

A lecture, on the situation of the large blood-vessels of the extremities; and the methods of making effectual pressure on the arteries, in cases of dangerous effusions of blood from wounds : delivered to the scholars of the late maritime school at Chelsea ... To which is now added, a brief explanation of the nature of wounds, more particularly those received from fire-arms / by William Blizard.

Contributors

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A
L E C T U R E,

On the Situation of the large Blood-Vessels of the Extre-
mities; and the Methods of making effectual Pres-
sure on the Arteries, in Cases of dangerous
Effusions of Blood from Wounds:

DELIVERED TO THE SCHOLARS OF
THE LATE MARITIME SCHOOL AT CHELSEA;

And first printed for their Use.

THIRD EDITION.

TO WHICH IS NOW ADDED,

A brief Explanation of the Nature of *Wounds*,

More particularly those received from FIRE-ARMS.

BY WILLIAM BLIZARD, F.R.S.

Prodesse quàm conspici.

L O N D O N :

Printed by H. L. GALABIN, Ingram-Court;
and published by C. DILLY, Poultry.

1798.

A
L E C T U R E

OF THE
NATURE AND PROPERTIES OF
THE
MATTERS WHICH COMPOSE
THE
UNIVERSE
AND
THE
MANNER IN WHICH THEY
ARE
GOVERNED BY THE
LAWS OF NATURE
BY
WILLIAM BILNARD, M. D.

IN
A
SERIES OF
LECTURES
DELIVERED AT
THE
MIDDLE TEMPLE
BY
WILLIAM BILNARD, M. D.
IN
THE
YEAR
1798

BY
WILLIAM BILNARD, M. D.

LONDON:
Printed by H. J. Galtier, Stationer,
and published by C. Dilly, Bookseller,
in Pall Mall.

IT is the duty of every man to be ready to meet the enemies of peace, order, and happiness; but, while preparing to assume all the noble British character, through which, under Divine Providence, our matchless constitution and unparalleled blessings have been acquired and continued, let us not be unmindful of those means of preservation, in situations of danger, that Science and Art direct, of which the following are at all times proper to be understood, and especially at the present moment.

Devonshire-Square,
April 30, 1798.

W. B. E. P. A. C. B. C.

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P R E F A C E.

THE INTRODUCTION prefixed to these pages, when first printed for the use of the scholars of the late **MARITIME SCHOOL** at Chelsea,* explains their original design. A passage in **Captain DRINKWATER'S** Account of the Siege of Gibraltar, expresses the probable utility of such a publication. — “ September, 1781. The 30th, a soldier of

* An institution intended for the maintenance and nautical instruction of the sons of those naval officers who had bravely fallen in the service of their country, without a provision for the support and education of their children. The failure of this undertaking is to be lamented as a national misfortune. May public spirit soon revive the humane and patriotic design; to remain a monument of regard for those objects that ought to be held most dear by Englishmen!

“ the 72d. lost his legs by a shot from
 “ *Fort Barbara*. He bore amputation
 “ with prodigious firmness; but died, soon
 “ after, through the loss of blood pre-
 “ viously to his being brought to the hos-
 “ pital. This fact being represented to
 “ the governor, the sergeants of the dif-
 “ ferent regiments were ordered to attend
 “ the hospital, to be taught by the sur-
 “ geons how to apply the *TOURNIQUET*;
 “ which was afterwards productive of very
 “ beneficial consequences. Tourniquets
 “ were also distributed to the different
 “ guards, to be at hand in case of ne-
 “ cessity.”*

Were the knowledge of the situation of
 the blood-vessels of the extremities, so far
 as is necessary for checking dangerous ef-
 fusions of blood, and the use of the tour-
 niquet, more general; not confined to the
 navy and army, but extended to col-
 leges and schools, particularly military and

* Vide Drinkwater's History of the Siege of Gibralt-
 tar, p. 190.

nautical academies, manufactories, hospitals of every description, prisons, plantations, fire-offices, the clergymen of parishes in which no surgeons are resident, commanders of merchantmen, miners, &c. it could not fail of proving highly beneficial to mankind.

The late Sir BARNARD TURNER would have bled to death, on the spot of his accident that terminated fatally, had not compression been instantly made on the artery of the wounded limb. Last winter, a poor man, in Cornhill, actually bled to death, from a ruptured vessel in his leg, for want of the timely application of a tourniquet. — But the experience of most persons could afford instances of danger or death through defect of this knowledge.

When a fellow-creature is restored from a state of apparent extinction of life by drowning, rewards are assigned to those who exerted themselves in the recovery. The knowledge of the means proper to

be employed on such an alarming occasion is also, very humanely, generally propagated. Surely, then, if men be in earnest in their endeavours for the preservation of human life, they will admit the importance of the information here recommended; since there is no doubt that many have fallen sacrifices to ignorance of the means of restraining HÆMORRHAGE.

The familiar form of the Lecture is retained, as the best for general information.

July 30, 1786.



INTRODUCTION.

FROM reflection on my duty, as SURGEON to the MARITIME SCHOOL, and a sincere regard for the objects of my care, I proposed to teach them the situation of the large blood-vessels of the extremities, and the application of the TOURNIQUET. This I attempted, in the plainest manner in my power, in the way of LECTURE, as the most familiar and effectual method of impressing truths on juvenile minds: and it was pleasing to observe the ATTENTION and FEELING expressed by my young auditors.

From a desire to promote the great cause of the naval interest of my country, in that essential concern, THE PRESERVATION OF THE LIVES OF SEAMEN, I have now endeavoured to render my Lecture an useful OFFERING to these young warriors.

In

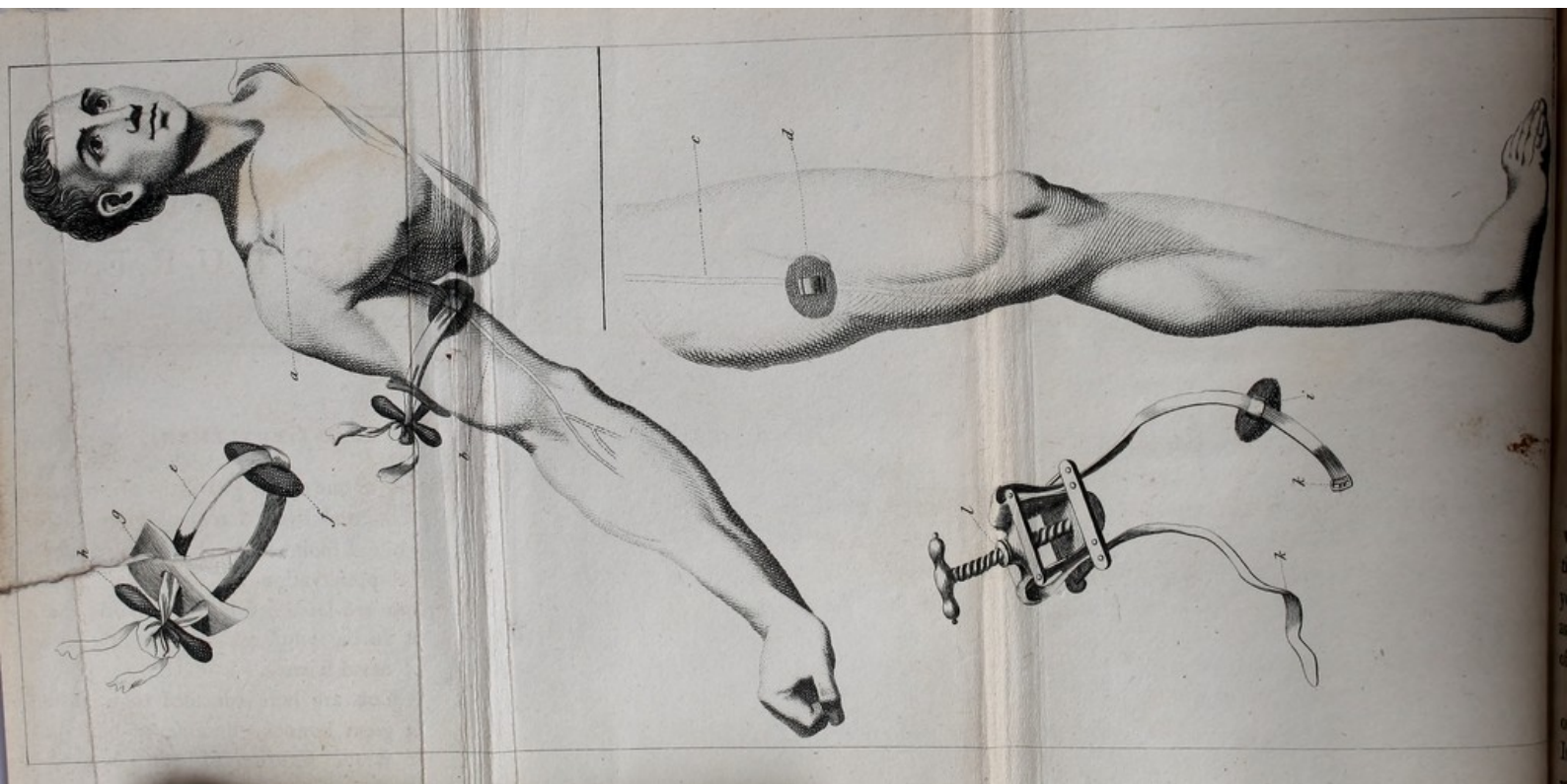
In the navy and army, cases continually occur, in which the information it contains is absolutely necessary for the preservation of existence: but there can hardly be a situation of life, in which, at some period, the knowledge might not prove of equal importance; and it cannot fail of adding to confidence and courage in the moment of danger.

But knowledge of this kind may be productive of some degree of good, though never *practically* required; for, SCIENCE ever tends to improve the heart, and raise the mind to contemplate the power, wisdom, and goodness, of HIM THAT MADE US!

No professional fame can be acquired from explaining facts known to every student in surgery. This little work must, therefore, be considered as a tribute to HUMANITY, offered from a sense of duty.

July 15, 1783.

A L E C-



A.

LECTURE, &c.

YOUNG GENTLEMEN,

AS one of the guardians of your health and lives, I request your attention, while I point out what may conduce to the preservation of these blessings when you are launched into the world, as well as during your residence in this seminary of naval science.

You are here educated to a profession of great honour, because of high utility. It is the security of our country, our religion and laws, our commerce and riches.

riches. The SEAMAN, then, according to his rank and merit, has a claim to the respect and care of his countrymen.

You are ambitious to become SEAMEN, are ready to join the veteran band, to go forth to fight the enemies of your country, and therefore merit the esteem and services of your fellow-citizens.

We are excited to attend to the welfare of the BRITISH SAILOR by another consideration. Trained up in the principles of true honour and bravery, hardy in the practice of them, and properly considering his life as devoted to the service of his country, he is less mindful of bodily evils, and the means of averting them, than the more wary and delicate landsman. He has a title, then, in generosity, to that attention from others which a martial spirit prevents him from shewing to himself.

I am assured, gentlemen, that, in his majesty's ships, you will have many occasions

casions for the exercise of your judgment and spirit respecting the health and lives of your men. You must *reflect for them*; and, when they find that you are truly zealous in all things for their good, they will obey with alacrity, will bear you with spirit through danger, and prove themselves worthy of your generous regard. — These considerations will, I trust, engage your attention to whatever promises benefit to your companions in war.

Every good and brave man would lay down his life in the discharge of his duty to his king and country. But, when sick or hurt, he is not to neglect the means of relief which PROVIDENCE has afforded. On the contrary, we are commanded, by divine authority, to preserve our lives and those of our fellow-creatures.

For the preservation of the health and lives of the officers and seamen of his majesty's navy, there are appointed, by
government,

government, to each ship of war, a SURGEON, and a certain number of MATES; according to the rate of the ship. During the time of action, the station of these officers is in the COCK-PIT. From their necessary confinement to this situation, evils of a very serious nature may sometimes happen; for they cannot possibly render instantaneous assistance to those in a remote part of the vessel, whose bleeding wounds may urgently require the aid of surgery.

Some of the methods of chirurgical relief are very simple, though of the greatest importance. Of this kind is the making an effectual temporary pressure upon a part, to prevent a fatal effusion of blood, in the case of wound, till means of permanent benefit can be employed.

Men of true courage are not dismayed at the sight of blood. In firm possession of themselves, on all occasions, they are capable of exercising their judgement, and employing the means with which they
are

are happily acquainted, either to their own benefit or that of others. It is proper, then, that they should have information of whatever is useful, and in their power to execute.

I cannot omit this opportunity, my young friends, of exhorting you to be **EXAMPLES OF SOBRIETY** as well as of the other **VIRTUES**. What advantage can flow from reason or courage in a state of intoxication? Many a brave seaman has lost his life from having his mind clouded, by the effects of strong liquor, at the time of receiving a wound. — By **TEMPERANCE** the body is preserved free from various disorders, and the mind calm and firm, to direct under circumstances of accidents and on every trying occasion.

Induced by these considerations, I proposed to the good men who direct your education, to teach you the application of the instrument, called **TOURNIQUET**, employed for stopping the flow of blood
from

from wounded vessels. With their sanction, I have the pleasure of addressing you on this subject, and most heartily wish the instruction may prove useful.

A circumstance has occurred, since I proposed to meet you on this occasion, which has strengthened my notions respecting the utility of the intended explanations; and will, I have no doubt, be satisfactory to your governors.

I requested the sentiments of an intelligent naval surgeon on the subject. This was his answer:

“ I can best express my opinion by
 “ relating to you the practice of an in-
 “ genious surgeon in the service, and as-
 “ suring you that his and my sentiments
 “ perfectly coincide. — Mr. ****, sur-
 “ geon of the *BARFLEUR*, had observed,
 “ with great concern, the dreadful effects
 “ of wounds that happened in time of
 “ action, from the seamen being entirely
 “ ignorant of the manner of applying
 “ the tourniquet, many instances having
 “ occurred

“ occurred of men bleeding to death, par-
“ ticularly in the tops, before assistance
“ could possibly be rendered them. —
“ To prevent these evils, as much as
“ was in his power, he provided every
“ seaman, stationed in the tops, with a
“ tourniquet ; and, on every opportu-
“ nity, taught them the method of ap-
“ plying it ; so that, in a short time,
“ they became perfectly expert in its
“ use.”

The pious Psalmist beautifully exclaims,
“ I am fearfully and wonderfully made !”
It would, indeed, require the study of a
long life to learn the little that has been
discovered of INFINITE WISDOM in the
structure of the several parts of the hu-
man body, and of INFINITE GOODNESS
in the laws by which they perform their
functions to the maintenance of health and
life.

It is proper, however, that you should
have a general idea of the circulation of
the blood, in order to understand the

B

practice

practice that will be laid down, and to enable you to adapt it to particular cases.

“ In the BLOOD is the LIFE of man.” That is to say, this fluid contains the principles of nourishment, and distributes them to every part of the body for its supply and refreshment ; like the water of the great ocean, which conveys the riches and good things of the world to every quarter of the globe.

The HEART is the source of this fluid. It is seated in the breast, a little to the left side ; nearly, however, in the centre of the body. This organ is hollow, for containing the blood ; and it has the power of contracting, and strongly propelling its contents. By this contraction of the heart, the blood is pushed forwards, with an exceedingly rapid current, to the remotest parts of the body ; as the tide of the sea influences and presses on the waters of rivers, observable here in the swelling Thames.

The

The vessels, or tubes, which proceed from the heart, to convey the blood to all the parts of the body, are called **ARTERIES**. From the power with which the heart propels the blood through this system of vessels, it happens, that, whenever they are wounded, the blood flows rapidly and in jerks from the wounded part. They divide, to be distributed to parts, from trunks, like the branches of a tree from its body; so that, on pressing together the sides of any trunk, the flow of blood, into the branches beyond the compressed part, is prevented.

The vessels, which return the blood to the heart, are named **VEINS**. The blood in them receives but little of the impelling force of the heart, and, therefore, moves not with a strong tide or current, but glides evenly and gently on, like the ebbing water; and, consequently, wounds of these vessels are not of much importance: a small degree of re-

sistance, by a finger, or some folded linen, applied to the wounded part, will generally stop the bleeding.

This transmission of the blood from the heart through the arteries, and back to it by the veins, is the CIRCULATION; which was the discovery of our illustrious countryman, Dr. WILLIAM HARVEY.*

It

* The use of the lungs in the circulation is here purposely omitted. — The reader, who is desirous of enlarging his mind with the principal truths of anatomy and physiology, will be amply gratified in his inquiries. It is to be lamented that this kind of knowledge is not generally pursued as a part of a liberal education. The study of the animal economy affords the most beautiful and satisfactory ideas, and is calculated to prove highly beneficial to society; for, it enables men to distinguish between ignorance and knowledge, and, consequently, to encourage deserving men, suppress quackery, and advance true medical science. — The medical books, that are frequently to be found in the libraries of gentlemen, are likely to produce very different effects. — The summary accounts of diseases, with receipts for the cure of them, are pillars of the most dangerous empiricism: so far

It is very plain, then, that, if a bandage or ligature be made sufficiently tight around any limb, the flow of blood into all the parts below will be prevented. But, to render this effect certain, the pressure must be very great in the whole circumference of the limb; and, in some cases, from the situation of arteries between bones, the end cannot be obtained. To perform this process, therefore, successfully, in cases of wounds and operations, and, at the same time, to prevent the evils of an exceedingly strong *general* pressure, surgeons have fixed on certain parts of the TRUNKS of arteries for the application of a pad or COMPRESS. — These parts are expressed in the annexed plate.

The PULSE is the beating, or distending, of an artery, from blood propelled

far from furnishing the mind with useful truths, they fill it with error, and beget a confidence in ignorance often fatal to health and life.

into it by the heart. The spaces of time between the pulsations are periods when the heart itself is distending with blood returned to it by the veins.

Now it is evident, that there can be no pulsation when the flow of blood and distention of an artery are prevented. Where, then, a pulse can conveniently be felt, as in the wrist, the ceasing of it, from a pressure made on the trunk above, will prove that the pressure is made effectually. To illustrate this by an experiment: — Let a friend feel the pulse in your wrist; then apply two or three fingers in *the little pit, immediately below the collar-bone, close to the shoulder, marked a in the plate.* Press strongly, and the pulse will cease; because, the artery that supplies the upper extremity *passes under the collar-bone, over the first and second ribs, along this part,* and will be now pressed against one of these ribs. Remove the fingers, and again apply them, and

and the pulse will be found to alternate with the pressure.

Suppose, then, a wound to be received, an artery of a considerable size cut or torn, and a copious bleeding, in consequence, to happen, in any part of the arm *below* the place *a*: — it is manifest, that, by making a pressure with the fingers, in the manner described, or assisted by a pad between the fingers and the part, the bleeding would instantly cease. Is not this an useful remark? Let this little process be your first exercise; and, when you are expert in the practice of it, we will proceed to consider the other places in the limbs where effectual compression may be made, and the instruments proper for the purpose.

The arteries of the upper extremity or arm proceed from the trunk at *a*, after this manner: *the trunk passes into the armpit, deeply situated; it then proceeds along the side of the arm, next the body, obliquely towards the fore part of the joint or*

bend, and here divides into three branches. In this course to its division it lies near the bone, and may therefore be successfully compressed. — The situation of this trunk to its division is described in the plate by the lines *b*.

All compressive means, for preventing a flow of blood from wounded arteries of the upper extremity, must, therefore, be made either at *a*, or in some part of the course of the trunk of the artery, expressed by the lines *b*, *between the arm-pit and the bend of the arm*.

The distribution of the vessels of the lower extremity is in this way. — The artery passes from the cavity of the belly to the GROIN, where, in thin persons, the pulsation of it may be felt.

At this place, in case of wound and effusion of blood very high in the thigh, effectual compression may be made, by some fingers pressed very strongly, in the manner described for compression below the collar-bone; though it were better

to have some kind of strong pad, or firm body, such as will be described, interposed between the fingers and the part.

From the groin, the artery proceeds in an oblique direction, downwards and inwards, as expressed by the lines c; and, at about the middle of the inside of the thigh, expressed by the compress d, it lies closely to the bone. This is the most favourable part for making a pressure upon it, because of the resistance of the thigh-bone behind. And, where there are opportunities of choice, as in cases of wounds or operations below this part, this is the place which surgeons fix on for the application of the compressing body; it therefore deserves your particular attention.

The course of the vessel is then downwards and backwards to the HAM; in the hollow of which, against the lower flat part of the thigh-bone, compression may*

* It is highly necessary, that the greatest attention should be paid to this point of instruction. The pad of
the

may again be very successfully made in all cases of wounds or operations below the knee-joint. But *beyond* this part compression must not be depended on; for, immediately below the joint, the artery divides, like that of the upper extremity, into three vessels, which are situated between the bones of the leg.

You have, I doubt not, anticipated me in a remark on the goodness of the great CREATOR, in ordaining the situation of the larger blood-vessels so that they should not be exposed to danger in the necessary offices of life.

the tourniquet being placed as here directed, the ligature must be brought *round the thigh, immediately above the knee*, and the twisting, of course, be made upon the thigh. If, on the contrary, the pad be placed in the hollow of the joint, and the ligature carried round the leg, the consequence might prove fatal before the error could be corrected. But it is generally more safe to make compression in the middle of the thigh than at the part here described, and more proper as to effects afterwards; for, it is always right that the bruise and irritation that necessarily arise from the ligature should be as distant as possible from the seat of injury or operation.

The

The instrument called **TOURNIQUET**, we are informed, was the invention of a surgeon, named **MORELL**, at the siege of **BESANÇON**. It consists of four parts: *viz.* 1. *e*, a yard and half of strong worsted, or other kind of band, an inch broad; 2. *f*, a pad of leather, tightly stuffed with wool or horse-hair, two or three inches long, and of an inch breadth and thickness, having a loop on one side for the band to be slid through;* 3. *g*, a piece of strong leather, three inches long and two broad, having two apertures, an inch asunder, for passing the band or ligature; 4. *h*, a piece of smooth, round, and strong, wood, about four inches in length.

Description often fails even in things of great simplicity. This may possibly be the case in the account of the **TOUR-**

* It has been suggested, that, for the use of persons who may not retain an accurate remembrance of the situation of the vessels, it were better for this pad to be made as large again as here described.

NIQUET ; but the slightest view will make it understood.* The manner of applying it is this. — Place the pad upon the proper part of the artery to be compressed ; bring the band, passed through the loop of the pad, round the limb, and carry the ends through the apertures in the leather ; make a double knot with the ends, leaving a space between the knot and the leather that will admit three or four fingers ; through this space pass the stick, and with it twist the ligature sufficiently tight to stop the flow of blood through the artery into the limb. The leather, knot, and twisting, are to be placed and made upon the upper part of the limb, nearly opposite to the compress.

* It is much to be regretted that this instrument is not generally known, and kept in every family. The price of it is too trifling to be mentioned. — The life of a valuable gentleman in Hertfordshire would have been lately lost for want of it, if a surgeon had not providentially called at his seat in the moment of a dreadful effusion of blood, from a wounded artery in his hand, occasioned by the breaking of a bottle in a fall.

It

It is manifest that this process, simple as it is, requires both hands for tying the knot; and, therefore, that you could not apply the tourniquet to your own arm without assistance. It is as plain, also, that it demands a constant application of a hand to the stick, as the ligature would otherwise instantly slacken.

To obviate the necessity of two hands, in regard to the arm, let the ligature be about twelve inches long, and have at each end a loop: proceed in its use exactly as already described; only, instead of making a knot over the leather, pass the stick through the loops at the ends of the ligature, and then perform the twisting.

To fix the ends of the stick, so as to prevent the ligature from untwisting, and the constant application of a hand, fasten a portion of tape or packthread, by means of a hole, at each end of the stick; carry the two pieces round the limb, and secure them by tying or pinning. — Many other expedients

expedients may be contrived to answer this purpose.

Besides the tourniquet that I have described, there is another, an excellent piece of machinery. It was invented by M. PETIT; and improved by the late Mr. FREKE, of St. Bartholomew's Hospital. It need only be seen to be understood. — The pad, *i*, being placed upon the artery, and the ligature buckled at *k*, then, by turning the screw, the upper moveable portion, *l*, will be raised from the lower, and, consequently, the ligature may thus be drawn to the degree of tightness required.

The advantages of this instrument are very great. — It may be applied with only one hand; and, on being fixed, will remain safely in that state without attention.

Thus the defects of the former instrument are supplied; and, on every occasion for a tourniquet, *when there is a want of ASSISTANTS*, nothing more useful was

was

was ever contrived. The surgeons on-board ships of war, in the hurry of engagement, oftentimes cannot possibly perform their necessary operations so soon as required: by this machine, the bleeding from wounds can instantly be restrained, and then the wounded may wait, without danger, till the surgeons can calmly execute their duty.—Government have wisely directed every ship to be supplied with many SCREW-TOURNIQUETS.

And now, young gentlemen, after what has been said of VESSELS and TOURNIQUETS, suppose any of you were wounded by a penknife, or other thing, in the thigh, leg, or arm, and, a large artery being punctured, a violent bleeding should ensue. You have no tourniquet; but you clearly understand what has been taught on this subject. How, then, would you act?—Undoubtedly you would instantly pull off your garter, or take the first piece of string or cord you could find; roll up your handkerchief hardy, and lay it on the
trunk

trunk of the artery above the wounded part; pass the garter or cord over the handkerchief and round the limb; tie a knot, leaving a proper space; and then twist the ligature by a piece of your stick or cane, or any other firm body you could procure.

It may be truly said, that, in either of the branches of medicine, “ a little learning is a dangerous thing.” My sole design was, to explain to you the means of stopping a flow of blood from wounded limbs, and preventing fatal consequences, *till more effectual aid from surgery be obtained.* It is happy for mankind that there are professors in this science in almost every town and village, as well as appointed to the army and navy.



A BRIEF

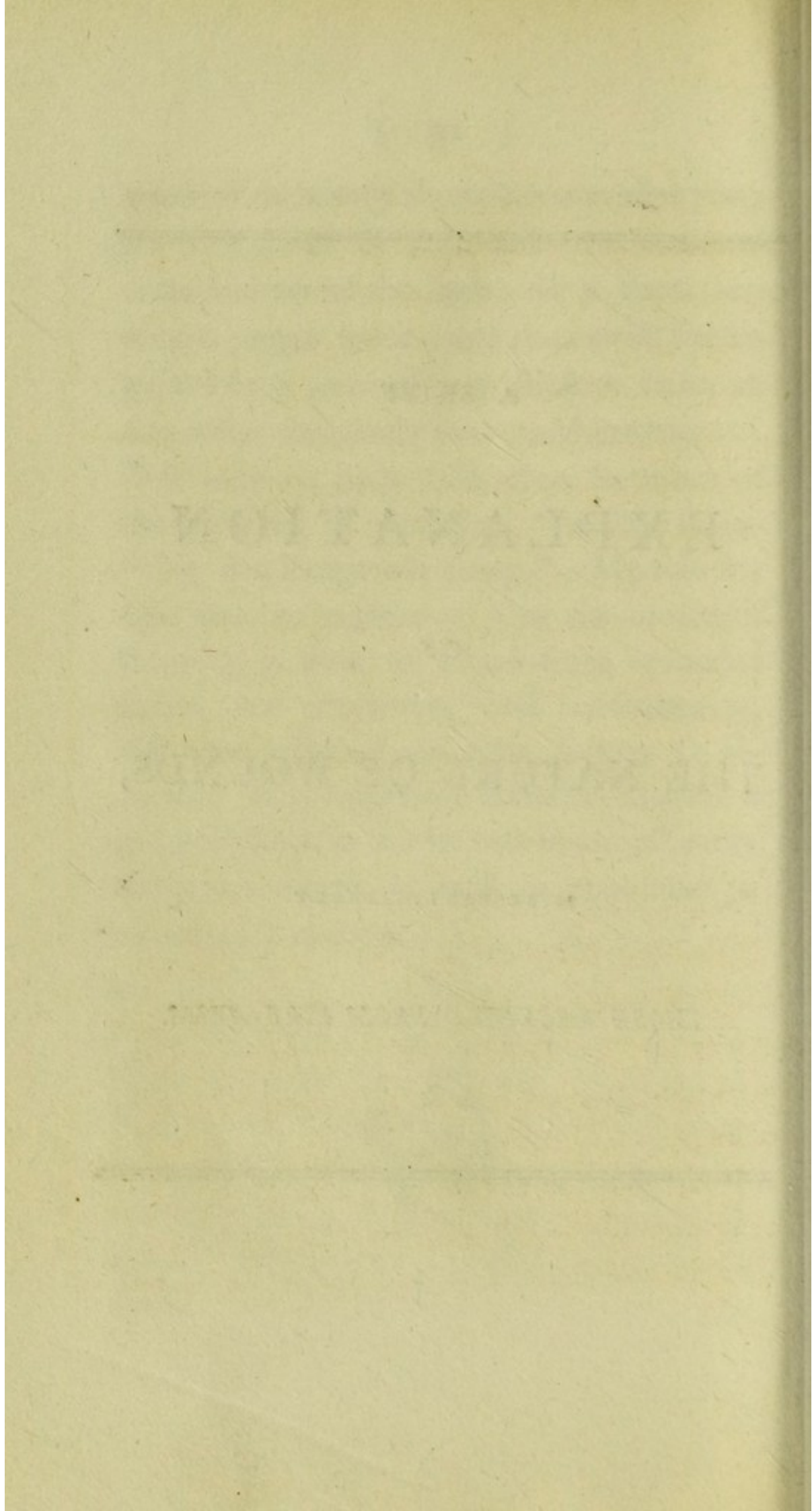
EXPLANATION

OF

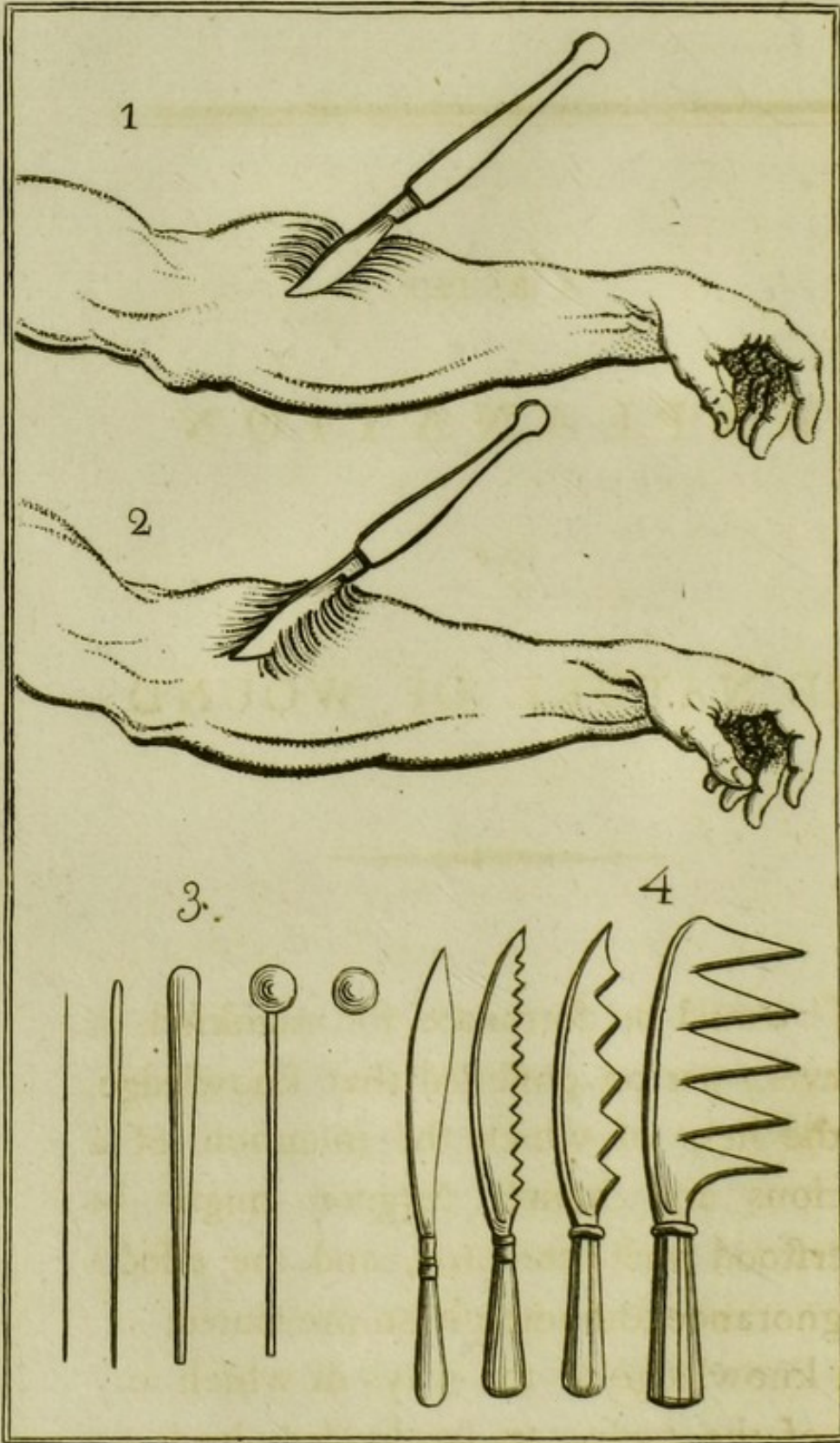
THE NATURE OF WOUNDS,

MORE PARTICULARLY

THOSE RECEIVED FROM FIRE-ARMS.







A BRIEF
EXPLANATION
OF
THE NATURE OF WOUNDS.

IT would be fortunate for mankind, if every person possessed that knowledge, by the help of which the intention of a judicious and honest surgeon might be understood and promoted, and the effects of ignorance and imposition prevented.

A knowledge of the ways in which any part of the body can be divided, leads to

that of the nature of wounds ; and this information, added to a very little acquaintance with the animal economy, points out the manner in which such species of injury should be treated.

The terms of distinction applied to wounds will be more clearly understood from considering the manner in which they happen.

Conceive, then, the acts of dividing the fibres of an animal body by an instrument moving in a direction either perpendicular to the surface of the fibres, or parallel to it.

In the former case, the instrument, of whatever description, must be pressed perpendicularly to the surface ; from which pressure, the fibres will be more or less stretched ; bruised in a mass together, proportionably to the extent of the pressing body ; and, lastly, broken through in a perpendicular direction. (*Fig. 1.*)

In the latter case, the instrument must have teeth. These teeth must be made too

enter

enter into spaces between some of the fibres ; or they must press down some fibres, while others rise into the intervals of the teeth. The instrument being then drawn in a direction parallel to the surface, there will be a yielding and stretching of the fibres, till they can yield and be stretched no farther ; and then they will be broken through in a parallel direction. (*Fig. 2.*)

Hence are derived elementary ideas of every sort of wounding instrument, and of every distinction of wound.

Suppose, for illustration, a series of instruments, placed in regular order, beginning with the finest needle, and ending with a stick having a leaden bullet fixed to its extremity. Then figure to the mind the same bullet, unconnected with the stick or any other body. Imagine, in the next place, a wound produced by any one of these instruments, in a similar way, by pressing, bruising, and rending, the fibres of the part, perpendicularly to its surface. (*Fig. 3.*)

The wound produced by each of these instruments will be a *contused wound*; but the wound made by the needle will be styled a *punctured wound*. Yet this very needle would fatally bruise a minute insect. Whence we learn, that the technical terms *contused* and *punctured* are relative to the size of the instrument, and the tenuity of the part injured.

If the wound made by the bullet fixed to the end of a stick, by the force of an arm or otherwise, be a contused wound, it follows, that a wound caused by the same bullet, propelled by the force of gun-powder, will also be a *contused wound*, without any difference whatever, save what may arise from greater force or *momentum*, through greater velocity, and from its separate state, on which account it may be made to penetrate, and may be reflected, differently from what can happen while fixed to a stick held by a hand.

Suppose another series of instruments, placed in the same regular order, beginning

ning with the finest knife, and terminating with a row of spikes. Then consider the analysis of a knife. It consists of many pointed teeth or spikes; thus it answers to the character of a saw; and, as graduating from the back to the edge, it possesses the principle of a wedge. As the edge is more or less finely graduated, and the points are more or less small, so is the knife expressed as more or less keen. (*Fig. 4.*)

Conceive, now, a wound to be made, by each of these instruments, upon the principle of a cutting instrument. The points of each must be pressed down between the fibres, and next drawn in a direction parallel to the surface, as has been explained.

But how different, in many respects, will be the wound made by the fine knife, and that occasioned by the saw, or instrument with spikes. The wound made with the least conceivable stretching or bruising effect, is called a *simple incised wound*: as that made by the hand of a surgeon with a fine

knife ; in which case, it is gently pressed as a wedge, so as to pass the points of the edge into the spaces between the fibres to be divided, and no more ; the instrument is then drawn in a direction parallel to the surface ; the tender fibres are thus broken ; and, by repeated applications and drawings of the knife, successive layers of fibres are divided to the extent required. — The one attended with much violence of effect, from the resistance of the fibres, as that made with a jagged instrument, is termed a *lacerated wound*.

But, when we consider the graduation of the sharpest knife into the spiked instrument, and that, in wounding with each as a cutting instrument, the same process takes place, these terms also will appear relative, to the fineness of the instrument, and the delicacy of the subject divided. — That which might be expressed as a *simple incised wound*, in the side of an elephant, would probably be a dreadfully-lacerated one in the human body.

In every case of wound, pressure and stretching must happen prior to division of fibres, with whatever velocity of succession these effects may be produced.

Stretching irritates fibres through their whole extent; as the string of a musical instrument is vibrated through its whole length by a force applied to any part of it. Division saves from farther stretching; as the breaking of a vibrating string destroys the continuity between its extremities, and sets at rest the separate portions.

The effects of irritation are pain; inflammation, and its consequences; convulsion; delirium; spasm; and locked jaw.

Proportionably to the degree of the irritation; the irritability of the wounded part, and the body generally; will be these effects, up to death.

Contusion always implies stretching and irritation, and also death of parts. The effects of irritation, and detachment or sloughing of dead parts, consequently follow.

The

The process by which divided parts are united, and parts lost are supplied, is universally the same.

The agents are the absorbent-vessels and the arteries. The former labourers being employed in conveying particles away; the latter in bringing and depositing matter of supply.

There can be no union of divided parts without a medium of new substance. The expression, therefore, of a union *sine medio* is founded in error.

A glutinous matter is produced by the extremities of the divided arteries; its properties being, in some degree, determined by the irritation of the hurt.* Minute vessels, of the three species, (*viz.* arteries, veins, and absorbents,) shoot into this glu-

* So that a wound, hypothetically admitted without irritation, would want the necessary *stimulus* to the early steps of union or supply. In this remark, however, we have only a particular illustration of a beneficent general law respecting the preservation of every part, and of the whole animal fabric.

ten, and increase, till the mass becomes duly organized for the end required; and the vessels of the skin have, according to their nature, formed a cuticle or *cicatrix*.

The vessels thus produced fix the ultimate state of the new-organized substance, according to the disposition of the vessels they are extended from. Thus, if the division be of bone, they will secrete bony matter, and form a union by what is termed *callus*; and, according to the structure and functions of the various other parts of the body, will be the density, resistance, flexibility, &c. of the medium of union, as in muscle, tendon, ligament, cellular substance, membrane, skin, &c.; only it must be observed, that no part is united or supplied with a substance possessing the original characters of the part separated or divided, excepting cuticle.

In a simple incised wound, if the space between the divided fibres be very inconsiderable, if there be no extraneous body in
that

that space, if irritation and inflammation be not so great as to produce *pus* or matter, then may the sides unite by what is called the *first intention*, or, very properly, *agglutination*; for, they are truly, in the first place, glued together.

The objects of surgery, then, in a simple incised wound, are, to restrain irritation and inflammation; to remove extraneous matter; and to bring and retain the sides in contact.*

Bleeding,

* The less the quantity of uniting medium, the less liable it will be to change afterwards; the stronger will be the union; and the more perfect, in every function, will be the united part. The circulation in a new substance is never so strong as in a part originally formed: whence its vessels are less capable of sustaining the influence of causes productive either of ulceration, by occasioning the absorbents to convey away loaded and oppressed parts; or of death and sloughing, through obstruction by pressure upon the returning veins and absorbents. — The breaking of the *cicatrices* of wounds and ulcers, the consequence of many causes affecting the vessels beyond what they can bear, are illustrations of this position. — When it is designed to unite by the first intention, care should

Bleeding, purging, injection, and low regimen, are proper in the first intention; adhesive plaster, bandage, bolster, future, and, above all, *position*, in the last.

It must be manifest, from the nature of what is denominated lacerated wound, that it will be attended with great irritation; the effects of which are, therefore, to be guarded against by opium, in addition to the other means mentioned, indicated also in this case. Fomentation of warm water, bread and milk poultice, or poultice of decoction of poppy-heads and linseed-meal, are proper for the purpose of allaying irritation and pain.

should be taken that the divided sides are, in every part, brought into accurate contact. It were better that a chasm should be left near the surface, than that the superior parts should be united, while a hollow is left beneath, that will become the source of future pain and trouble. Nicety in the application of the edges of the skin, however proper with a due regard to the deeper parts, is not, therefore, of so much importance as the coaptation of the sides from the bottom of the wound.

If

If a muscle, the fibres of which are united in one tendon, be partially divided, the effects will probably be more violent than if the whole were cut through.

In the case of a punctured wound, (by a small sword or bayonet for instance,) no inquiry into its depth or penetration should be made, by probing or otherwise. Gratification of curiosity, in this case, may prove fatal, but never can be productive of the least benefit. Life will often depend entirely upon immediate agglutination; to promote which, all the means proposed for preventing and removing irritation and inflammation should be rigidly employed. A probe would break down the tender glutinous medium, and irritate the sensible extremities of the divided vessels, upon whose gentle action success altogether depends. — There is no case in which attention to position is more required than in this; and it should be remembered that no part about the trunk can be at rest otherwise than in a recumbent situation.

In

In every contused wound, there is an object to be regarded, in addition to what occurs in other distinctions of wounds; namely, the separation of dead parts. This process being very weakening, reduction of the strength, by bleeding, &c. should not exceed what is absolutely required on account of an excessive *degree* of irritation and inflammation. Soothing means, as fomentation of warm water, and poultice with milk or decoction of poppy, are generally proper.

In every gun-shot wound, then, there is death, and must be separation, of parts.

According to the *momentum* of the ball, and the resistance it meets with in its progress, so will reflection more or less readily happen; and reflection will, of course, be determined by the angle of incidence.

Persons, ignorant of the reflections that are produced upon bullets passing into or through any part of the body, have concluded very falsely concerning the parts injured in gun-shot wounds; and, upon the foundation

dation of such mistakes, many marvellous stories are related.

Balls have been reflected round the body, without penetrating the *peritonæum*, or membrane that lines the cavity of the belly, and without perforating the *pleuræ*, or membranes that line the chest; and have then either lodged, or passed out at an opposite part. The like events have happened respecting the scull and its contents. Even a whole charge of flugs, from a blunderbuss, has penetrated one side of a knee-joint, passed round the knee and through the opposite part, without injuring the articulation.

In any such like case, it is not unusual hastily to conclude, that the ball has gone through the bowels, or the brain: and the laws of the animal economy have been thence misinterpreted.

It is a vulgar error, that the contents of fire-arms do no harm when discharged closely applied to the body.*

When

* This opinion was, however, seemingly assented to a few years ago, at the Old Bailey, in the trial of Dr. Elliot

When a bullet penetrates a flexible part, it seldom happens that any portion of the substance is detached inwards before the ball; for the divided extremities of the fibres, at the point of rupture, are bent, and yield to the passing body. The fibres afterwards recover themselves, according to their degree of elasticity, from their curved state, and present an aperture bearing but a small proportion to the size of the ball. This is most remarkable in a muscular or fleshy part.

When, however, a ball penetrates an inflexible body, as bone, the effect is different: a portion of the substance penetrated is forced inwards before the ball. — If a bullet pass through a hard body, it will splinter and scale the surface of its egress; while that of its ingress presents an

liot for shooting at a lady. In consequence of which, experiments were made to ascertain the truth in this matter. The result was, (as common observation and common sense led to suppose,) the nearer a pistol or gun is applied to any part, when fired, the greater is the effect.

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opening

opening nearly corresponding with the size of the bullet. This is illustrated by the effect of a cannon-ball that has passed through the side of a ship, the splinters from which are so dreadfully destructive, Every case of fracture of the scull affords also some degree of illustration. Such fracture happens from a force applied to the part itself; and the portion of bone beaten inwards, will always be scaled or fractured farther in the internal than in the external surface.

In every instance effects will vary, according to circumstances of resistance in the substance penetrated; the figure, and obliquity of direction, of the body penetrating; &c.

In every case of gun-shot wound, whether in a yielding or an unyielding part, extraneous matter may be forced inwards.

There is nothing more mysterious, then, in gun-shot wounds, than in the other distinctions of wounds: the *phænomena* of them

them all are explicable by the same laws of Nature.

There are occasions for the aid of surgery, when advice and assistance from afar cannot be obtained ; when *instant* decision, *immediate* means, are necessary for preserving life. Of such a nature, generally, are wounds from fire-arms. A lesson this to young surgeons who enter into the service of the army or navy, in the hope of rising to situations of the most serious responsibility.

There are *two* periods, respecting HÆMORRHAGE in gun-shot wounds, to be particularly regarded. Through the laceration of large blood-vessels, a fatal effusion may *instantly* happen, if not prevented, at first, by the tourniquet, or other compressive means ; and next by ligature, operation, &c. — The second period is, when the bruised and dead parts begin to separate, or slough away. Openings into vessels, and dangerous hæmorrhage, may thence suddenly happen ; so that, in cases where,

from the circumstances of the wound, such an event is apprehended, it is to be guarded against in the most cautious manner.

There are *two* periods, also, in gun-shot wounds, when endeavours to extract foreign bodies are proper: — First, immediately after the accident, before swelling has taken place; and, secondly, when tumefaction, from irritation and inflammation, has subsided by suppuration.

Enlargement of the wound, when it can be safely done, or an opening at a distant part near which the ball is felt, will often be less injurious than repeated introductions of the forceps into the wound made by the ball.

When a ball is lodged out of observation, either in the brain or in any part within the belly or chest, it is not to be blindly sought after. Measures best calculated to prevent evils, from the presence of the extraneous body, are immediately to be adopted. Effects are then to be watched, and made the guide of future conduct.

MR.

MR. RANBY'S book on gun-shot wounds contains many valuable observations, and is written with great sincerity ; but its general doctrines are either unfounded, or not clearly conveyed. The practice of dilating generally, for instance, is not warranted by reason or experience ; and the effects of bleeding, and of the bark, are not peculiar and specific in this case, as might be thought from the tenor of the work ; but are to be accounted for upon those known general principles by which symptoms and their remedies are explained.

Dilatation of the wound should be made only when plainly required. It may be necessary at two periods of time, namely, immediately after the hurt, for the more ready extraction of the ball, or any other thing that may have been forced into the part ; for the more effectual making of ligature, in the case of hæmorrhage ; and, sometimes, for the sake of dividing a muscle entirely : — and after suppuration, when the same reasons may call for it as at first ;

and when, besides, a free exit to matter becomes indispensably necessary. On the last account, dilatation may frequently be useful; for, as the wound is generally zig-zag, through the different degrees of resistance of parts, matter is very liable to be retained, and, consequently, to require expedients for its discharge. From the beginning to the end, every cause of irritation is to be avoided. Operations of any kind are allowable only as far as they promise obvious definable benefit.

Applications to the part should be simple and easy. Fomentation, and poultice with milk or decoction of poppy-heads, will, at first, be most proper; and, when suppuration is established, and the vessels need moderate excitement, a poultice of porter and oatmeal will probably be as good an application as can be employed.

Wounds from fire-arms are practically distinguishable into two stages; the first terminating, and the second commencing, at the period of suppuration.

During

During the first stage, the violence of symptoms of irritation and inflammation is to be moderated by bleeding, purging, small doses of antimony, opium, diluting draughts of watery drinks, &c. *Bleeding* should, however, be allowed with the strictest regard to the pulse, as expressive of the strength of the body. It may be copious at first, especially from the divided vessels themselves; but it should be repeated rather in moderate quantities than largely. Topical bleeding, by leeches, will prove more immediately beneficial than by the lancet, and less weakening in its remote effects.

Inflammation, as necessary to suppuration, and the detachment of dead parts, *must* happen, for the event to be fortunate. If, therefore, the strength be so reduced that inflammation cannot be sustained in a due degree, or for a sufficient length of time, the termination will be fatal.

In every case of necessarily large detachment of parts, suppuration is to be looked

for as an event of the utmost importance. Indications will then instantly change, and upon answering them in time will depend principally the issue of the case: for, as, during the first stage, means for keeping inflammation within proper bounds are necessary; so, when inflammation has terminated in suppuration; when pain, the consequence of strong action of vessels and tension of parts, and fever, have ceased; when these symptoms are succeeded by a sinking pulse, general sense of weakness, discharge of matter, and fall of swelling, in the seat of injury; the lowering means are immediately to give place to those of opposite tendency, — to bark, small doses of opium, good aliment, spice, wine, porter, &c.

It, indeed, sometimes happens, from a previously weak state, or hæmorrhage from the wound, that the stimulants just mentioned are necessary from the very beginning. So far from inflammation rising to too high a point, it cannot be raised to, or retained

retained at, a proper height for all the ends required, through the inflammatory action of the vessels. This is, indeed, a situation of great peril, and calls for the nicest attention; for, excitement, beyond what the circumstances of the moment demand, will prove, in effect, a waste of vital power. The minutes, therefore, must be watched; and according to what they bring forth must be determined the adequateness of remedies.

AMPUTATION is to be performed only under circumstances, unequivocally expressing it to be necessary for the preservation of life.

Events, in gun-shot wounds and compound fractures, seem to justify the assertion, that success oftener attends amputation after suppuration, than when performed before that period.

There are, however, occurrences in these and other descriptions of cases that at once determine the judgement as to the propriety of *immediate* amputation; and,

and, independently of the hurt, abstractedly considered, there are many things that will have great weight in deciding upon the operation as the best expedient, even when, *prima facie*, the nature of the injury may be such as, under more favourable circumstances, might justify a less severe decision. The situations of wounded people, in a crowded hospital, in an airy plain, in the field of battle, in a chamber of convenience and security, in the anxious moment of engagement, when in quiet possession of the field or the sea, during the hurry of a pursuit, the alarm of a retreat, &c. are very different, and will present reasons for acting differently in similar injuries.

General chirurgical principles, confirmed by experience, must, however, be adverted to, and should be the guide upon every occasion.

The more topical or limited the hurt, the more proper, generally, will be *immediate*

mediate amputation ; and, *vice versá*. A wound, by a musket-ball, in the ankle-joint, and one in the thigh, with fracture, from a cannon-ball, are cases that illustrate this position. — It is the more necessary that an inexperienced person should well consider this rule, as the signs of the greater extent and degree of violence might otherwise be very likely to mislead his judgement.

The operation should be done completely beyond the seat of *contusion*, as well as of fracture, &c. This plain rule, also, is of great importance: the utmost care, therefore, is necessary in determining upon the nature and boundary of the injury.

Gun-shot wounds in the joints generally require amputation.

In every case of wound of a large artery, it is safer to make a ligature upon each divided extremity, than to trust to one only: branches may supply the lower

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er portion, and continue or renew hæmorrhage.

The period of separation of contused and dead parts must be religiously watched. The alarm of bleeding may happen when not expected from any *sign* of contusion ; and life will consequently depend upon immediate assistance. The retracting of a vessel, or fainting, may suspend hæmorrhage, that may afterwards occur, and prove fatal.

Whenever LIGATURE can be made in the case of an opened artery, it ought to be done. Nothing that bears the title of STYPTIC is to be *depended* upon.

Men should be wary how they give their sanction to dependence upon STYPTICS in preference to *certain* means of stopping hæmorrhage. A little matter will sometimes suffice to restrain a bleeding. In an amputation of the leg, below the knee, of a boy eleven years of age, at the London-Hospital, all the arteries retracted

tracted so much that not a ligature was made, and he was soon well. If any thing called styptic had been employed in this case, it would have acquired unmerited reputation, and the loss of many valuable lives might have been the consequence.

Resistance to a flow of blood may be made by divers means, that may prove effectual in bleedings from *small* arteries; but are always to be regarded as fallacious in divisions of large vessels.

Mealy, and tender fibrous, substances, united with the blood, may form a resisting paste. Acids, spirit of wine, &c. may coagulate the blood, and so occasion resistance. Stimulating things may excite the extremities of divided vessels to contract, and retract, and thence resistance may be caused. Coagulation of the blood in the coats of a divided artery, as well as in the tube itself, and, consequently, death of the vessel, may happen from heat, and various things called caustics.

Solutions

Solutions of resins may be decomposed by the blood in the part, and the resinous coagulum may obstruct the divided vessels, as with the compound tincture of gum-benjamin, tincture of myrrh, &c.; and some of these properties may be united in the same article: but experience has demonstrated the fallibility of all such means.

Unhappily, however, there are occasions where ligature cannot be made; and it *sometimes* happens, that the trial of a styptic may be admissible, even in cases where ligature can be performed. Oil of turpentine, applied by buttons of lint, will generally prove the most effectual article of the class of styptics: being made hot, its styptical property becomes considerably augmented.

But, most of all, next to ligature, COMPRESSION is to be depended upon. This may be made by means of compresses of linen, lint, &c. either against the ends of the vessels, upon their sides, or in both ways.

ways. *Sponge* is admirably adapted for pressure; but, when it is employed, the *rationale* of its use should be remembered. The end purposed will depend upon its elasticity. It is, therefore, to be so pressed into, or upon, the part, as, when expanded, to maintain a proper degree of pressure against the open vessels.

Ligature may be made with the greatest probability of success upon any artery of the upper extremity; and upon any artery, below the ham, of the lower extremity; and there is some probability that ligature may be successful below the large artery, called *arteria profunda*, that goes off from the artery in the groin: but no person is to be suffered to die by hæmorrhage that can be restrained, from any vessel. What may *possibly* happen cannot be foretold. The very order of things, in the distribution of the vessels in the part wounded, may be reversed; and it should be remembered, that the nourishment of the parts
below

below may be effectuated through the gradual dilatation of myriads of communicating small vessels, in the ratio of their diameters, where no large artery, that can itself carry on the circulation, exists.

The difficulty of effectually securing bleeding vessels increases much by the loss of time; especially, if irritating styptics have been employed. The adhesions, thickening of cellular substance, &c. that follow, render it oftentimes no easy matter to ascertain, and properly bring to view, the injured vessel: nor is such a state so favourable for the event of a ligature as the condition before inflammation. Experience has proved it a safer general practice, in the case of puncture or division of a large blood-vessel, at once so far to extend the wound as to allow of tying the artery with ease and proper effect.

The elastic forceps are convenient for holding vessels while ligatures are made upon them; but, in precarious situations, it is safer to use the needle and ligature;

ture; taking great care, however, to leave out distinguishable nerves. The *many-tailed* flannel bandage is the best for the thigh after amputation. By cutting off one of the portions of a ligature, the bulk of extraneous matter in a wound is favourably lessened.

There is sometimes a state of dreadful apprehension, concerning operations, even in persons of undoubted courage. An occurrence, some years since, at the London-Hospital, will express this in a striking manner, and may convey some instruction. A foreigner was to have his leg amputated, on account of a disease in it through which he was sinking. He was so reduced, that it was determined to perform the operation on his bed. At the moment of proceeding to the incision, he suddenly raised himself, fainted, and fell backwards. He thus continued some minutes, with a pulse barely perceptible. He then recovered a little, again started up, asked,

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“ Is my leg off?” and, upon being told it was not, fainted again. It was judged, that he would inevitably die without amputation ; that he would probably die from repeated fainting ; that the operation, performed with due care as to loss of blood, would tend to rouse, instead of weakening, the action of the heart and vessels ; and that, therefore, it ought to be performed. It was done, with as much expedition as possible. — The operation was entirely finished, when he again raised himself, and put the question as before. Being assured that his leg was removed, he instantly became cheerful, and fainted no more. He left the hospital perfectly well ; and always declared, that he had not the least painful sensation from, or consciousness of, the operation.

MORTIFICATION is the death of a portion of the body ; and is the consequence of any cause that puts a stop to the circulation of the blood in it. Thus the arteries

teries of a part, in an over-distended state from inflammation, become incapable of acting upon, and assisting in, the propulsion of their contents; whence the sides of the veins, and absorbents, are at length so compressed as to occasion such a degree of obstruction and resistance in them as the power of the heart is insufficient to surmount: the fluids in the tubes, consequently, become stagnant. In what manner the bruising of vessels, coagulation of the juices by heat and other causes, ligature, &c. occasion mortification, may thence be easily conceived.

It will, moreover, be plain, that a diminution of power in the heart, and in the vessels of any part, may occasion mortification; especially if, at the same time, a more than ordinary degree of resistance is to be overcome.

That mortification should often follow gun-shot wounds, will not, therefore, appear extraordinary.

It is trusted, no surgeon need be told, that amputation will not check mortification : or that the operation is not admissible till Nature has said, *Thus far, and no farther* ; till, in short, the line of separation of dead parts is manifest. — There are also rules to be observed equally interesting as this maxim.

SCARIFICATION cannot be of use, except in the dead parts, for the extrication of putrid air.

The application of oil of turpentine, or any other powerful stimulant, while inflammation is present, must prove injurious.

Although high action of the heart and vessels may, for a while, be concomitant with mortification ; and although, during such a state, the object of surgery is to cool and calm the heated system ; yet, sooner or later, the powers will become depressed, and require all the aid of diet and medicine to sustain them in their functions. In this state, wine,
opium,

opium, and bark, are remedies principally to be depended upon. The two latter have been experienced of such great efficacy that some persons have ascribed to them *specific* virtue; thus ignorantly admitting mortification to be a specific disease. They are beneficial in this case, upon the same principles as in debility from any cause whatever.

When topical excitement is called for, oil of turpentine, mixed with olive-oil, may be proper; but the natural terebinthinate balsams, as balsam of Copaivi, &c. are generally to be preferred.* Aromatic fomentation, with camphorated spirit sprinkled over the flannels; and poultice of beer, oatmeal, and pepper in fine powder; and antiseptics to the dead parts, as vinegar, diluted mineral acids, spirit of wine, tincture of myrrh, fermentative articles affording fixed air, &c. will be useful.

* *Camphor*, united with gum-arabic and water, in the form of mucilage, becomes an application very antiseptic and kindly stimulative.

STIMULANTS, both external and internal, should, however, at all times, be nicely graduated according to the effects which they produce. *Debility* in the moving fibres is the consequence of action too long continued, too often repeated, and too strongly performed; as well as of opposite states, arising from torpor, or from defect of exciting power.

In mortification of a limb, when detachment becomes necessary, care must be taken that amputation be not deferred till the strength is too much exhausted.

The effects of wounds and contusions from fire-arms are often felt at great distances of time from the infliction of the injury. The bones are frequently the seat of remote evils from those causes. The *phænomena* of diseased bone arise from the agency of their arteries and absorbents; or from the death of these vessels, their contents, &c. as in *necrosis* or *mortification*. — The analogy of the changes in bone with those in the soft parts

is exact in every particular. A dead portion of bone is separated or *exfoliated* by becoming first insulated from the living parts, through ulceration, by absorbents; and then pushed away by an organized substance, the production of arteries. — Sometimes, all the particles of a dead portion are removed by absorbents; and the event of exfoliation is thence obviated. Nature often extends the growth of an organized substance very far, in order to apply her useful instruments, the absorbents, to perform important offices; and, not often, her beneficent intentions are frustrated, in the destruction of this substance, by ignorance, under the title of *fungus*. The period of the insulated or exfoliated state of a dead portion of bone should be timely ascertained: then it is that surgery may be eminently useful; for, such portion will be felt as an extraneous body, and upon its speedy removal the fate of a limb, or even life itself, may depend.

When a ball, or any other thing, becomes lodged, it often happens, that the vessels of the surrounding parts, when the surprise from its introduction is over, set about accommodating themselves to the presence of the body. The consequence of their friendly exertion is, a callosity of the immediately-surrounding surface, graduating to the naturally flexible parts. Thus the ball obtains a bed, that shields the more distant and tender parts from the effects of its pressure. Bodies are more likely to remain quiet in cellular and fatty parts than when near muscle. — A hollow, with such a callous state of the sides, arising from the pressure of retained matter, is termed *fistula*.

Removal of the thing that presses, and prevention of future pressure, are all that are required towards relief.

Inflammation in the callous parts, from adventitious causes, during the residence of a ball, &c. may produce a train of serious evils, that can be prevented

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ed or remedied only by the extraction or discharge of the body.

Injuries of large nerves, particularly in the extremities, and more especially in the fingers and toes, are most likely to occasion locked jaw: injuries of muscle may be ranked in the next degree among the causes of this dreadful symptom.

That state of debility, joined with irritability, produced by warmth of climate, particularly disposes to spasm and convulsion; which should be guarded against accordingly.

To obviate these evils, the system is to be fortified by a generous regimen, bark, &c. while every thing besides is done that is calculated to allay irritation.

All the parts about the head are highly organized, and thence liable to strong inflammation when injured. Evacuations are, therefore, to be early and copious.

Hurts received in the head, as well as the trunk, are dangerous, also, from the proximity of parts important to life.

BURNS

BURNS from gun-powder are to be regarded in the same light as burns from any other cause. The *degree* of injury from HEAT, by whatever *medium* applied, is the principal point to be considered. — In every case, there is irritation: this may be with or without vesication; and with or without coagulation of the juices, or death of some portion. The heat may also be so intense, as at once to decompose and crisp up the parts to which it is applied.

In slight burns, cold spring water and vinegar, or cold water alone, applied by means of linen kept constantly moist, generally prove good remedies. In burns of greater degree, it may also be useful during the first two or three days; when it should be succeeded by fomentation and poultice.

This case, also, is distinguishable into two stages. All that is appropriate for lessening irritation is to be done in the first period; and the commencement of sup-
puration,

puration, and floughing, may be considered as the index of the second stage, when wine, bark, &c. will probably be necessary.

IRRITATION in the highest degree, as relative to the irritable state of the body, occasions speedy death. The nature of the irritant makes little difference. A scald, in a slight degree, through its extensiveness over the sensible skin, may quickly cause death. The abolition of the vital functions, from this cause, from arsenic, corrosive sublimate, &c. when happening soon from mere irritation, is to be accounted for upon the same principle.

Wounds, of every description, and injuries from heat, lead to various states that require the nicest chirurgical regard. The condition of PURULENT SORES, for instance, is what calls for constant attention. Some observations upon that subject may not, therefore, be unacceptable.

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The operations of nature are hidden from human sight, although her agents be sometimes known by their effects. In the forming and moulding of parts in animals, the arteries and absorbents are understood to be the immediate instruments; but this is learned from the works of these vessels, and not from observations upon their actions. The organizing process of uniting parts, and supplying deficiency, is veiled by a covering of matter. This may be considered as a matrix into which arteries, veins, and absorbents, are extended: its condition is, therefore, a point of important consideration; for, it expresses the disposition of the vessels that are to organize. These vessels may be influenced by internal means, circuitously applied; and, also, more directly, by external applications. To determine with judgement upon the latter, it is necessary to have correct general ideas of the various ways in which things, when applied, act upon the vessels

vessels that first secrete pus, and afterwards ramify into this fluid.

Things applied to purulent surfaces are of a nature miscible with pus, becoming constituents of it, as watery, spirituous, and saline, preparations; or immiscible with it, not altering its properties, only retaining it, and defending the tender surface, as oily and waxen substances. They may consist of parts, some of them miscible, others immiscible, with pus; the latter, by warmth and confinement, separating from the former, as in ointments containing metallic and other salts. Subtle, oily, and aërial, particles may be disentangled from substances in which they were involved when applied, and may either unite with, or penetrate through, the medium of pus, and so, or in both ways, act upon the vessels of the surface; as when the essential oil of turpentine is evolved from resinous articles, or fixed air is extricated from fermenting substances. Also, some articles act upon sores in a manner

manner purely mechanical, as lint, linen, silk, sponge, &c.

From what has been remarked, it will appear, that the pus prepared by the vessels of the part itself is at all times the *immediate* and proper covering and defence of the fore surface; and, consequently, as there is this medium, that chirurgical dressings do not come into contact with the granulated surface, otherwise than in the manner explained, either by uniting with, or penetrating through, the matter; except at the moment of applying them, after it has been wiped or washed away.

It will be also plain, that to bring about, and to maintain, a proper secretion of pus, are the simple objects of surgery in the treatment of purulent sores; because, healing proceeds properly, while the secreted matter is prepared in due quality and quantity.

Gentle stimulants are often of great utility in keeping up the healing process. The lunar stone, (*argentum nitratum*),
applied,

applied, in the lightest manner, to the surface of the sore, avoiding the edges, is particularly beneficial. Other stimulants will, however, sometimes prove more useful in changing the disposition of the vessels.

The effect of acids, in correcting the air when abounding with putrid effluvia, particularly in their concentrated state, and elevated in vapour, is well known; but the favourable influence of *vinegar* in SORES is not generally understood. The practice, as it has been many years followed at the London-Hospital, consists in the application of linen, frequently wetted with a mixture of one part of common vinegar and two parts of fresh spring water. The freshness of the water adds much to the efficacy of the remedy: no more, therefore, should be mixed than is required for immediate use, as the water should be instantly drawn from the well. Distilled vinegar, and river or rain water, may, however, prove useful substitutes.

substitutes. In the summer-season, in hot climates, when putrescency is to be counteracted locally, or in the surrounding air; or when a cuticle only is required upon an organized surface, this topical mode of treatment will deserve attention. No person of understanding, however, would apply even vinegar and water to a fore without due advice, provided it could be obtained: for as all effects are relative to circumstances, much judgement is often required in determining upon the safety of the most simple means.

Vegetable applications are frequently preferable to those of an unctuous nature. Some plants afford dressings in their foliage entire, as the cabbage, mallow, plantain, &c.; the leaves of others are applicable when bruised, as those of hemlock; and many roots, fresh or boiled, pounded, &c. have proved efficacious in mending the condition of a purulent surface, as carrot, potatoe, onion, &c.

CONTUSION,

CONTUSION, from whatever cause, differs only in degree. It frequently happens from spent balls, fragments of shells, and splinters. The vessels of the contused part may be merely irritated; may have blood forced, through their open extremities or ruptured sides, into the cellular substance; or may be disorganized, and destroyed as living tubes. In each case, there must be irritation; to allay which, bleeding, purging, and opium, are necessary: and, in the view of promoting the absorption of extravasated blood, these evacuations are principally to be depended upon. The best immediate applications are those endued with astringency: vinegar, water, and spirit, are proper. Afterwards, fomentation, poultice, embrocations, &c. may be necessary. Collections of extravasated blood should not be opened without absolute necessity. The utmost exertion should be made to obtain the removal of the fluid by absorption. A wound, made to discharge blood from a

bruised part, generally becomes ill-conditioned, and sometimes proves fatal. When the violence of contusion is such as to destroy parts, the period of their separation is to be looked to with a watchful eye; for, evacuations beyond that time, and in the interval of it, farther than symptoms absolutely demand, would be dangerous. The state of parts fatally contused, yet remaining entire, has sometimes deceived unwary observers.

It may be useful to add a word of caution respecting the use of *vulnerary balsam, tincture of myrrh, &c.* in simple wounds. Not a drop is to be suffered to pass into the wound; for, it would irritate, form a medium of varnish over the surfaces of the divided parts, and frustrate the intention of its application. The sides and lips of the wound are to be accurately closed, and retained in that state; when some lint, over the line of contact, is to be moistened with the resinous solution, and suffered to dry and harden. In
this

this manner, the parts will be defended from the air, and kept in a state favourable for healing.

I cannot close this tract without observing, with much satisfaction, that the attention of late paid to the surgeons in the army and navy is founded in justice to those persons, and will conduce greatly to the public benefit; for, however some men may be irresistibly impelled to studies by their attachment to the objects of them, it generally happens that knowledge is pursued according to the estimation in which it is held by those who have the power of assigning rank and reward to its possessors. *Examinations* are proper tests of that degree of talent *below* which none should be admitted to situations upon which the health, happiness, and lives, of men depend: but examinations can neither create abilities nor direct their application where most required. Proper encouragement will do both: it will stimulate pupils to apply to the study of surgery with industry,

dustry, spirit, and effect; and, when masters in the science, it will induce them to employ their skill in the comfort and preservation of those members of the community who are entitled to our first and greatest care.

THE END.