibula, the popliteal artery was, on examination, found closed in the lower part of the ham by coagulable lymph, proceeding from a rupture of the internal coat of the vessel. Two inches below this the posterior tibial and fibular arteries were completely torn across, and gave rise, in all probability, to the extravasation. From this dissection it would appear (and I have observed the same thing take place in others), that the internal parts were not entirely deprived of life by the blow, or the popliteal artery would not have been closed by coagulable lymph, the blood extravasated changed into a sanious fluid *, or the attempts at the formation of matter commenced; but that they died shortly afterwards, without much effort on the part of nature to prevent it. The death of the part being soon accomplished, and almost without a struggle, the constitution became less sensibly affected by it; and, for the first few days, it may fairly be considered as a case of local gangrene. When the operation was performed, the constitution was certainly affected, but only in a slight degree, and the operation therefore succeeded, although the man died subsequently from dysentery. The proper surgical practice in such cases is to amputate as soon as the extent of the injury can be ascertained, in order that a joint may not be lost. It is hardly necessary to give a caution not to mistake a simple bruise or ecchymosis for mortification. To prevent such an error leading to amputation, the Baron Larrey has directed an incision to be previously made into the part, and to this there can be no objection.

In order to meet the whole of this question fairly, it is necessary to notice gangrene taking place from wounds by musket-balls, which cannot, by the shock which they cause, or the force with which they are impelled, deprive the part of life. When gangrene occurs, then, from a wound made by a musket-ball, it must be in consequence of having divided the great vessels and nerves, or from inflammation running on

* Of this there may be some doubt.

to excess in persons of unhealthy habits. The latter state alone will at present occupy our attention, inasmuch as I do not consider it as a local disease, but dependent on constitutional causes, and therefore not coming within the limits of the rule of practice for traumatic gangrene. I cannot understand how gangrene can follow a wound from a musket-ball but from excess of inflammation, unless the great vessels or nerves supplying the limb have been divided by it, and therefore I am not competent to argue the point. The Baron Larrey states the fact in his Memoir as occurring in two cases; I cannot however, from attentive consideration of these cases, suppose them to be simple wounds, and I am more especially led to this conclusion from the circumstance of the mortification being rapidly induced, and beginning in the extremities of, rather than at the injured part of the arm; and although the operation was in both cases successful, I am disposed to attribute it to the mortification being more immediately local, according to my opinion, than the Baron suspected. If the mortification had been the result of high inflammation, the parts far above the seat of injury would have been affected by it. The following remark on this subject, taken from the first edition of my book on Injuries of the Extremities, applies so strongly to this case, and appears to me to be so correct, that I shall transcribe it. Amputation, as a general rule, in cases of traumatic gangrene, placed in opposition to that of never amputating in cases of gun-shot wounds, until a line of separation between the dead and living parts is distinctly marked, I think the best. It admits, however, of exceptions, and principally where the gangrene does not come on quickly, from want of power in the parts arising from deficient nourishment; but, where the inflammatory action has been high, has included the neighbouring parts to some distance, has continued some days, and gangrene appears to have occurred in consequence of this excess of action; or when it takes place in a constitution debilitated and injured by hard drinking, or long residence in a tropical climate. In these cases, where there is much

constitutional affection, amputation would not be so advantageous as awaiting the line of separation.

The operation must be performed on parts partaking of the inflammatory disposition; it is done whilst the constitution is in a state of great irritability, and the operation would act as an additional stimulus to increase it. Where gangrene, however, is rapidly extending towards the trunk of the body, without any hope of its cessation, the operation is to be tried; for it has certainly succeeded where death would, in a few hours, have ensued. Under these circumstances, the nature of the operation, and the reason for doing it, should be clearly understood by the friends of the patient before it is performed. I may add, that where the constitution was bad, I have always failed either in amputating on the approach of gangrene, in the hope of avoiding it, or when it had apparently ceased.

In hot climates, if a cannon or grape shot were to destroy so effectually as to cause the death of the parts injured to a considerable depth, and gangrene appeared to spread with little preceding inflammation on the third or fourth day, and especially if this injury were near the trunk of the body, amputation would be advisable; for I do believe it would rapidly extend, and the line of separation would never be formed, as I have seen in several cases of this kind, which terminated fatally in forty-eight hours after gangrene had commenced.

In the first edition of my work on Injuries of the Extremities, I described another species of gangrene, which had been but little attended to, and which is more purely local than any which have yet been noticed.

A soldier may receive a flesh wound from a musket-ball in the middle of the thigh, which passes through the limb apparently without injuring the main artery; or, it may pass close behind the femur where the artery turns to the back part of the bone; or it may go through the middle of the bone from behind forwards between the condyles of the femur into the knee-joint, and the patient shall walk

to the surgeon with little assistance, be superficially dressed, and, in many cases, considered slightly wounded; yet the femoral artery and vein in the whole of these cases, and, indeed, in many others, may be wounded, or cut across, and the local inflammation be so slight, as to obtain little attention. On the third or fourth day, however, the patient shows his toes discoloured, and complains of pain and coldness in the limb below the wound, the constitution begins to sympathize with the injury, and the surgeon probably thinks the case extraordinary. Perhaps he suspects the real nature of the case, but is surprised that a wound of the femoral or popliteal artery, with so little attendant injury, could cause mortification. The more he considers, the more clearly does he recollect that the anastomosing branches are declared to be sufficient to nourish the limb; and their not doing so here, he thinks still more extraordinary. He is anxious to do something, but mortification, or, at least, gangrene, having commenced, he must, according to general rule, await the formation of the line of separation. The temperature of the leg, a little above the gangrene, is good, perhaps higher than natural; he hopes the mortification will not extend farther, and it probably does remain stationary for a little time; at last, the parts originally affected, the toes, become sphacelated, and gangrene quickly spreads up the leg as far as the wounded artery, by which time the patient dies. This accident occurs more frequently than is generally suspected, being placed to the account of gangrene from other causes, especially if there be a wound of any magnitude, and of course more attendant inflammation.

I believe two errors are committed here, one, in supposing that the anastomosing branches are sufficient to support the limb in the majority of cases, when the great blood-vessels are wounded by gun-shot: the other, of waiting for the line of separation, or rather, the cessation of the gangrene; for, if the wounded vessels be in the middle of the thigh, it will extend to the seat of the injury, and destroy the patient, before the action of separation can commence. To obviate this misfortune, amputation is to be performed where the

artery, or artery and vein, have been divided, as soon as the gangrene is perceived to extend beyond the toes; and the swelling and slight attendant inflammation, which is marked more by the tumefaction than the redness of the part, has passed up higher than the ankle.

The constitution at this period will have sympathized but little with the injury, and gangrene after amputation will not occur in the stump, as most frequently happens in sphacelus from other causes. I may here add, that the stump is to be tenderly treated, not bound firmly down by adhesive plasters if it will not unite kindly; and such constitutional symptoms as arise, are to be moderated as in other amputations.

I by no means intend to assert, that the anastomosing branches of arteries are not equal to carry on the circulation in the extremities in every instance, where the main artery has been wounded: for I know the contrary; indeed, in the upper extremity it will almost invariably be effected; but in the lower, where there has been no previous disease, and the femoral or popliteal artery be divided by a musket-ball, the anastomosing branches cannot always carry on the circulation, and sphacelus will affect the toes. I think I have seen it cease at a part of the ball of the great toe, in an unsuccessful case of femoral artery tied after a gun-shot wound; and I have seen it in other cases destroy the patient. If the vein accompanying the artery be injured, I believe mortification of the extremity to be inevitable; and in gun-shot wounds there is frequently more or less injury of the vein, as well as of the artery.

In cases of wounds from cannon or grape shot, the effects of the injury cannot be so well observed, from the practice of immediate amputation. In doubtful cases, or wounds from shells or grape-shot, where there is a hope of saving the limb, gangrene is more frequent; but then it is attributed to the effect of the general injury, rather than to the division of the vessels, and the defective state of the circulation. The nature of the gangrene to which I particularly allude, is always

pointed out by its commencing below the wound; for example, if with a wound near the elbow, the hand first becomes gangrenous, or even at the same time as the wound, with little inflammation in the vicinity, the trunk of the brachial, or, the radial and ulnar arteries have been divided. If the foot and leg become gangrenous, where the wound has been in the leg by a grape-shot passing through the tibia; or, with a wound of the ham or thigh, the principal artery or arteries have been wounded, and in all probability the great vein has been injured. A wound of the tibialis antica, or postica, singly, will not cause it, as either vessel is sufficient to support the limb, even if the fibular artery be also injured.

This kind arises from no previous defect of constitution, in which the whole system must participate, it does not follow a long-continued, or excessive action which the vitality of the parts cannot sustain, and to the support of which contest the whole system has been, and is still contributing, but, from the sudden subtraction of the blood of a part, on which its life depends, and in consequence of which, it dies nearly in the same manner as the whole animal would do on the cessation of the function of the heart. The part is cold, insensible, of a deadly white colour, and with no surrounding inflammation; but the patient soon complains of numbness, afterwards attended with pain, the skin becomes streaked and discoloured, and the living parts in the immediate vicinity are slightly tumefied. The general state of the patient at this period is but little affected, the pulse hardly accelerated, little heat of skin, thirst, want of appetite, or derangement of the sensorial functions. There is not that appearance of the countenance which attends mortification of a part of the body from constitutional causes. This state continues for three, four, or more days; there is a struggle to support the limb; if the wound be in the middle of the thigh, the calf of the leg is as warm, probably warmer to the touch than the other, a little more swelling and redness bounds the gangrenous part, the patient becomes restless, the whole system is affected, there is fever. In the course of a few hours, the limb swells to

the calf, is very painful, tumid, yellowish, and streaked with bluish lines, the swelling visibly extends, it passes the knee, the patient expresses much anxiety, becomes delirious, and dies. During the first few days, where there is no very evident sympathy of the constitution, I consider amputation will be successful, if performed at the spot where the vessels are wounded; and I recommend it to be done, as soon as the death of the toes and part of the foot indicates the defect of the circulation. If this stage should have passed by, and the gangrene has suddenly begun to extend, I would refer to the original wound; if it is above the knee, I would amputate instantly; for, although it may at this period be unsuccessful, the patient has a chance of living, which he will not have if he be neglected. If the gangrene should have already extended as far as the wound in the leg or ham, without much constitutional affection, it will probably stop there; and the line of separation will be formed, which should be awaited; but the patient will have little chance of escaping with life.

Having lost all the cases of gangrene succeeding to wounds of arteries, and other cases of greater injury, in which it supervened on the third or fourth day without much previous inflammation, I began to think it an error to wait for the line of separation, when there appeared but little prospect of its formation. In two cases after the battle of Salamanca, in which I had reason to think the gangrene was of this kind, I amputated with success; a third died after amputation, but not of gangrene affecting the stump; and the fourth and fifth, which I left for the appearance of the line of separation, on the cessation of the gangrene very soon died. This practice, in cases of severe injury after gun-shot wounds, has succeeded in the hands of others, even in England.

There is a great peculiarity in this species of mortification, which is, that at the same period the two states of humid and dry gangrene may be seen in the same individual, and part

affected. On the first failure of the circulation, the toes, if in the lower extremity, shrink, become cold, insensible, and die, assuming a livid, and then a black colour. In this state they may continue for days, and be finally separated, or the mortification affects a part of the foot and then ceases. So far the mortification is purely local, and the limb above shows no sign of inflammation; but nature soon attempts to recover what she has lost, or relieve herself, and she effects it, or perishes in the attempt. If successful, a line of separation is established; if otherwise, the limb swells, humid gangrene takes place from weakness of part and debility of constitution, and spreads so rapidly as to be almost observed in its progress by an attentive eye. The hours of the patient's life are numbered, and nothing can save him but amputation, and that only when done the moment the spreading of the gangrene commences, for at a subsequent period it will be too late.

Mr. Samuel Cooper, in his First Lines of the Practice of Surgery, has noticed my observations on this kind of gangrene; but in the ensuing remarks on the subject he has not been able to divest himself of the impressions arising from ligatures made on arteries suffering from aneurism, and would induce his readers to suppose, in opposition to the opinions I have given, that a large artery may be tied, or divided, without fear of gangrene. He says, page 64, "On the whole, perhaps, we are not yet authorized to infer, that the mere interruption of the circulation through the main artery of a limb, and the simultaneous stoppage of the nervous influence, derived from one of the principal nerves of the member, would generally occasion mortification, if there were no other additional violence or injury done to the part." He then supports his argument by instancing cases in which aneurism had existed; but the state of an artery unexpectedly injured, is as different as possible from the state of an artery affected by aneurism; and the success of one operation is so far from bearing upon the case of the other, and so far from being si-

milar, as to be precisely the reverse, and I invariably establish it in my lectures as a demonstrated fact, that the theory of the cure of aneurism can in no way be applied to the treatment of wounded arteries, without the greatest error being committed. I am obliged then, in justice to myself, to reiterate my observation, and to confirm it by saying, that I have never seen a case in which the popliteal artery and nerve were divided, without mortification following as a necessary consequence. I do not believe a case of this kind ever did occur without it; and I am, I conceive, fully authorized to put my positive experience against any negative opinion, until cases, in which gangrene did not take place, are adduced in support of it. I have made exceptions in favour of the upper extremity; but Delpech states, that mortification has almost always taken place when the nerve accompanying the axillary artery has been included in the ligature *.

I beg to be understood as making these observations on that part of Mr. S. Cooper's work, alone, which relates to wounded, and not diseased arteries; for, in regard to the latter, sounder or more truly surgical opinions are not any where to be met with, and, therefore, ought to be duly appreciated.

A mortification, very similar to this, occasionally takes place in the feet of persons suffering from typhus fever; but essentially different from the dry gangrene affecting the feet of old people and voluptuous livers, which Mr. Pott has described. During the winter of 1812-13 typhus fever, in a very concentrated form, made great havoc in that part of the army which was cantoned in the north of Portugal, where the troops were badly fed, clothed, and lodged, and especially among the recruits. In many of these cases, the feet were lost before it was known they were affected; and I have a foot, given to me by my colleague, Dr. Charles Forbes, which is an excellent specimen of dry gangrene, being perfect

* Précis des Maladies reputées Chirurgicales, tome i. 98

in all its parts, although shrivelled, dry, and hard, resembling the foot of a mummy rather than any animal substance which had ever suffered from the putrefactive process. In all these cases the toes, and then the feet, became cold, powerless, and slightly tumid; they then assumed a livid hue, and afterwards changed to black, and when not kept hot and moist, dried rather than putrefied. Most of these cases proved fatal; indeed the mortality from this fever was otherwise very great, and the surgical treatment of the feet was of course always subordinate to the medical treatment of the febrile disease.

Mortification occurs, by no means unfrequently, from cold on military service; it is very analogous to that which I have been last describing, and is not, in my opinion, satisfactorily explained. The effects of cold on the French army after the battle of Eylau, are well described by the Baron Larrey, in his Campaign in Poland, vol. iii. p. 60; but the narration does not notice so much the direct effects of cold, as the results which followed its application; and he concludes that cold is not an exciting, but only a predisposing cause of inflammation and gangrene, which is true, as far as regards the gangrene which follows inflammation; but incorrect with relation to the actual death of a part, or of the whole, of the body, which occurs without inflammation.

As far as I am able to judge, from observations I have had an opportunity of making in North America, the effects of cold have not been sufficiently considered, with due relation to its different states of mildness or severity; and on reading over the very able statements of Dr. Thomson, in his Lectures on Inflammation, and of Mr. Samuel Cooper, in his First Lines of the Practice of Surgery, in which they have collated the best authorities on the subject, I am the more confirmed in this opinion, inasmuch as the different accounts of the effects of cold, therein mentioned, can only be reconciled by such proceeding, and the different opinions as to cold being stimulant or sedative be thoroughly understood.

The stimulant effects of cold, in the sense in which it is generally understood, extend no further, properly speaking, then when they exert a beneficial influence on the human frame, although it cannot be denied that the continued application of cold, in a moderate degree, may act as a stimulant, and cause an increased and dangerous action in a part long after the cold has ceased to be applied; and this effect will follow the application of cold, which has been augmented to a degree in which its stimulant properties are not perceptible, and it appears to act directly as a sedative. Hence the difficulty of deciding on the limits to be given to the stimulating and sedative properties of cold.

The symptoms and appearances attending the application of cold, or the abstraction of heat, are well known, as far as this abstraction is agreeable to the system, and produces healthy and renovating effects on the constitution. I shall only consider the effects of cold in a greater degree, as relating to my present subject. The human body enjoys the singular property of being able to resist cold and heat (in the common acceptation of the words) in an extraordinary degree, provided that the augmentation or abstraction of heat be made in a gradual manner, and the temperature of the body, during the augmentation, is increased but three or four degrees beyond the natural state, or about 98 of Fahrenheit. Instances are related of persons exposing themselves to a heat of 290 degrees for several minutes with impunity *; and by habit, persons can be brought to bear intense cold for a certain time without detriment. We find this to be the case in Russia, in North America, and other parts; but there is yet a degree of cold which neither man nor other animals can resist, and we find that all living creatures retire before it to a more genial climate. I understand that during the coldest part of the winter in Lancaster Sound, where the late expedition under Captain Parry wintered, all the animals

* See the observations of Sir C. Blagden and Dr. Fordyce, Phil. Trans. and Rees's Cyclopædia, article Cold.

disappeared. The degree of cold I have not heard stated; but I know that it must have been considerably below zero of Fahrenheit. In British North America the effects of cold, usually denominated frost bite, are seldom observed, unless the thermometer has fallen below zero; and under circumstances of common exposure, frost-bitten persons are rarely met with, unless the mercury has fallen ten degrees below it, or from forty to fifty degrees below the freezing point. At this degree of temperature, animals are not alone the sufferers, its effects may be seen and heard around. The trees of the forest crack and split with a loud noise, the surface of the sea seems covered with steam, as if it were actually boiling, every animal, bird, or reptile hides itself; man alone remains for a time unshaken. If there be no wind the sea freezes, and a greater degree of thermometrical cold can be borne without injury, than if there be a high wind, which is always from the north, and is called, from its effects, the *barber*, and which, by agitating the sea, prevents it from freezing. When this degree of cold is accompanied by a high north-west wind, man can no longer resist it, the evolution of caloric, however great it may be, is not equal to the rapid abstraction of it, and the extreme parts of the body become frost-bitten. I once saw the 29th regiment marched about three quarters of a mile to church, with the men's faces opposed to the *barber*, and when they arrived at the church-door nearly fifty men had their noses, ears, and fingers frost-bitten. The scene was rather ludicrous, for no one was sensible of what had befallen him, one called to another, that his nose or ears were frost-bitten, and the parties then challenged, mutually armed themselves with a handful of snow, and getting under the shelter of the church, rubbed each other until the circulation and sensibility were restored. At this time it unfortunately happened that a party, consisting of a sergeant and a dozen men, were sent out after two men who had deserted a day or two before, and were exposed to the inclemency of the weather a great part of the night of the

day alluded to. Two men were frozen to death, one lost both legs, and the remainder suffered severely. The effects of cold locally at this low degree of temperature, combined with the rapid exhaustion of caloric, are the deprivation of the sensibility and circulation of the part in so sudden a manner, as to be unaccompanied by the consciousness of the patient further than, on attempting to move the part affected, he finds himself incompetent to do it, and on inspection perceives that it is of a dead white colour, very much resembling that of a tallow candle. If he should have a ring on a finger affected, it will fall off from the shrinking of the part. If the exposure be continued, the whole limb assumes the same appearance, the patient sits down, feels benumbed all over, lies down and dies. After death the body becomes so stiff that it may be sawed, but cannot be cut, yet does not change colour; no reaction, no mortification has taken place, but the death of the whole from the general deprivation of life. If a part of the body only be affected, the arteries of that part contract from the first, the veins are not dilated, as they are after the moderate application of cold, but are diminished; whilst the blood retires into the larger and deeper vessels, where it becomes congealed. When a limb has been fairly frozen in this way, I do not believe it can recover without suffering great detriment, and if it should have been frozen for an hour or two, I do not believe that recovery is possible. The limb will mortify. The stories then related by Richter and others, of recovery from a generally frozen state of the body, are either fables, or great exaggerations. It is possible they may have been, in truth, nearly in the same state as the lad whose case is described by Dr. Kellie, in the first volume of Dr. Duncan's Medical and Surgical Journal. He says, "When we arrived he was stretched out before the fire on his back, with very little appearance of life; the whole body, with the exception of the face, which was well coloured, was of a deadly pale appearance, and very cold. The powers of sensation and of muscular motion were

completely suspended. The head and limbs, perfectly flexible, fell lifeless to the ground, from whatever position they were raised to; the mouth was half open, and the jaw, obedient only to the hand, could be moved upwards and downwards, but returned to the half-closed position; the inspiration was obscure and insensible; but the pulse was quite distinct, even at the wrist, although irregular and slow. The organs of sense were equally inexcitable; a candle held close to the exposed eyes made no impression, the eyeballs remained fixed and motionless; the pupils, though dilated, contracted irregularly, while yet exposed to the light, in the way I have sometimes observed them do in the recently dead."

This was evidently a case occurring from the long-continued application of a moderate degree of cold, combined with fatigue, hunger, and moisture; and the symptoms which attended it, are not to be considered as those arising from the application of intense cold.

I have shown that intense cold, when combined with the more rapid abstraction of caloric, by means of a high wind, causes the almost sudden death of a part, and of the whole of the body, if it be exposed to it for a sufficient time. The facts mentioned by Messrs. Parat and Martin, in the first volume of the Memoirs of the Medical Society at Lyons, 1798, may be accounted for by attending to this circumstance. They say "that the French soldiers who were employed in driving the Piedmontese from their entrenchments in the Alps, suffered more in their pulmonary organs than in their extremities. The mouth and nose involuntarily contracted, the respiration became suspended, and when the patient made an effort to distend his chest, the keenness of the air and a sensation of cold prevented him." They further say, "if the storm, instead of ceasing, is redoubled, if the person cannot protect himself by a change of position, or if he cannot weaken the force of the blast by placing his hand before his mouth; in a word, if his respiration remains for any length of time suspended, his head soon becomes giddy, he falls down,

or is swept away by the blast, and soon finds a tomb under the snow which the winds rapidly accumulate over him." This is clearly a case of death from the effects of a cold wind on the lungs, not from absolute cold. If it be said to be from cold, as well may a person caught in the desert of Arabia in a *Siroc* wind be said to die of heat, or that he is burned to death.

Maupertuis, during a winter residence at Tornea in Sweden, found that the spirit of wine in the thermometer froze, and that when the door of a warm room was opened, the external air, on rushing in, immediately converted the vapour of their breaths into whirling clouds of snow. At this time they felt as if their breasts had been rent asunder. They were every moment startled and alarmed by the loud noises, which the bursting and cracking of the wood by the cold occasioned in every part of their houses. They saw several persons who had lost legs and arms from cold; and if Maupertuis had been exposed out of doors, he would have found more injurious consequences follow its external, than what may be termed its internal application; that is, he would have certainly been frozen to death.

When cold of the intensity of from 45 to 50 degrees below the freezing point, is applied without a high wind acting on the body at the same time, or only in a moderate degree, the effects of it are often more general than local; and the account given in the second volume of Dr. Hawkesworth's edition of Cook's Voyage round the World, the effects produced on Dr. Solander and the late Sir J. Banks, is applicable to every case of the same kind.

"At the time when Captain Cook lay off Terra del Fuego, Mr. Banks (late Sir Joseph) and Dr. Solander, with other ten men, went on shore, with a view to penetrate as far as they could into the country, and to return that evening. After various hardships, and after having travelled through swamps for a considerable way, the weather, which had been very fine, became gloomy and cold, with sudden blasts of a piercing wind, accompanied by snow. Before they had ac-

complished their object, the day was so far spent that it was found impossible to get back to the ship before next morning. This being their situation, it was proposed to push through a swamp that lay in their way into the shelter of a wood, and there to build their wig-wams and kindle their fire. It was now eight o'clock in the evening, and Mr. Banks undertook to bring up the rear. Dr. Solander, who had more than once crossed the mountains which divide Sweden from Norway, and who well knew that extreme cold, especially when joined with fatigue, produces a torpor and sleepiness that are almost irresistible, conjured the company to keep moving, whatever pain it might cost them, and whatever relief they might be promised by an inclination to rest. 'Whoever sits down,' said he, 'will sleep; and whoever sleeps, will wake no more.' Thus admonished and alarmed, they set forward; but they had not gone far before the cold became suddenly so intense as to produce the effects that had been most dreaded. Dr. Solander was the first who felt the inclination against which he had warned others, irresistible, and insisted upon being suffered to lie down. Mr. Banks entreated and remonstrated with him in vain; down he lay upon the ground, though it was covered with snow; and it was with much difficulty that his friend kept him from sleeping. One of the black servants began to linger in the same manner with Dr. Solander. After much persuasion and entreaty, they were dragged on a little way; but they again both declared they would go no further. The black servant was then told, that if he did not go on he must be frozen to death; but to this his answer was, that he desired nothing but to lie down and die. The Doctor said, he was willing to go on, but that he must first take some sleep; though he had but a short while before told the company that to sleep was to perish. They were both suffered to sit down; and in a few minutes they fell into a profound sleep. After Dr. Solander had slept about five minutes, Mr. Banks endeavoured to awake him, and happily succeeded; but, it being impossible to make

the servant stir, two people were left along with him, to bring him forward, as soon as he could be roused. Of the three that were left in this situation, it is sufficient to say that only one survived, and that he too seems to have been preserved by leaving his charge, coming soon to join the company, and by partaking of the benefit of their warm fire."

When the cold in North America attains to this degree of intensity the sentries on duty do not become frost-bitten, unless there be a high wind, but they become affected with such a degree of torpor or sleepiness, that they cannot resist the impulse of standing up in the sentry-box, which they are forbidden to do, because the instant they do so they fall asleep, and are frost-bitten or frozen to death. To prevent this, the sentries are relieved every half hour instead of standing the usual time of two hours; and whenever they feel this propensity to sleep coming on, they are ordered to give the alarm, that they may be relieved, and additional communicating sentries are placed for the purpose, or the corporal of the guard visits each sentry every ten minutes. Proper instructions are given in case of accident; and although sleeping on sentry is the greatest crime a sentry can be guilty of, except deserting, no officer would think of punishing a man who fell asleep under these circumstances.

Dr. Thomson says, page 624, " It is doubtful, however, how far the state of sleep is the necessary consequence of simple exposure to cold; or, at least, what other circumstances besides cold are necessary for its production, since this exposure may be made to an intense degree of cold, for a considerable length of time, without sleep being induced." He instances in support of this opinion, the cases of Elizabeth Woodcock, who was buried in snow for eight days, near Cambridge, in 1799, and remained sensible the whole time; and of some sailors, who were shipwrecked, and were kept for twenty-three hours in the water at a very low temperature without being drowsy; but neither of the facts bears on the

question of the application of intense cold *. It is well known to all philosophers and practical chemists, that a thermometer plunged into snow, does not fall to a degree indicating any thing like intense cold; and, when they want to produce it, they add salt, &c. for the purpose of effecting it. I conceive then, from what I have said, and the facts I have related, that I am authorized in saying that a state of sleep is a necessary consequence of exposure to intense cold.

In regard to the capability of bearing cold, the Baron Larrey has said, page 125 of his fourth volume, that, "in the late disastrous campaign in Russia, individuals of a brown complexion, mostly born in the southern provinces of Europe, bore the cold better than fair persons born in northern countries; that of the Dutch grenadiers of the guard, consisting of 1787 men, only 41 returned, whilst of the two other regiments of grenadiers, composed of men who were nearly all born in the south of France, a considerable number were saved. The Germans also lost, in proportion to their number, many more than the French." The Baron attributes this difference to the greater courage and exertion of the French, and he is at liberty to compliment his countrymen as much as he pleases; but I do not believe that the fact is as he conceives it to be; for I have always found natives of warm climates, suffer much more than those from cold. During the siege of Ciudad Rodrigo, the troops were obliged to sleep on the ground, without cover, and one night when it froze hard, three of the Portuguese actually died of it, whilst the British escaped without being frost-bitten. In the expedition to New Orleans, a regiment of blacks was sent from Jamaica to aug-

* When the cold is so intense as I have just described, or the thermometer is at 45 degrees below the freezing point, water freezes before the fire, and the fire-irons are so cold, although in contact with the chimney, as to burn the fingers, as it is termed, when touched; that is, the metal causes so sudden an abstraction of heat, that vesications arise a short time afterwards, from the reaction. Mercury, when solid from cold, is not bearable on the palm of the hand.

ment the number of troops; but when the cold weather set in, the men were not only found incapable of doing any thing, but many of them were actually frozen, and several lost their hands, feet, and legs, from mortification. There is now in the Detachment Hospital at Chelsea, in charge of Mr. Burmester, a man, born in Hindostan, of a native woman, but an European father, who has actually lost his feet from cold in this country, and whilst in regimental hospital. His feet became at first benumbed, and swelled; and, after several days, it was discovered that they were black and gangrenous; but from such an occurrence being unsuspected, too late to afford relief.

Cold applied in a more moderate degree, does not cause in a direct manner, the part to be frost-bitten, so as to assume the dead white appearance I have described, or to become senseless and motionless; the persons affected are capable of moving about, and of resisting the effects of cold, although incapable of sustaining those produced by a sudden change of temperature. They are nearly in the state of those who have been frost-bitten, and who, after having partially recovered, are too suddenly removed into warm rooms. It is the effect of the application of a more moderate degree of cold, for a greater length of time, exhausting thereby the powers of the part, and rendering it incapable of supporting any reaction which may afterwards take place. The case of Elizabeth Woodcock, alluded to page 143, is of this kind; and the French army, after the battle of Eylau, suffered in the same manner. During the continuance of the cold, the troops moved about and felt little inconvenience from it; but as soon as a thaw took place, reaction commenced; the vessels became distended with blood, which they were incapable of circulating; the limb assumed a livid hue from the congestion, became tumefied, black, and fell into a state of mortification, which at this time was local, but which after a short period would become constitutional.

From these premises I consider myself authorized to conclude legitimately, that intense cold destroys the vitality of a

part without any reaction taking place; but that cold, applied in a more moderate degree, only impairs the vitality of a part, yet frequently to such an extent, that it is unable to exist, when reaction takes place; and more especially, if it be too rapidly induced.

The question of amputation hinges here, on the same principles, as in other instances of local gangrene; and when mortification is fairly established, there can be no doubt of the propriety of removing the limb, as soon as the patient is in a state to admit of it, and without any line of separation being established. If, however, an improper delay has taken place, and the system at large has become affected, the surgeon should wait for the cessation of the mortification before he proceeds to operate.

When a part has been frost-bitten, the best application is snow rubbed on it with the hand, the heat of which gradually melts the snow, and warms the part in a slow but regular manner; and as it becomes warmer the friction may be greater, and the application changed to water, or combined with a little spirit. This must be done in a room without a fire, and the patient in no manner exposed to a high or even a moderate temperature. As he recovers the use of the part or his senses, a light warm cordial should be ordered, he should be put to bed in a room without fire, and some warm, but watery drink given. The body may be well rubbed, and perspiration excited by the usual means; tobacco injections are highly improper, although stimulant enemas may be serviceable. Under the most favourable circumstances, slight vesications generally take place, the part tingles, as it is called, for some time, and is, during the rest of the season, much more sensible to cold.

After the line of separation has been drawn, and the dead parts are nearly thrown off, gangrenous inflammation often again takes place without any evident cause. This occurrence is generally a fatal one. That amputation will sometimes here save the patient, the following case, communicated to me by Staff-surgeon Bruce, now surgeon at Ripon, in Yorkshire,

will testify. Private Laws, of the 40th regiment, during the expedition to New Orleans, was frost-bitten in the right foot, and reached the hospital-ship on the 28th of January 1815. The mortification of the foot was complete; wine, bark, brandy, &c. were administered, and poultices were applied. Under this treatment the separation of the foot was going on; and, on the 4th of February, the astragalus was loose and partly detached. On the evening of that day, the inflammation assumed a darker colour, and was attended by a burning pain, which increased, and, on the 9th, mortification was spreading rapidly up the leg. He passed a restless night, was at times delirious, and covered with perspiration, pulse feeble and very weak, the tongue brown and dry, suffered much from thirst, and begged to have his leg cut off. The operation was performed on the 10th, above the knee; he lost little blood, and observed, shortly after the operation, that he felt more comfortable than at any period since he was frost-bitten. On the 26th of the month, the ligatures had all separated, the stump was healing fast, and the man was sent to England, in the Bedford man of war.

I may here be permitted to confirm the old remark, that gangrene often takes place without sufficient apparent reason, ceases in the same manner, and as readily recurs. The prognosis, in every case, should then be very guarded, until the mortified parts are completely separated; and, even then, should not be too confidently given, as to the certainty of its future non-appearance.

Gangrene from pressure is by no means an unfrequent occurrence after wounds, in consequence of confinement to bed. I have known many cases lost by it when the wounds were going on in a favourable manner. It generally occurs from weakness of part, sometimes from the stimulus of the urine, which, in cases of paralysis, is capable, when combined with pressure, of inducing it in a few hours. The part pressed on, first looks red, then black, and dies, with little surrounding inflammation. No application, that I am acquainted with, is of any

use in arresting its progress, unless the pressure be removed and the part kept dry, and a cushion made with a hole to receive it, when the mortification will cease. I have seldom known it spread beyond the part which sustained the pressure; and in bad cases, the sacrum, the tuberosities of the ischium, and the trochanters should be defended in this manner.

Having endeavoured to establish the principles on which mortification is supposed to depend, it will be unnecessary to enter in detail into the treatment. In all cases, except in excess of inflammation, the internal means should be to sooth and support the system. Bark I have not found useful, further than as a tonic, and given in such quantities as not to overload the stomach. Camphor, the carbonate of ammonia, opium, wine, brandy, I conceive to be better remedies. As topical applications, emollient and fermenting poultices are decidedly the best, alternating with mild spirituous fomentations. I have always seen scarifications do harm, when they approached or interfered with living parts, and stimulant applications are only admissible, on the common principles of surgery, as applicable to parts in a state of ulceration. Any thing, however, which keeps them clean, and tends to remove or destroy the fetor from those which are dead, is beneficial.

The following Reports, No. I. II. III. and IV. will confirm several of the statements I have made, and may be satisfactory on other points. Nos. I. and II. are returns of officers and soldiers treated after the battle of Toulouse, classed according to the nature of the wounds. In the first ten weeks, one eighth of the whole died, and one eighth more may be considered as dying afterwards, or as being unfit for service; the permanent loss after a battle to the effective strength, varying from one fourth to one third of the whole number wounded. Of 1359 cases treated, including officers, only one artery required a ligature; the other cases of secondary hæmorrhage having occurred as complications of compound fracture, rendering am-

putation necessary; facts which are strongly confirmative of the statements made as to secondary hæmorrhage at page 8.

The difference of loss between the officers and private soldiers is rather remarkable, and cannot readily be accounted for. The wounds were certainly not so severe, as may be seen by comparing the tables, the officers being to the private soldiers nearly as one to eleven. In regard to the surgical treatment, I can conscientiously say the officers were not more regularly attended than the privates, neither were the surgeons more able men. The very same kind of indulgences, as to quality and quantity, were supplied to both; and although the separate apartments of the officers might make some difference, it could not be to any extent.

No. III. is the first weekly report of the largest hospital, containing 470 men, and will show the precision with which the duties were performed, and the attention paid to the several cases: it confirms the statement made as to erysipelas, page 105.

No. IV. is a report of the same hospital at the end of five weeks, when nearly all the wounded had been transferred to Bordeaux, by the river Garonne, in a favourable state, and is a very instructive document.

The remaining hospitals containing about 250 men each, were in charge of Staff-surgeons Burmester, Dumoulin, Mathews, and Dease. The officers were in charge of Staff-surgeon Murray, who had the benefit of the advice of Mr. Gunning, Surgeon in chief, and I saw all the cases among them of importance, as they were objects of my particular attention.

In regard to the hospitals, the medical officers commenced their duties at six o'clock in the morning, at which time I always visited one of them, and was expected by all, and again at the same hour in the evening; so that almost every case of importance came under my inspection daily, and more especially those at the Caserne de Calvete, Letter A, on which account I have selected the returns of that hospital.

No. I.

Return of surgical Cases treated, and capital Operations performed, in General Hospital at Toulouse, from 10th April to 28th June 1814.

Diseases and State of Wounds.	Total treated.	Died.	Discharged to Duty.	Transferred to Bordeaux.	Proportion of Deaths to the number treated.
Head	95	17	25	53	1 in $5\frac{1}{17}$
Thorax	96	35	14	47	1 in $2\frac{35}{96}$
Abdomen	104	24	21	59	1 in $4\frac{1}{3}$
Superior Extremities	304	3	96	205	1 in 101
Inferior ditto	498	21	150	327	1 in $23\frac{5}{7}$
Compound Fractures	78	29	—	49	1 in $2\frac{20}{29}$
Gangrene					
Wounds of Spine ..	3	3	—	—	1 in 1
Ditto of Joints	16	4	—	12	1 in 4
Amputations Arm ..... 7 Leg and Thigh 41	48	10	—	38	1 in $5\frac{1}{3}$
Total.....	1242	146	306	790	1 in $8\frac{146}{145}$

Wounded Officers .. 117 not included.

Among these, 13 cases of tetanus occurred; all proved fatal.

Secondary Operations.	Total treated.	Died.	Discharged.	Transferred to Bordeaux.
Amputation of superior Extremities ...	15	3	—	12
Ditto of inferior ditto	37	18	—	19
Operation of taking up the femoral Artery	—	1		
Trephine	4	3	—	1
Shoulder Joint	1	1		
Total	58	26	—	32

Of the 48 primary operations, 10 died; of these, 3 of the thigh within a short time after the operation, being as high up as

could be performed by the common operation. Forty-one of the operations were of the thigh and leg, 7 of the arm.

Of the secondary operations: of 15 of the superior extremity 3 were lost, and of 37 of the thigh 18 died.

Of fractures of the thigh there were 43; of these,

20	died, 7 having suffered amputation.
5	were amputated.
18	cured and under treatment.
Total.. 43	

Of the 18 cured and under treatment, five only can be considered well, or as using their limbs. Two more consider their limbs more valuable, or serviceable, than a wooden leg; and the remaining 11 wish they had been amputated at first, as they are not likely to do well; and if they recover, the limbs will be distorted and unserviceable.

No. II.

Return of surgical Cases treated, and capital Operations performed, amongst Officers at Toulouse, from the 10*th April to* 28*th June* 1814.

Diseases and State of Wounds.	Remained.	Admitted.	Total treated.	Discharged.	Transferred to Bordeaux.	Died.	Remaining.	Proportion of Deaths to the number treated.
Head	—	6	6	4	1	—	1	
Thorax.....	—	10	10	2	2	—	6	
Abdomen	—	1	1	—	—	—	1	
Superior Extremities.	—	33	33	9	15	—	9	
Inferior	—	49	49	12	21	1	15	1 in 49
Compound Fractures	—	7	7	—	1	2	4	1 in $3\frac{1}{2}$
Slight Wounds	—	11	11	7	2	—	2	
Gangrene								
Total...	—	117	117	34	42	3	38	1 in 40

Secondary Operations.	Total treated.	Discharged.	Transferred to Bordeaux.	Died.	Remaining.	
Amputation of superior Extremities	1	—	—	—	1	
inferior	4	—	—	1	3	
Tetanus occurred	—	—	—	—	—	1 died.
Total.....	5	—	—	1	4	

The officers in the column remaining were permitted to find their way to Bordeaux at their own convenience.

No. III.

Weekly Report, Letter A Division.

Toulouse, April 21st, 1814.

The Caserne de Calvete, or Letter A Division, has been only one week established, and contains chiefly the wounded of the 4th and 6th divisions, who suffered in the actions near this city, on the 10th instant. The total admitted is 470, of which number nineteen have died: eight proved fatal almost immediately after their being brought into hospital, and no minutes of their cases were preserved; of the remaining eleven, two were cases of mortification supervening on compound fracture; two of tetanus supervening on wounds of the lower extremity; two amputations of the thigh, one performed on the field and the other in hospital; three were wounds penetrating the cavity of the thorax; one a wound entering the abdomen; and one a wound of the spine.

The number of amputations in hospital amounts to near thirty; and with the exception of three or four, in which there is unhealthy action from constitutional irritation, they are doing remarkably well; three amputations only have as yet been performed since the establishment of the hospital; no shoulder or hip case whatever has presented itself.

There are twelve cases of injury of the head; in all of them, there is either fracture, or denudation of the bone; in one instance only it has been necessary to use the trephine; two cases have required extensive dilatation, and the removal of loose and depressed portions of bone: one terminated fatally; the other is apparently doing well; from the insidious nature of this species of wound, the most marked attention is required to be paid to the state of the pulse and bowels, and the antiphlogistic plan is rigidly pursued with the whole of them.

The wounds of the thorax are numerous; in about twenty cases, musket-balls have passed through, or lodged within the

cavity; in three of them an unfavourable termination may be speedily expected; about the same number may be considered dangerous; and the remainder hold out the hope of eventual recovery.

There are a few cases of wounds of the abdomen; the inflammatory symptoms have been subdued, and they all promise to terminate favourably.

The compound fractures amount to near thirty; those of the leg and upper extremity are going on well; the thigh cases, as usual, are very severe, and their issue of course doubtful; they are placed in the extended position, and the utmost attention is paid to the personal cleanliness of the patient.

There are many cases of wounds of joints, or where the site of the wound being in the neighbourhood of a joint, the inflammation has extended to the cavity; the inflammatory symptoms have been kept down as much as possible; in several of these the propriety of removing the limb will be a subject for serious and necessary consideration.

Two cases of hæmorrhage only have occurred; one from the profunda, in a case of compound fracture, which required amputation of the limb; the second from a branch of the internal iliac, the patient having been wounded by a musket-ball, immediately at the junction of the sacrum with the os coccygis: the bleeding was stopped by the graduated compress, but the issue is still very doubtful.

One case only of erysipelatous inflammation supervening on gun-shot wound has been observed; it has been successfully treated by bleeding, cathartics, antimonials, and the antiphlogistic regimen.

The remaining cases are flesh wounds, some of them very severe, but the whole are at present under the influence of a perfectly healthy action, and promise a very speedy recovery.

CHARLES BOUTFLOWER,
Surgeon to the Forces.

No. IV.

Return of surgical Cases treated, and capital Operations performed, in Letter A, General Hospital, Toulouse, in Charge of Staff-surgeon BOUTFLOWER, *from April 10th to May 16th, 1814, inclusive.*

Diseases and State of Wounds on Admission.	Remained.	Admitted.	Total treated.	Discharged to Duty.	Transferred to Bordeaux.	Died.	Remain.	Proportion of Deaths to Diseases treated.	REMARKS.
Head	—	12	12	—	2	6	4	1 to 2	Two died the day of admission: one after being trephined; the remaining three from inflammation and suppuration in the substance of the brain; in the whole, the cranium was more or less fractured.
Thorax	—	26	26	—	5	14	7	1 to 2	Three died the day of admission; many of the remainder were complicated with other severe wounds.
Abdomen	—	10	10	—	2	7	1	2 to 3	Three died the day of admission.
Wounds of the Spine	—	3	3	—	—	3	—	1 to 1	In all there was paralysis of the lower extremities; one died on the eighth, a second on the fourteenth, and the other on the fifteenth day.
Wounds of Joints	—	16	16	—	2	4	10	1 to 4	Two were admitted in a state of mortification, and died on the seventh day; one died after amputation; the fourth was a wound of the hip-joint, not admitting of amputation.
Compound Fractures	—	25	25	—	2	7	16	1 to 3½	On two, amputation was performed very high in the thigh, after considerable hæmorrhage; a third was carried off by pneumonia.
Amputations	—	26	26	—	16	4	6	1 to 6½	In one case there was secondary hæmorrhage; the remaining three had fever of the bilious remittent type.
General Wounds (severe)	—	270	270	36	212	8	14	1 to 34	Five were cases of tetanus supervening on wounds of the foot.
Ditto ditto (slight)	—	82	82	70	11	1	—	1 to 82	This was a case of enteritis.
Total		470	470	106	252	54	58	1 to 8	

Secondary Operations.	Total Number.	Died.	Discharged.	Under Treatment.	REMARKS.
Trephine	1	1	—	—	Died twenty-four hours after the operation.
Amputation, upper Extremities	6	1	—	5	Attacked with bilious fever the day after the operation; died on the seventh day.
Ditto, lower ditto	9	4	—	5	In one, amputation was performed, after tetanus had occurred; two were amputated very high in the thigh, the femur being broken, and the artery having given way: the remaining one sunk under bilious remittent fever.
Total	16	6	—	10	

Five cases of tetanus occurred: in one the cold bath was the principal remedy; in a second, amputation was performed; in the third, the warm bath and pulv. ipecac. comp. were used; in the fourth case, opium and ether in excessive quantities were exhibited; and in the fifth, the tinct. digitalis and bleeding were adopted: the result in all was fatal.

2. ON GUN-SHOT WOUNDS,
Accompanied by Lesion of the larger Nerves.

When an injury has been inflicted upon one of the larger nerves of the body, peculiar symptoms follow, which are generally referrible to parts distant from the seat of injury, and are entirely dependent, as to their nature, on the extent of the nervous affection. The sufferings of the patient are of two kinds, from deficiency or excess of sensibility; and between these two extremes, there are of course several intermediate stages. It has fallen to my lot to see a great many wounds of this description, and several of them have been productive of the greatest suffering for years. When a large nerve is injured, the pain or inconvenience which arises is not felt at the place of injury, but in the part to which the nerve is distributed. If it be completely divided, the effect produced is, total loss of sensation and motion in the part supplied by it. If, on the contrary, the nerve be only injured, the effect is pain in the part supplied, which has a greater susceptibility for stimuli than natural, with diminished capability of bearing them, partial loss of sensation, and a greater loss of the power of motion. The part of the nerve actually injured offers little or no impediment to the healing of the wound, which is generally effected in the usual time. Such is the outline of a case of this description; and at page 22 I have alluded to it, with reference to the seat and nature of the attendant pain. The consequences which follow may be local or general; and whether they be one or the other, are frequently almost unbearable, and certainly productive of much distress.

When the great nerve, or all the nerves going to a part or extremity are divided, the whole of the limb is deprived of the power of motion and sensation; it swings by the side of the body like a pendulum, according to the impulse communicated to it from external agents; or it remains in the position in which it may happen to be placed, until it is again removed. The circulation of blood through it continues, as far as can be

observed, perfectly unimpaired, although the size of the vessels appears to be diminished; the pulse of the affected side not being so strong as that of the sound extremity. The limb is shrunk, the muscles being greatly diminished, the deposition of fat comparatively trifling, and the skin loose. The temperature is always lower than that of the sound limb by several degrees, and the change from heat to cold, or the reduction of it, is more readily effected. The power of resisting heat or cold, which is inherent in a natural state of the human body in an eminent degree, seems to be nearly destroyed, and the sufferer is in danger of being scalded, or frost-bitten, from applications which produce no unusual effect on parts in a healthy state. The circulation in the smaller and capillary vessels is of course easily obstructed, although the arteries and veins perform their functions, in consequence of a vitality or power they possess independently of the usual and common nervous influence sent to the limb by the nerves belonging to it. Whether this be aided by the ramifications of the great sympathetic, which Chaussier and Ribes have described as accompanying the arteries to their extreme branches, I know not; but it would seem to be insufficient, from whatever source it may be derived, to maintain the several smaller vessels in all their integrity, inasmuch as they are incapable of supporting the application of stimuli, mechanical or chemical, and of acting in their usual manner when in a perfectly healthy state. The process of inflammation is not carried on in the same way as in health, it more rapidly passes over the adhesive stage and runs on to the ulcerative; it is not, however, so prone to pass into the gangrenous state as in paralysis from internal causes, from which, in this particular, there is a considerable difference. The absorbent system seems also, like the sanguiferous, to be in a great measure independent of the nerves going to the part, and its functions to be performed with regularity. It is possible, indeed almost evident, that the duties of this system are much diminished, and probably in due proportion with the deficiency in the actions of the smaller vessels of the sanguiferous system, but not, as far as I can judge, in so great

a degree as in paralysis. Lastly, when the complaint is local, the health of the person and the appearance of the frame, generally, with the exception of the part affected, are not deteriorated, and the usual functions of the body are unimpaired, which is not the case in paralysis from internal causes.

An officer received two balls at the battle of Salamanca; one passed through the knee-joint, the other through the upper part of the chest, near the shoulder, but underneath the clavicle, dividing, as was supposed, the nerves going to the left arm, which was immediately deprived of the powers of sensation and motion. Suppuration occurred in the knee-joint, inflammation had taken place in the chest, he had a very troublesome cough, hectic fever had supervened, and this gentleman seemed to be almost without hope, when my opinion was requested. It appeared to me, after careful examination, although the lung of the left side had been affected by continuity of inflammation, and was still suffering from its consequences, that the hectic fever had principally been caused by the disease of the knee-joint, the amputation of which offered the only chance of relief. This appeared to be, and was, a very strong measure; but no intermediate one could be resorted to with any hope of success; and, after having the true state of the case made known to him, the patient decided that he would have his leg removed above the knee. The operation was done, and succeeded. He slowly recovered, and the wounds healed, but the arm remained in the state I have described. Eight years have elapsed, and he is now grown stout, is in excellent health, but the arm remains nearly the same. He has within the last two years perceived some sensation in the course of the muscular or spiral nerve. He has also been indicted for a rape; but the magistrates, very properly, however they might admit the attempt, would not consent to the admission of the fact.

When there are several nerves supplying different parts of a limb, the DIVISION of one of the trunks produces no further inconvenience than that which arises from the loss of sensation and motion in the part to which the ultimate ramifi-

cations are distributed. This is particularly the case in the arm, to which several large branches are sent, one of which may be divided without causing any affection of the rest. It also seems possible that, in such cases, the nerve may be regenerated, although it is an extremely rare occurrence after a gun-shot injury. A soldier, at the battle of Albuhera, received a ball on the inside of the arm, which divided the ulnar nerve, and caused an immediate paralysis of the little and of one side of the ring finger, which remained a permanent inability. Another soldier, of the 48th regiment, received a similar wound on the same day, and affecting the same parts. The nerve, it would appear, was not however completely divided, although it must have been nearly so, for he suffered considerable pain at first in these two fingers and in the hand; this, however, soon subsided; and four years afterwards, when I accidentally saw him, I found that he had recovered the use of his fingers, although he complained of the want of power in them, when compared with their former state, and their liability to suffer in a greater degree from any considerable change of temperature.

Wounds or injuries which do not entirely divide the trunk, or branch of the nerve, are attended by symptoms and consequences of a much more important nature, and which may be considered as local, or general: local, when affecting the nerve or nerves immediately injured; and constitutional or general, when, by sympathy, or continuity of disease, other nerves and other organs of the body become affected.

A soldier received, at the battle of Waterloo, a wound in the back part of the thigh, which stunned him at the moment, but was shortly followed by considerable pain, not in the part actually injured, but on the outside of the leg below the knee, in the sole of the foot, and in the toes. This pain gradually increased rather than diminished, became at times intolerable, and rendered the sufferer's life miserable. It seemed to increase by paroxysms, during which the man was in agony; the pain not only being permanently intense in the foot, but darting down to it, and accompanied by spasms of the whole extre-

mity. No kind of medicine had any effect upon it, and at these periods the poor fellow found relief only by putting his foot on a cold stone, or by enveloping it in cloths wet with water, or the liq. plumbi subacet. dilutus. This man was discharged, without having obtained any permanent benefit, although from habit he became less sensible of the pain, and more accustomed to the necessity of jumping out of bed, and placing his foot on a stone, or of keeping it constantly wet and cold.

An officer of the Rifle Brigade was wounded at Waterloo, nearly in the same manner, and has suffered since with corresponding symptoms, but in a minor degree. I saw him a few weeks ago, when he came up to be examined for his pension, and he was still lame, in consequence of the limb being deficient in power, thereby rendering him incapable of taking more than very moderate exercise. The pain experienced by this gentleman was never so permanently acute, neither were the paroxysms equally severe, although he is still subject to them. There is, however, this marked difference between the cases, that the gentleman could not bear the application of cold, which always increased the pain, whilst in the soldier it invariably afforded relief. In this respect the case of the soldier is peculiar, for, out of a number of persons who have sustained this kind of injury, I have not met with another, who obtained decided relief from cold, which, on the contrary, generally did harm; and the greatest inconvenience which such persons suffer on common occasions is from cold, against which they are obliged to take especial care to guard, by the use of flannel, hare-skins, &c.

An officer of heavy cavalry was wounded at the battle of Waterloo by a piece of a shell, which lacerated the outside of the right arm above the elbow, but external, to the lower part of the belly of the biceps flexor cubiti muscle. The wound itself gave no more pain than is commonly felt, and healed in the usual time. He suffered greatly, however, from pain in the thumb and fore-finger, and to a less extent in the second finger, but with increased violence on the back of the hand, which was sometimes intolerable, of a burning nature, always present, although frequently increased by paroxsyms,

and particularly so on any change of the weather. This pain prevented his sleeping, and was a source of continual distress. The thumb and fingers were powerless, and nearly insensible to the touch. The parts affected were rather swelled, and were frequently in danger of being frost-bitten, from a moderate degree of cold; and of being scalded from the application of hot water, which the other hand could bear with impunity. This gentleman is now much better, but a twelvemonth elapsed before any amendment took place, and during that period he suffered an aggravation of the pain, uneasiness, and swelling of the hand, which his physician in the country conceived to be an attack of rheumatism.

An officer of infantry received, at the same battle, a wound from a musket-ball, nearly in the same place, which was followed by similar effects, and has taken the same course. Both these gentlemen have obtained pensions; and there can be no doubt of their deserving them, although they are not incapacitated from doing their duty as field officers.

A private soldier, after the battle of Vimiera, came under my observation, with a wound from a musket-ball, as nearly as possible like the two former, and who, when I saw him, was suffering in the same way. These three cases show the effect of an injury of a nerve in a more remarkable manner than the others, inasmuch as it is not the nerve actually supplying the part affected that is injured, but one only in communication with it. The radial, or median nerve accompanying the brachial artery, supplies the thumb, fore and second fingers, and one side of the third, whilst the muscular, or spiral nerve, which must have been the principal one injured, is only partially in communication with the part by its deeper seated branch.

Dr. Denmark, in the fourth volume of the Medical and Chirurgical Transactions, has related the following case, which is exactly in point.

"Henry Croft, a healthy young man, belonging to the 52d regiment, was wounded, on the night of the 6th April 1812, at the storming of Badajos. A musket-ball entered the triceps extensor cubiti, about an inch and a half above the

inner condyle of the os humeri, which, grazing the inside of that bone, passed obliquely downwards through the brachialis internus, and out anteriorly near the bend of the arm. The wound soon healed, and without manifesting any particular morbid symptom during the cure. On his admission into this hospital, I found him labouring under excessive pain, which the largest opiates could not assuage, with almost constant watching. The little sleep he had, if it could be called such, was disturbed by frightful dreams and starting. I always found him with the fore-arm bent, and in the supine posture, supported by the firm grasp of the other hand; the wrist also bent, being unable to move it into any other position by the voluntary exertion of its own muscles. He could suffer me to extend the hand, but with increased pain. It always, however, on the removal of the extending power, fell into its former bent situation. The act of pronation he could also suffer me to perform, but in like manner with increase of pain. A small tumour could be felt in the site of the wound on the anterior part of the arm, which he could not bear to be touched without evincing additional torture."

"He described the sensation of pain as beginning at the extremities of the thumb and all the fingers except the little one, and extending up the arm to the part wounded. It was of a burning nature, he said, and so violent as to cause a continual perspiration from his face. He had an excoriation of the palm of the hand, from which exuded an ichorous discharge. The cause of this he ascribed to a shell rolling over it. His agonies, he observed, were insufferable, depriving him of sleep, and the enjoyment of his food, for which he had sometimes an appetite. He declared himself incapable of enduring it longer without some relief, and earnestly requested the removal of the arm. Before proceeding to any operation, I recommended him to try the effects of the warm and vapour baths, anodyne embrocations, &c.: but from none of these he experienced any alleviation of his sufferings."

"The symptoms were sufficiently clear, I conceived, to

lead to a correct prognosis. The part wounded, the nature of the pain, and its course from the fingers, with the exception of the little one, indicated the affection to be in the radial nerve. The increased pain, attendant on the act of pronation, further corroborated that supposition, from the pressure of the pronator teres on the nerve, in its passage through that muscle. The man said he had profuse bleeding after receiving the wound, yet the pulsation of the radial artery I found to be as strong as in the other arm. It was difficult to suppose the radial nerve wounded and the humeral artery to escape: such, however, proved to be the case."

"I proposed to my patient the possibility of saving the limb, and relieving the pain, by cutting down upon the nerve, and removing a part of it, above the wound; which he willingly consented to; but observed, that he would rather have the arm amputated at once, than run the risk of a second operation."

"In a consultation which I held with my colleagues upon the case, when we considered the chance of failure, together with the injured state of the arm, and contracted elbow-joint, we determined on the propriety of amputation. I immediately performed this operation, and with instantaneous relief to my patient. He was discharged cured in three weeks, having in that time rapidly recovered both his health and strength."

"On dissecting the arm, I traced the radial nerve through the wounded parts; it seemed to be blended with and intimately attached to them 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 its length. This contraction, I thought, partly accounted for the bent position of the arm, and the increased pain on attempting its extension; but on further examination, I was surprised to find, on dividing the fibres on the posterior part of the wounded nerve, that there was a small portion of the ball firmly imbedded in it, which had been driven off by graz-

ing the bone. This description of injury more fully accounts for the exquisite pain felt by the patient. The os humeri was discoloured where it was grazed by the ball, and the humeral artery was uninjured. The nerve was evidently thickened, both above and below the wound. Would the division of the nerve, and cutting a piece of it out, have been attended with success?"

Mr. Wardrop has inserted the following interesting case on the subject, in the eighth vol. of the Medical and Chirurgical Transactions: "A respectable woman about forty-eight years of age, twelve months before she applied to me, pricked the fore-finger of her right hand, near the point, with a gooseberry thorn; it was immediately followed by a great degree of pain, swelling, and redness, and in a few days the inflammation extended along the finger and adjoining phalanx of the middle finger. After continuing nearly three months, during which time no suppuration took place, the pain and swelling went off, except that of the two first phalanxes of the wounded finger. These remained extremely painful, and, about six weeks previous to the time I saw her, her general health had suffered considerably, and she was attacked with severe nervous paroxysms. The pain in the point of the finger became excessively severe, and the skin of it so acutely sensible, that she could not endure it to be touched; even the dread of any thing coming in contact with it, would make not only the finger, but the whole hand, flow with perspiration; and, to use her own expression, 'it was so painful to the touch, she could not hold a pin betwixt the finger and thumb, to save her life.' The finger appeared of its natural form, and no change could be perceived in it, except a light red spot on the skin at the point."

"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 root 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 in her stomach, and always vomited after taking food or drink; her flesh, too, was much wasted, and she had become extremely feeble."

"During her illness, various cooling and astringent lotions were used without any benefit, and seven months after the accident, three incisions were made into the point of the finger, which gave excruciating pain, but from which she received not the smallest benefit."

"As well from her own suggestion, as from the opinion I had formed of the disease, it was agreed on to amputate the finger, and accordingly this was done in the usual manner at the second joint."

"On carefully dissecting the finger, no change could be detected in the structure of the nerves."

"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 sickness, which she had so long felt, immediately subsided, and in half an hour after the operation, she said that she felt for the first time as well as she had done previous to the accident, except merely a slight pain in the stump."

"The greater portion of the wound healed by adhesion, and, when I saw her some weeks afterwards, her general health was completely re-established, and she never had the smallest return of any of the nervous symptoms."

He further remarks, "The success of amputation where the affection is produced from an injury of the nerve, is illustrated in the case which has now been related, as well as in that published in the fourth volume of the Transactions of this Society by Dr. Denmark. Had the nerve been merely divided, in this latter instance, as was originally proposed and

as was done in a similar case related by Sir Everard Home, in the Philosophical Transactions, it is extremely probable that the operation would have been attended with the same fatal result."

Sir E. Home, in his work on Ulcers, has given the history of a spasmodic affection of the thumb, which appears to have been caused at first by a blow, but which after a time affected all the parts to the head, proceeding from the thumb in "the direct course of the trunks of the median nerve up to the head." Sir E. Home "divided the nerve, as it passes from under the annular ligament, towards the thumb and fore-finger," it having been laid bare for above an inch in length, and detached from its lateral connexions; for fifteen hours no spasms were felt, but at the end of that time a violent one was experienced, and they continued from time to time for five months, when the patient died in a fit supposed to be apoplectic.

In other cases in which I have known the radial and ulnar nerves to be injured, the pain and inability have been referred to the extreme parts supplied by them, as the thumb, and fore and second finger, when the radial nerve was affected, the little and ring finger when the ulnar nerve had been injured. The sensation accompanying the pain has sometimes been compared to what is usually felt on striking the elbow in a particular manner against the corner of a chair, and which most persons have experienced, although few know that it arises from bruising the ulnar nerve between it and the bone. The pain has always extended up the arm, but in a much less degree, and never so far as to approach the part actually injured, in which the patient has never suffered any inconvenience. The motions of pronation or supination have been accomplished at the will of the patient, without much inconvenience; the muscles of the arm have certainly been much shrunk and wasted, liable to frequent spasms, and the fingers contracted, but by no means in the same manner as in the case described by Dr. Denmark.

It is a question, deserving of very particular attention and

inquiry, whether the pain in all these cases is actually felt in the part to which it is referred, or not? although to some persons it may appear very easy to reply, more especially as there seems to be in most of them, during any increase of pain or distress, a greater flow of blood to the part. It must be recollected, that many who have had their limbs amputated, suffer for years; and some of them constantly from pain, which they say is in the part they have had removed; if, for instance, the leg has been cut off below the knee, the pain is felt so strongly as if in the ankle, that they cannot refrain, until after a moment's recollection, from putting their hand down in search of the part; and this pain is often so intolerable, that the person is actually obliged to move his stump, as he would his leg, if he had it, in order to try if that will give relief. In a case of this kind after amputation, there can be little doubt, from its continuing for years, that it occurs from undue pressure on the end of the nerve, a portion of which formerly supplied the part to which the pain is now referred. A wounded nerve may be placed, from the granulating and cicatrization of the wound, nearly under the same circumstances, and the pain may be not only brought on in a very great degree, but kept up by them. It appears to be well ascertained, that the pain accruing from a wounded nerve, is not so severe on the day of the injury, as it is some days afterwards. A nerve that has been completely divided, seldom causes any inconvenience, except after amputation; yet it must be in nearly the same situation as to the granulating and cicatrization of the parts, as a nerve only partially divided. It is probable, that the inflammation which takes place in the substance of the nerve itself and its neurilema, and which is increased by pressure, may be the cause of the difference.

When a ligature happens to include a nerve, it is a long time before it comes away, and is frequently broken off close to the knot, leaving the noose behind, which causes a great deal of misery to the patient; and if the wound closes, never, perhaps, does come away. Dr. Hennen has given, in his

Principles of Military Surgery, the case of Major-general Sir George Cooke, whom I saw several times, and who suffered very much from some nervous filaments, or branches of nerves, having been included in the ligatures on the blood-vessels. The pain was referred, when the ligatures were pulled upon, to the parts which they usually supplied, and once, when greater stress was laid upon them, to the brain; and other nerves arising from it were sympathetically affected, so that the pain was not only very acute in the head, but spasms of the muscles of the mouth and face were observed with the other usual appearances dependent on intense pain. This suffering I have frequently seen in other instances, but the patients have described the pain as passing up the stump, and on to the head with the greatest velocity; indeed, when nerves become morbidly sensible from disease or derangement, the passage of sensation from one part to another is often clearly described.

The changes which take place in the end of a nerve in a stump, are the reverse of those which occur in an artery, a vein, or even the bone itself. In these latter, a diminution of size takes place in several different ways, according to the proper texture of each; whilst in a nerve, the cut extremity swells, assumes a bulbous and oval form, becomes firmer in its structure, and permanently increased in size. When a ligature is applied on a nerve, this swelling of the end of it, which appears to me to be a natural occurrence, must prevent its ever slipping off, and the ligature can only come away in consequence of the rotting of the silk or material of which it is composed. A large thick ligature will not readily break at the knot, a small one often does when much force is used. In the case related by Dr. Hennen, the ligatures were very large, and therefore were, as far as concerns the nerves included, favourable to the successful result. By leaving ligatures on nerves to the operations of nature, it is understood that they are left to decay; when the hold acquired by the noose being lost, they slip by the side of this bulbous extremity,

which the nerve has acquired, and are withdrawn. I have known a ligature remain for nearly two years.

Wounds of nerves, causing very distressing symptoms, cannot always be so directly traced to the immediate seat of injury, or nerve affected; and many alarming symptoms often arise, both locally and generally, which can only be attributed to the communication of derangement from one branch, or one trunk of a nerve, to another, and so on in continuation to the brain, from whence again other parts are affected through the medium of the nerves by which they are supplied*.

An officer of light cavalry received a wound from a musket-ball in the back part of the right thigh, near the trochanter major, which lodged, but which from its direction, as far as it is apparent, does not seem to have injured the great sciatic nerve. The wound healed in the usual time, but he found the affected limb much weaker than the other, and liable at times to suffer from intolerable pain, although it has never been deprived of sensation or motion. The pains are brought on by any exertion of walking. He cannot ride a horse that is wide in the back, or expose himself to any inclemency of the weather, without suffering materially. He is frequently very lame, and the pain is then felt principally in the sole of the foot and the outside of the leg in the direction of the fibular nerve. There is also one spot on the outside of the thigh which has no sensation. Cramps, as he terms them, are frequently attacking him both by day and night, especially on any change of weather, or any personal irregularity; and if in bed, he is obliged to jump out, and put his foot on a cold stone, which affords him momentary relief.

* Stumps are frequently subject to severe spasmodic affections, which extend towards the trunk in the course of the nerves, and are often productive of great alarm. I know one gentleman who suffers very frequently from them, and as I conceive from two causes, exposure to cold, or derangement of the digestive organs; and he obtains relief from the use of purgatives, and the application of leeches and warm fomentations to the part, followed by the use of stimulants and narcotics.

An officer, who has retired from the service on his full pay and pension as Lieutenant, was wounded by a musket-ball, which entered above and behind the great trochanter, but does not appear to have materially injured the great sciatic nerve, although it has lodged in the pelvis. Sensation and the power of motion have not been materially affected in the lower extremities, although the right leg is altogether weaker than the other, rendering him incapable of taking any smart exercise, which is also prevented by the occurrence of pain, which becomes more severe on any change of weather. This gentleman not only suffers from pain in the sole of the foot and the side of the leg, but experiences very frequently such violent spasms in the whole leg and thigh, as to roar out in agony: and when the muscles are spasmodically affected, the contraction of them and the starting of the limb may be seen at some yards distance, accompanied by a corresponding motion of the muscles of the face. The bladder seems in this gentleman to have lost its power of expelling the urine, which requires, he says, to be drawn off with a catheter morning and evening, and when neglected he is subject to great pain in his abdomen, which comes on and occasionally continues even when this operation has been duly attended to. In other respects he is in tolerable health, although frequently obliged to sit up a great part of the night. The application of a tourniquet high up on the thigh generally affords some relief.

An officer of rank was wounded in 1812 on the inside of the left great toe by a musket-ball, which, from the appearance of the slit made by it, was supposed not to have entered. It was discovered, however, some days after, flattened and lying between this and the next toe, from whence it was cut out. Symptoms of inflammation, followed by great irritability, ensued, and numerous spasmodic affections rendered an attack of locked jaw very probable. Fortunately the spasms, although extending from the foot to the head, were more general, and this dreadful malady did not supervene, as was daily expected. This officer came to Eng-

land, the wound healed, and the spasms, although general on the whole of the affected side, gradually subsided, and he was able to return to his duties. The toe continued extremely tender, rendering him incapable of taking much walking exercise; he suffered from occasional attacks of nervous indisposition, his powers of digestion became a little impaired, but upon the whole he continued in a tolerably healthy state until after the peace succeeding the battle of Waterloo, when the army was cantoned in France. At this period the spasms were more frequent and troublesome, the toe, and particularly that part of the foot on which he trod, became so tender, as to induce him to take means to prevent the pressure, but with little avail: the whole limb was slightly diminished in size. At this period I saw him in consequence of a sudden increase of the spasmodic affection in the muscles of the back of the neck, mouth, and throat, accompanied by a sense of tightness, constriction, and drawing of the head, which seemed to him like the commencement of locked jaw, and the immediate forerunner of some mischief within the head. This paroxysm subsided, and was followed by others; but as his mind was relieved from the fear of locked jaw or palsy, he became more at ease I found that his digestive organs were much impaired, and that the general nervous distress frequently followed, sometimes preceded, and sooner or later was always accompanied by great uneasiness of stomach. Attention was paid to the digestive organs in an especial manner, but his relief from nervous irritation has not been commensurate with our expectation. An attack was often distinctly traced to exposing the foot to cold, or to pressure, and as frequently to apparent derangement of stomach, although no one could be more regular and attentive in regard to his food. From 1817 the complaint subsided, and he became more accustomed to it, but he received no benefit from any particular medicine, or mode of treatment, although various methods were tried, under the direction of Dr. Baillie and others. It was proposed to divide the nerve in the toe supposed to be in-

jured; but Mr. Cline objected to that, as well as myself, and the patient is too well aware of the danger to suffer the experiment to be made. He is now much better, but cannot bear pressure on the foot; suffers from indigestion, although he takes every possible precaution to avoid it; and occasionally feels what he terms all the nerves from his toe to his head; but in other respects he appears in perfect health. In this sketch of his case I have only wished to draw attention to the great extent of the nervous system affected, and to the sympathy between it and the digestive organs.

In cases where the spine has been seriously injured, paralysis of the parts below the injury has followed in the usual manner, with the total deprivation of the function of the testis, and of the desire for sexual intercourse. Where the injury to the spinal marrow has not been so well marked, the powers of motion and sensation are sometimes only impaired. In one particular case of this kind, where the injury was high up in the dorsal vertebræ, and from a buck shot, the patient, although he can walk, declares he has lost all desire and capability for sexual intercourse, on which account he obtains a pension. In another instance the gentleman thinks the deterioration is considerable, but it is difficult on this point to get at the truth.

Spontaneous affections of nerves are by no means uncommon, and as far as I have been able to observe, resemble in their symptoms, according to the nerve affected, those occurring from an injury. Tic douloureux affords the best instance of the branches of several nerves becoming affected by the same disease from communication, in like manner as the arteries of a part enlarge, although furnished by different trunks, when disease is fairly established among them; and this sympathy by continuity deserves particular attention, and in the treatment of wounded nerves, may have a decided influence on the practice to be adopted, inasmuch as it is useless to divide one ramification of a nerve, where several branches of the same, or different ones, are affected.

Diseases of nerves of other parts of the body have the

same symptoms, as when they have sustained an injury. I have seen and know of several cases of affection of the great sciatic nerve, the pain of which was referred to the fibular nerve and the sole of the foot. In one, the patient always traced with his finger the course of the fibular nerve, and then complained of the sole of the foot. When the spasms were severe, he could trace the great sciatic nerve; and pressure in the course of the nerve, where it passes out of the pelvis, always gave him great uneasiness. I conceived, according to the opinion of Professor Chaussier, that it in all probability depended on some low inflammation of the investing membrane of the nerve, probably at or about this part, causing a deposition of serum within it, which pressed upon, or otherwise irritated the nerve itself. Whilst I was deciding in my own mind, whereabouts, after cupping on the loins, I would apply the moxa, a severe attack of erysipelas came on the hip and thigh affected, and cured my patient.

In similar cases, or even in some which have been more severe, the moxa, blisters, and other stimulants have effected a cure, even when applied to the part to which the pain is referred. Richerand * supports the opinion of Cotunnus, and recommends a blister or the moxa to be applied immediately, over and below the head of the fibula, where the nerve passes out in a very exposed situation; and he relates several cases in which he obtained either complete or partial success by these means, attending at the same time to the state of the primæ viæ. On the failure of them, he recommends the application of the actual cautery, on the pained part, and gives an instance of its efficacy in an old and very obstinate case, in which the patient had suffered more or less for upwards of thirteen years. This is analogous to the relief sometimes obtained from the application of a blister to the inside of the thigh, a little way above the knee, in a case of diseased hip-joint, when the pain is referred to that part.

* Richerand, Nosographie Chirurgicale, 4th edition, tom. ii.

Among the various internal remedies given for these complaints, arsenic has been much praised, but I have not had sufficient opportunities of verifying its good qualities in my own practice. In one well-marked case with which I am acquainted, it failed, whilst local pressure and irritation have been of essential service.

Mr. Pearson, in his very valuable paper entitled, Case of a nervous Affection, published in the eighth volume, page 252, of the Medical and Chirurgical Transactions, has many observations bearing strongly on the subject. The paper is too long to transcribe, but I have selected the concluding observations, as deserving particular attention.

"When a punctured wound is inflicted on one of the toes, or a finger, by a small and sharp instrument, as a needle, or the fine point of a pair of scissors, a filament of a nerve is sometimes injured. The minute wound commonly heals immediately: but the muscles of the limb frequently become subject to spasmodic affections, during many months after the infliction of the injury; and the skin, with the subjacent parts, indicate a preternatural sensibility when pressed upon. 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 a 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."

"In some cases, likewise, of painful contractions of the large joints, which were unaccompanied by inflammatory symptoms, or any remarkable change in the structure of the parts, a similar mode of treatment has been attended with complete success, after the common methods had been employed, during many months, without the least advantage. I think myself warranted to insist on the cutaneous excitement, with its concomitant appearances of tumefaction, and of an

eruption, more or less extensive, as circumstances essential to the obtaining of a cure in these peculiar affections of a nerve. It is proper to mention in this place, that there exists a very striking difference in the susceptibility manifested by the skin of persons suffering from these complaints. In some patients it is so irritable, that the concurring symptoms produced by the rubefacient appear in the course of two or three days; whereas ten days or a fortnight may elapse before any heat, redness, or tumefaction shall be seen in others; and, in a few instances, no sensible change on the surface of the skin, nor any beneficial alteration, has occurred from a long-continued application of the liniment, composed of two ounces and a half of the oleum olivæ, one ounce and a half of the oleum terebinthinæ, and one drachm of the acidum sulphuricum."

He further adds, "This mode of treatment is not applicable to that diseased condition of the nerves, in which a conspicuous morbid alteration is discernible in their structure, where little tumours, resembling noduli, are found in some of the larger ramifications of these organs of sense, connected with pain, lameness, muscular spasms, and sometimes with atrophy of the disordered limb. The existence of tumours thus situated, has been noticed by different writers *; but I am not aware that a satisfactory account has been presented to the world, of the differences which subsist in these productions, and of the rise, progress, and ultimate change of structure, which occurs in nerves when infested by such diseases."

"I am not authorized by experience, to offer any information on the effect of this mode of treatment in cases of the tic douloureux. When nerves proceeding immediately from the

* Vide Medical Facts and Obs. 6th volume. See also Portal, Anat. Medicale; the Edinburgh Medical and Physical Journal.

Mr. Crampton, of Dublin, has been so good as to inform me, that the best account he has met with of the subcutaneous tubercle is to be found in Camper's Anatomical Description of the upper Extremity. Folio.—G.

cerebrum are the subjects of this painful disease, temporary relief is often conferred, and sometimes permanent benefit has been obtained by dividing the nerve whence their suffering seemed to be derived; but it must be likewise acknowledged, that this operation has often failed of curing the disease. In an instance, where the painful affection was referred to one finger, the patient was relieved by the amputation of the part; but a similar disease soon attacked one of the fingers of the other hand. The nerves distributed to different parts of the face have also been successfully divided, until very little of the surface of the skin remained, which had not been subjected to the operation. I never saw any real benefit derived from the division of a branch of a nerve, in either the upper or lower extremities, unless in those cases when the agency of a mechanical cause, or some well-defined change of structure, existed. When no deviation from the 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, sympathize 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 an unsuccessful 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 the brain."

Mr. Abernethy, in the second volume of his Surgical Works, has made some observations on injuries of nerves, and notices some cases mentioned by Mr. Pott and Dr. Monro in their lectures, in which the patients suffered distracting pain, followed by convulsions, and he recommends the operation of dividing the nerve at the part injured, with the view of removing the disease. In the same volume, he relates the case of a lady, who suffered from pain, resembling tic douloureux,

of the parts adjoining the inner edge of the nail of the ring finger of the left hand, which occurred at irregular intervals, and in general without any evident exciting cause. As the pain increased, the disorder seemed to extend up the arm. At the end of eleven years "the pain of the part was intolerable; and it extended all up the nerves of the arm; and this general pain was so constant during the night, as to deprive the patient of rest. The muscles of the back of the neck were occasionally affected with spasms. The integuments of the affected arm were much hotter than those of the opposite side, and sometimes the temperature was so increased as to cause a burning sensation in them." Under these circumstances, Mr. Abernethy removed about half an inch of the nerve going to the part affected, being the inner side of the ring finger, opposite the second joint. The painful affection of the nerves of the arm still continued, though considerably lessened in violence. This pain continued occasionally about four months, with varying degrees of severity; but the temperature of the skin was not hotter than that of the opposite side, as it had been before the operation. At the end of nine months, the general pains in the nerves had become very trivial, but sensation at the end of the finger gradually returned, nearly to its natural state. The lady died, four years after, of disorder of the digestive organs; and Mr. Abernethy adds, "Indeed, from what I have since seen of cases of tic douloureux, I am induced to believe that this disorder is as much constitutional as either gout or rheumatism." An observation which, if it be applied to the case to which it is appended, must lead to the inference, that he would not, at a later period, have performed the operation.

Previously to the reading of Mr. Cruikshank's paper on the Reproduction of Nerves, in June 1776, to the Royal Society, and which was published in the Philosophical Transactions for 1795, the possibility of the reproduction of the part of a nerve which had been cut out seems to have been unknown to the anatomists and physiologists of this and, I be-

lieve, other countries. His experiments prove that, in animals, this reproduction is very readily accomplished; and his paper deserves, I conceive, greater attention than has been paid to it. He found he could divide the par vagum and great intercostal, or sympathetic, of one side, in the neck, in a dog, with little or no inconvenience to the animal. Ten days after he divided both nerves on the other side, and the animal lived seven days. On dissection, he found the nerves on each side united by a new-formed substance, that, however, uniting the nerves last divided, being more bloody than the other. When he divided the nerves on both sides at the same time, the animal only lived twenty-eight hours, and in great distress, breathing with excessive difficulty. He repeated the former experiments of dividing the nerves on both sides, but removed a smaller portion, and performed the second operation three weeks after the first. This animal lived, and he concluded that, during this time, the nerve first divided (and of which a portion had been removed) was regenerated, and rendered capable of carrying on its usual functions.

Dr. Haighton read a paper to the Royal Society, in 1795, and which is published in the Philosophical Transactions for that year, confirming the experiments of Mr. Cruikshank. He also went one step further, by proving that the regenerated part did really do the office of the original portion which had been removed. He divided the nerves of one side, and, after an interval of six weeks, those of the other; from which experiments the dog perfectly recovered. Nineteen months afterwards, he divided the nerves on both sides in succession, below the part where he had formerly cut out a portion of each, and the animal died on the second day, having been, in the whole of that period, in the greatest distress. If the nerve had not been regenerated, the last division could not have had the effect of destroying the animal.

Since this period, many experiments have been made on the regeneration of nerves; and, although it is admitted that the portion regenerated is capable of transmitting the nervous

influence, it is still not supposed to be formed of real medullary matter; and there appears to be no doubt of its being, to a certain extent, of a different structure. Professor Meyer (Bibliothéque Germanique, vol. vii.) asserts, that the reproduction is more readily effected in some nerves than in others, that it is more rapid in the tibial than in the ulnar, and least of all in the sciatic.

These facts prove that, in *animals*, a portion of a nerve may be regenerated in a short time; that is, of the par vagum and great sympathetic in three weeks, and often in a less period; and rendered capable of performing in a satisfactory manner the usual offices of the original part of the nerve. It must be observed, however, that these experiments have been made on animals; that there are no instances on record, with which I am acquainted, where a portion of any nerve in the human body has been regenerated in the same time, or to the same extent in any indefinite period of time; whilst the cases and facts I have adduced prove that the reunion or regeneration of a nerve is a very difficult process in the human body, requiring years instead of weeks for its accomplishment, and in many instances never being effected. The conclusion to be drawn from this, is, that there is an essential difference in the powers of reproduction in nerves, between the lower animals and man; and that experiments made on the former, to elucidate other circumstances attending the nervous influence in man, ought to be received with considerable caution.

From the facts which have been related, some strong practical conclusions may, I think, be made, referring to the local or general nature of the injury or affection.

It is highly deserving of remark, that in the case of Henry Croft, in whose radial nerve a piece of ball was sticking, and causing constant irritation, very different and additional symptoms ensued from those I have described to follow a simple injury. The part injured could not bear to be TOUCHED, and a swelling was perceivable on it, being two distinct signs of disease continuing in the part, whilst the contraction of the

muscles was at the same time greater. I am, therefore, after attentive consideration, disposed to connect the symptoms of spontaneous disease, or alteration of structure in a nerve, with those of accidental injury, in which an irritating cause is constantly present; and to separate from them those accidental injuries and spontaneous affections of nerves, in which the part affected suffers no further inconvenience, than that which it sustained from the actual infliction of the injury, or derangement of function. It appears to me to be of consequence to do this, with relation to the practical inference to be drawn, and in order to enable us to decide whether an operation should be performed, or otherwise; and I am induced to conclude from the observations I have been able to make, that two different operations may be required in the first species of injury or disease, whilst sufficient relief may be in time obtained without any operation in the second.

The two operations are, the amputation of the limb, and the cutting out of that portion of the nerve which is affected. When a limb is supplied *principally* by one nerve, as the lower extremity is by the great sciatic, and the diseased part be the trunk of it, amputation is the only proper means of obtaining relief, provided the disease be incurable; because the removal of a portion of the nerve would be followed by the irrecoverable loss of sensation and motion in the part below, which would hang like a log of wood appended to the thigh, and greatly inconvenience the patient; whilst amputation would render him useful to himself and to society. It should also be recollected, that when disease has taken place spontaneously in a nerve, it is not possible to say how far it may have gone, and too small a portion may be removed, or the operation fail from its having extended to the surrounding branches. I have seen a disease of the popliteal nerve, causing a tumour within its investing membrane, render amputation necessary; I have known a foreign substance irritating it to diseased action, require the same mode of relief; and I believe that, consistently with the true principles of

surgery, no other operation in such cases should be attempted. It is very different where there are several nerves going to a limb, or separating from the plexus with which they communicate, high up, or near their origin. In the upper extremity five nerves*, going to the arm, separate from the axillary plexus, it may be fairly said in the axilla; and each may be divided, or a portion of it removed, at or near that part, if a necessity should arise for it. Lower down there can be little or no difficulty in removing a portion of any of them; and this operation should be done, instead of that of amputation. In the case of Henry Croft, Dr. Denmark proposed it to the patient, and I think it might have succeeded, and, therefore, suggest that in all similar cases, whether of spontaneous disease or of accidental injury, it should be done and found to fail, previously to amputation being recommended. If it succeed, a part of the extremity only will be deprived of sensation and motion; and although I do not believe the portion removed will be regenerated, still a certain degree of sensation and motion may be recovered, by means of the communicating nerves extending their influence beyond their usual sphere of operations. I have shown, in three different cases, that an injury of a communicating nerve is capable of affecting a part to which another nerve is directly distributed, and apparently for the endowment of it with sensation and motion. It is fair then to conclude, that the converse may take place, and sensation and the power of motion be partially, if not effectively restored, by the same influence exerted in a different manner.

Mr. Abernethy's case tends to prove this; the fatal cases which have been noticed, as occurring after operation, confirm it; and I am much deceived if the return of sensibility was not, in several cases of my own, owing to this communication of the different branches of the nervous system.

* Seven nerves are given off, by the axillary plexus; but I have not thought it necessary to notice them, or any communicating nerves from the chest.

I have several other cases illustrative of these different facts, which it would be of no advantage to relate. They are, it will be perceived, in many instances, analogous in their results to the injuries which occur sometimes in bleeding from the arm, and it becomes a question whether the practice should be similar or not. When a branch of the internal or external cutaneous nerve is wounded in bleeding, the pain is said to be very acute at the moment of operation, and is soon followed by inflammation of the part and of the whole arm; the fingers become bent and clenched in the hand; the wrist bent forwards on the arm; the pains and spasms are augmented during certain paroxysms; and at last the muscles of the upper arm, neck, and face, are affected, and the patient suffers even from general convulsions. The disease either wears the patient out, is relieved or increased by operation, or gradually but slowly subsides under proper treatment. There is a peculiarity in these cases, when compared with several which I have related, which deserves attention: it is, that, considering the size of the nerve injured, and the function we suppose it has to fulfil, a much greater degree of contraction, spasm, and irritation, is produced in the arm; that more constitutional derangement follows, and a more general affection of the nervous system is induced, than usually takes place after a wound of either or the whole of the three larger nerves supplying, as may be reasonably supposed, more important parts. These differences between the two injuries may arise, I will venture to suppose, in consequence of the patient being in a bad state of health, in the one case, viz. of injury from bleeding; whilst, in the other, he is generally in a state of sound health at the moment of injury.

I am quite aware of the great similarity which exists between locked jaw and those spasmodic affections dependent on injuries of nerves; yet there is something very distinct in the affections, which I cannot explain, and therefore shall confine my present observation to the remark, that, if my

opinion were required as to the probable occurrence of locked jaw in two cases, in one of which a nerve was certainly injured, and in the other there was reason to believe the nerves were no further affected than in a common injury, I should unhesitatingly declare, although the patient showed the same signs of approaching spasmodic affection in both, that the latter person was in greater immediate danger of locked jaw, and all its dreadful accompaniments, than the other; and this observation, although it may be incorrect, has not been lightly made.

As far as I have been able to obtain information, these affections after bleeding are by no means numerous; and, when compared with the number of persons who are bled, are extremely rare, and may, according to my ideas, be divided into two kinds; as dependent entirely on local injury, or on general derangement of health; which will account for the difference of success attending the treatment by operation. It is well known that, in many instances, division of the nerve, or the removal of the integuments at the seat of injury, has effected an almost immediate cure; whilst in others it has failed, the spasms shortly returning, and only subsiding in the course of time. In a consultation on a case of this kind with which I am acquainted, the opinions of several eminent men were equal, for and against an operation. It appears, therefore, very desirable to arrive, if possible, at some conclusion on the subject; and, from such observations as I have been able to make, I should say, that an operation is advisable for the division of the nerve; or, as that may not be easily found, for the removal of a small portion of the integuments around the puncture, not including the vein, except it has been transfixed; provided, that the injury has been recent, and the pain is confined, or nearly confined, to the nerve supposed to be injured. If, on the contrary, other nerves have become affected, and the disease is constitutional, not local, or has originated spontaneously, I consider the operation to be inadmissible, and that both general and local treatment constitute the proper means of cure.

All the injuries I have noticed in these observations, were treated consistently with these principles. In almost all, time has caused some, and, in many of them, so great an amelioration of the symptoms, that the complaint, although always a permanent defect, will yet be bearable, and preferable to the loss of the limb. In two cases only, that I am acquainted with, would the patients prefer the loss of the limb to the present evil. I did not recommend an operation in any of them, because I neither did nor do believe that the portion of nerve removed would, in man, be regenerated in an effective manner. If, however, the pain had become unbearable, and affecting the general health, I should not have hesitated to do it in preference to amputating the limb, except in the lower extremity. Mr. Earle, in the seventh volume of the Medical and Chirurgical Transactions, page 180, states the history of a successful case of removal of a portion of the ulnar nerve; to which I beg to refer, as containing many interesting facts.

The best means of mitigating the pain, independently of the application of heat and cold, which the patients soon choose for themselves, is by stimulants to the whole of the extremity, followed up by the application of a narcotic. I usually direct the part to be rubbed with the tinctura lyttæ, the oleum terebinthinæ, the liquor ammoniæ, &c. in the form of an embrocation, and of such strength as will cause on trial a good deal of irritation of the skin, short however of producing any serious eruption, which, in cases of injury, I have not found beneficial, although I believe it to be so in cases of spontaneous disease. After the friction has been continued for a quarter or half an hour, the same part should be rubbed with an ointment composed of hog's lard and as much opium as it will conveniently bear, or the tinct. opii may be applied to the part on cloths frequently changed, or the extracts of opium or hyoscyamus smeared upon it; all of which seem to be very efficacious in allaying pain and procuring rest. The limb must be carefully protected from any great changes of temperature.

After the patient has recovered in a considerable degree, he will frequently experience a recurrence of the spasms, with apparently increased violence, which I have found to be generally caused by some personal imprudence, or sudden exposure to cold. Cupping on the loins and nape of the neck, according to the part affected, I have found exceedingly serviceable: in some of these cases acting like a charm, and with the aid of a purgative removing the additional inconvenience which had supervened. An officer received a shot through the knee-joint at the battle of Waterloo, and escaped without the loss of the limb; but suffers from great lameness, pain in the part, spasm in the thigh, and a want of sensation in certain places, indicating, also, the lesion of some nervous filaments. He applied to me a short time since in consequence of the nervous affection of the limb not only becoming more painful, but apparently inducing the same kind of uneasiness in the other thigh, in places corresponding to those of the affected side. I directed him to be cupped on the loins to the amount of sixteen ounces, to be purged smartly, put into the warm bath, and an opiate given at night. The next day he was perfectly well.

In addition to the practical conclusion to be deduced from these observations, there are, I apprehend, some points of importance with reference to the temperature of animals, or the evolution of caloric, which deserve attention, and which do not appear to me to be easily reconciled, on the principles or hypotheses which are at present received on the subject, according to the experiments of Mr. Brodie *, Sir E. Home †, and Dr. Wilson Philip ‡. All these gentlemen have been induced to believe that the evolution of caloric,

* Mr. Brodie, Phil. Trans. 1811, 1812.

† Sir E. Home, Phil. Trans. 1811, 1814.

‡ Dr. Wilson Philip's Experimental Inquiry into the Laws of the vital Functions, 2d edit. 1818, and his additional observations in the fifteenth and seventeenth numbers of the Journal of Science and the Arts.

or the temperature of warm-blooded animals, is greatly under the influence of the nervous system. Dr. Wilson Philip is, however, the most precise, and has reduced his opinions into the shape of a doctrine, which may be explained in the following manner. Vide pages 250 et seq. of his work, to which I beg leave to refer.

1. That the power both of the heart and vessels of circulation is independent of the brain and spinal marrow.

2. That the nervous influence is, however, capable of acting both as a stimulus and a sedative to the heart and vessels of circulation.

3. That the vessels of secretion only convey the fluid to be operated upon by the nervous influence, and that, like the vessels of circulation, they are independent of, but influenced by, the nervous system.

By which I understand that the vessels of a limb only convey the blood to be operated upon by the nervous influence, without themselves possessing any power of separating or recombining the constituent parts of that fluid.

4. That the function of secretion is destroyed by dividing the nerves of the secreting organs, and that it may be restored after it is thus destroyed by the galvanic influence *.

5. The nerves to which Dr. Wilson Philip alludes are not the nerves of voluntary motion; but of the ganglian system, formed by the union of the par vagum, and the great intercostal, or sympathetic, which, as Ribes has shown, sends branches along with the great arterial trunks to the extreme

* See the observations and correspondence in the eighth number of the Quarterly Medical and Chirurgical Journal, April 1820, between Dr. W. Philip and Mr. Brodie, in which the experiments of the former prove this to be the case. The counter-experiments of Mr. Brodie, not having been performed under the same precise circumstances, cannot be considered as invalidating them, especially as Dr. Clarke Abel, of Brighton, has since repeated the experiments of Dr. Wilson Philip and Mr. Brodie, and declares that his results entirely correspond with those obtained by Dr. Philip. See London Medical and Physical Journal, May 1820.

parts, and as Dr. W. Philip supposes, pervading and making a constituent part of every portion of the body.

According to this opinion or hypothesis, an arm, in a paralytic state, is only deprived of the power of sensation and motion, in consequence of the nerves of volition being affected, whilst the circulation goes on in consequence of the independent power of the heart and vessels; secretion and the evolution of caloric being effected through the medium of the nerves of the ganglian system. This opinion seems to receive some support from the experiments of Mr. Earle, related in the seventh volume of the Medical and Chirurgical Transactions, in which, on the application of electricity, the temperature rose six degrees, and the parts in some degree obtained a temporary recovery of their sensibility. A paralytic limb, although generally colder than its corresponding sound extremity, is not always so, showing that the nervous influence, causing secretion, may be occasionally increased or diminished, that is, that the ganglian system may or may not be affected, by the same internal causes which produce disease in the nerves of volition.

This question is brought within a much narrower compass, if a limb, deprived of sensation and motion from the division of the nerves of volition, be substituted for a limb paralytic from internal causes; if we take, for example, the first case I have mentioned, that of the officer who was wounded at Salamanca, and whose arm is still paralytic, although eight years have elapsed. In this case the nerves of volition were certainly, I conceive, divided, and no influence whatever could be communicated to the hand, but through the medium of the ganglian system which remained unimpaired; yet the evolution of caloric neither did, nor does, go on as it ought to do, proving, in my opinion, that the influence of this system is not alone sufficient for the perfect production of caloric.

In a case where the muscular, or spinal nerve, and perhaps the external cutaneous nerve, appear to be the only

ones injured, the general temperature of the whole limb is not affected; but only of the part to which these nerves are distributed. Now, if it be said that the shock arising from the injury (which is not perceptible to the patient) be the cause of this, it ought to have as much effect on the whole ganglian system of the limb, as it has on the part to which the nerve is distributed; and as it certainly has not, I conceive I am justified in concluding, that the nerve of volition has something to do with the evolution of caloric, or, to speak more clearly, of that power inherent in the body, by which it is capable of resisting the application of heat and cold: a power which is always deficient in the part supplied, when the nerve of volition is injured. The experiments of Sir E. Home, to which Mr. Earle has alluded, are not conclusive on this point, because it was the par vagum and sympathetic he divided, nerves which, according to Dr. W. Philip, form the ganglian system.

The nerves of volition seem also to have some influence on the vessels, or texture, of a part when in a state of inflammation, inasmuch as this process is generally defective in a paralytic limb, although, upon the whole, it shows the influence of the ganglian system in a more perfect manner than in the evolution of the animal temperature. The influence of the nerves of volition is also shown by the fact, that when a paroxysm of pain comes on in the part to which a nerve of that description is distributed, there is, also, a greater flow of blood to it. The experiments of Sir E. Home are here again not directly applicable, being on nerves of the ganglian system; neither do I agree with him entirely in his inference, on the influence of the nerves on the arteries, "that the ready supply of blood to a limb by the small anatomosing branches, when the principal arterial trunk is obliterated, depends upon the same cause;" for, if it did, there would be the same facility given for carrying on, or re-establishing, the circulation in a case of divided artery as after an operation for aneurism, which is certainly not the fact.

If we suppose, according to Dr. Wilson Philip, that the evolution of caloric in the animal body depends on the ganglian system, would not some of the foregoing facts lead us to suppose that part of the nerves of this system pass, enclosed in the same investing membrane with the nerves of volition and voluntary motion, and consequently suffer when those nerves are injured? This opinion, if it be admitted, cannot be regarded as at all interfering with the well-known fact that the ganglian nerves do also accompany the great vessels.

Dr. W. Philip having read over the different cases alluded to, has been so good as to favour me with the following explanation, which he considers may, in some degree, clear up a considerable part of the difficulty, and which I therefore have great pleasure in transcribing:

"The reader will perceive, in perusing the account of the above cases, that the evolution of caloric was more affected by the injury done to the nerves, than the other ganglian functions were, although it was evident that all of them suffered. This is readily accounted for by a variety of observations, which prove, that slighter injuries of the ganglian system affect the evolution of caloric than its other functions. Thus, many causes of irritation in the stomach and bowels greatly lessen the temperature of the extremities, and sometimes of the whole surface, even producing fits of shivering, which little influence the healing of wounds and other functions, for which the powers of this system are necessary. When, however, the irritation is long continued, we find it affecting all the functions of the ganglian system. Thus it is, that the healing of wounds and the state of other local diseases are so much affected by that of the secretions in the primæ viæ."

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Messrs. BURGESS and HILL most respectfully beg to inform Professional Gentlemen, an extensive Collection of Books on Tropical Climates, NEW AND SECOND HAND, are always on sale. Gentlemen going to the East or West Indies may be *advantageously* supplied with an assortment of Books suitable to the different Climates, on application. Also, Gentlemen who have been some time on a foreign station are respectfully informed, that orders received will be punctually attended to; and, if requested, a selection of the most valuable new Publications added.