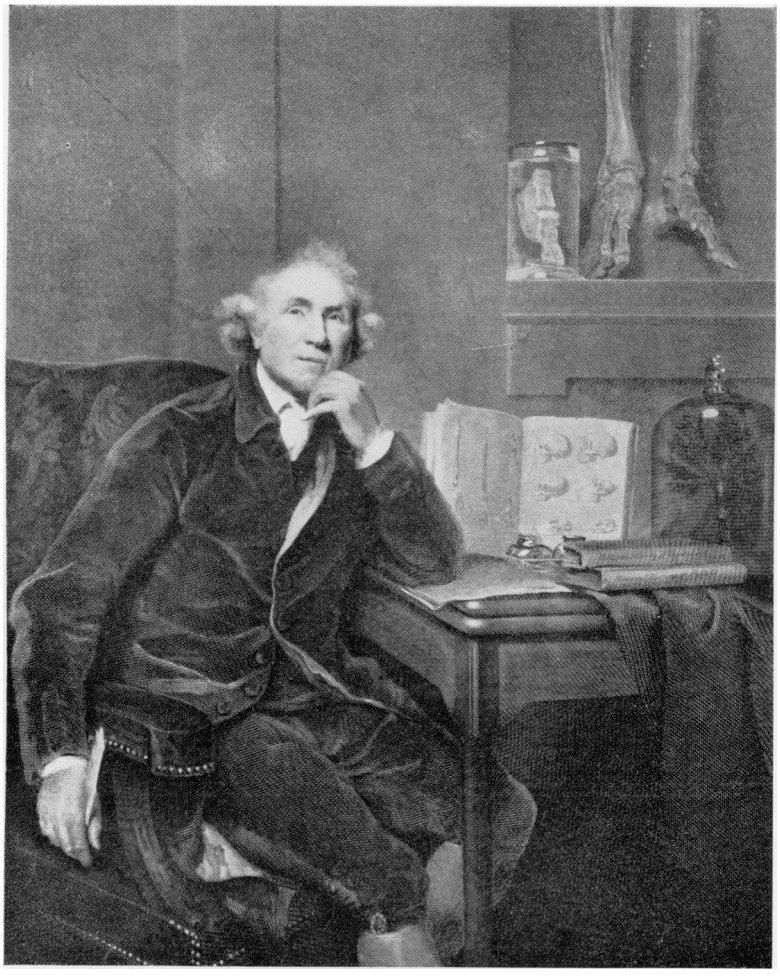

JOHN HUNTER

(From the Collection of Dr. George M. Smith,
in the Department of Anatomy.)

HISTORICAL STUDIES ON THE NATURE AND TREATMENT OF GUNSHOT WOUNDS FROM THE FIFTEENTH CENTURY TO THE PRESENT TIME*

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The "Traité des Playes d'armes à feu" of Ravaton** will be valuable always because of the many interesting cases reported there. The book is remarkable on account of the fund of practical experience it contains, supported by unusually unprejudiced observation. Ravaton took part in the War of the Austrian Succession, and he stated that the battles of Ettingen, Fontenoy, and the sieges of Philippsburg and Landau were especially bloody. The book has an unusual, though not impractical, form. After a short, general section, the reader is presented with a long series of cases in orderly succession, and interesting remarks are added to the simple observations which are repeatedly referred to later at important moments. Because of this arrangement, the book will always be of interest, although we cannot share all the opinions there given.

Ravaton is of the opinion that the deep incision, which had always been considered necessary, was required, not because of the wound itself, but on account of the irritating treatment, and he thought that with the use of more simple therapeutic measures, it would not be necessary, at least in the degree to which it had been employed. He states that physicians should not be persuaded to make an incision at the request of the patient, who often felt that he had missed something if the wound was not laid open. One should,

* Continued from Vol. 4, No. 2.

** Hugues Ravaton, with an experience of 36 years in war surgery, in 1750 wrote this treatise,—the outstanding contribution on this topic from the surgeons of the Franco-Austrian armies. The organization of the medical services of the army was much improved under Louis XV., and a relatively stable personnel was established. Ravaton wrote as "chirurgien-major" in the buffer fortress of Landau in the Bavarian Palatinate. (S. C. H.)

however, not go to the other extreme and fail to incise at all. If the wound was very long, the length of an extremity, for example, a counteropening was made in the middle, but even in such a case it was thought better to wait until pus could be seen under the skin, and then to make an incision for drainage. If the bullet could not be found, the wound was moderately dilated, and if the surgeon was not successful in its discovery and extraction, he waited until the bullet was forced out by suppuration. In extensive compound fractures, large incisions were strongly recommended. Such extensive incisions were thought necessary in head wounds in order to avoid internal suppuration, or to discover fractures. Ravaton stated that pus should not be squeezed out of wounds. If lint packing was required, only a small amount was advised, and it was thought best simply to lay lint, moistened with unguentum basilicum, on the wound. In cases of severe hemorrhage the artery was exposed, a tourniquet applied, and ligation carried out. Gangrene attacking bullet wounds as the result of severe inflammation was rarely treated successfully by amputation. Ischemic gangrene resulting from arterial wounds had a better prognosis. Excessive and unnecessary probing of wounds was sharply criticized, as was too tight bandaging of limbs, and the absurd emphasis laid on beautifully applied dressings which the surgeon hesitated to remove when necessary.

Several German publications followed upon this, among which the most important was "Directions for the Practise of Military Surgery", issued in 1762 by Dr. Johann Ulrich Bilguer. Bilguer was Surgeon General to the Royal Prussian Army, and took part in the campaigns of Frederick the Great, although probably only up to the Seven Years' War, since the book appeared during that period.* As a guide for army surgeons the book was as impractical as it well could be; the entire arrangement, diction, and style are extraordinarily clumsy. The 900 pages contain so much detail that one can hardly see the forest for the trees. The author possesses excellent

* Bilguer received his surgical training in Basel and Strassburg with a finishing period in Paris. In 1742, when only 22 years of age, he entered the Prussian Army as a regimental surgeon. He served for 50 years and fought in 12 campaigns. His writings, while prolix, were authoritative, partly perhaps because of the prestige of the Prussian war machine but somewhat, at least, by reason of respect for his experience and ability. His over-conservatism toward the operation of amputation apparently led to the ruling of Frederick the Great that none should be done except when gangrene was fully developed. This opinion was later contested and corrected by Baron Larrey as a result of his experience in the Napoleonic wars. (S. C. H.)

guiding principles, but the reader is compelled to discover them from among a great mass of worthless matter, and the whole work is unbelievably pedantic. It was very difficult for me to read it in its entirety. If Stromeyer stated that Bilguer's small book about head wounds was tiresome, the larger warrants the same criticism to a greater degree, but in spite of all these objections, it really contains much valuable material.

The first section on "The General Duties of the Wound Surgeon" should be recommended to every surgeon. It expresses the spirit of true kindness and humanity, and leads one to expect great things to follow. Bilguer was of the same opinion as was Le Dran about the incision of bullet wounds, although the opinions enunciated briefly and clearly by the latter are dealt with in a labored and circumstantial way by the German author. Directions for the preparation of ointments, plasters, and bandages are given in endless detail. (How I pity the poor surgeon who had to learn all these prescriptions by heart!) His wounds were almost completely packed with lint and bandage,—small wonder that incision was required.

The best part of the text, although it is extremely long, is the ninth section "Concerning Wound Healing and Its Complications". The signs of infection are very accurately described. At first, deep cuts were made, and if that measure was of no avail, the infected area was excised. A severe undulatory fever of an irregular type, which usually ran a fatal course, often appeared. It was supposed to be the result of an upset digestion, absorption of pus, the foul vapors of the hospital, and a particular susceptibility in certain people. Chill indicated the development of suppuration, a malignant catarrhal fever, or the onset of a prolonged mild fever which would carry the patient off. Pure air and fumigation were considered especially necessary. In the tenth section, on "Crushed Wounds and Stumps of Limbs", Bilguer dealt with his favorite topic, the uselessness and harmfulness of frequent amputation. He states that amputation done on the battle-field had such a bad prognosis that it was to be avoided wherever possible, and if in severe, crushed wounds, deep and extensive incisions were useless, the patient clearly could not be saved by amputation.

This point of view was recognized by many military surgeons who were opposed to extensive amputation, but such conservative surgery should not be carried to the extremes favored by Bilguer. The matter is of the greatest interest at this time when "conservative

surgery" often serves as a battle-cry. I am convinced that the extreme attitude toward this, adopted by some, has cost the lives of many patients who might have been saved. The severe injuries caused by machinery, so often seen in Berlin, have the greatest similarity to artillery wounds. In my experience, early amputation is the only possibility of saving life in these cases, a fact particularly true of crushing wounds of the foot or leg. I was inclined formerly to defer amputation as long as possible, and have seen almost all the patients who were so handled die. The individual peculiarities of each case must always condition the final conclusion.

A treatise by Joseph Jacob Plenk entitled "A New Theory to Explain the Mechanism of Air Wounds", leads us to the subject of wounds supposed to be caused by air concussion, a type of injury which received a great deal of attention at that time. It was believed that a bullet could cause a wound without touching the body, and the extensive crushing injuries without a break in the skin were explained in this way. It was stated that the wounded man did not perceive the impact of the bullet, and once the idea of a wound transmitted by the air was brought out it gave rise to tremendous discussion. According to Ravaton, Tissot, and Bilguer the air near the bullet was greatly compressed, and so caused the injury. Plenk, who contested the possibility of a wound being acquired in this way, supposed that electricity was produced by the friction in the bore of the gun or cannon and transferred to the bullet, thus causing the burning and crushing.* Luckily this theory had few supporters, and the mechanism of so-called air wounds was soon given a reasonable explanation, a matter which will be dealt with later.

A very good "Discussion of Bullet Wounds" was a prize dissertation from St. Joseph's Academy in Vienna, written by Wilhelm Schmidt. It contains the first good analysis of the effect of bullets as modified by their force, direction, and the resistance of the part struck. The opinions of Le Dran, Ravaton, and Bilguer are discussed particularly. The article is clearly and concisely written, and testifies to a certain amount of personal experience in the field.

The founding of special institutes for the training of army

* Plenk (1732-1807) is chiefly known as a classifier of skin diseases, the first of the great Viennese dermatologists. At this period electricity, then a novelty, was called upon to explain many things and this proposition of Plenk undoubtedly seemed up-to-date and scientific. In the World War the theory of "air concussion" was resurrected as an explanation of massive collapse of the lung, but it did not long survive critical investigation. (S. C. H.)

surgeons was begun by Joseph II. in Vienna in 1780, and by Frederick II. in Berlin in 1795. Military surgeons had such a deplorable position at that time that the present one seems excellent by contrast. Haeser, in his "History of Medicine", page 768, states: "In the Seven Years' War the under-surgeons in the army were given a rank no higher than that of the drummers. If one of the grenadier guards died under the care of an army surgeon, the latter expected, as a matter of course, the inevitable beating." This point of view was deeply impressed on the Prussian officers corps and as a result surgeons had, and still have, a very inferior position in the Prussian army. A proper war or bloody battle in which hundreds of noble officers lie groaning on the field and await the coming of the doctor with longing will quickly change that situation. While other countries compete with each other in making alluring offers to the able military surgeon, his position in Prussia is worse than in any other European nation. Those in authority can only be taught by experience.

The "Manual of the Army Surgeon", by Percy,* is an excellent little book, and was a prize-winning essay of the Paris Academy, entitled "Limiting the number of instruments invented for the extraction of foreign bodies from wounds, and especially from those caused by firearms; appreciating those instruments which are of indispensable use in each different case; establishing the rules of theory and practice which must direct one in their use."

The history of the instruments described is very adequate, and suitable recognition is given to writers of other nations. The observations and principles of the best military surgeons of that time are collected in this treatise, garnished with a number of brief case-histories. I found no great change in the principles of treatment. The use of incision was subject to the same limitations as formerly, principally recommended to make the extraction of bullets and

* Baron Pierre François Percy (1754-1825), Inspector General of the medical services of the French Army during the periods of the French Revolution and the Napoleonic Wars, was a very competent surgeon as well as a great administrator. He and Larrey improved the military surgery of their days both in practise and in organization. Particularly did they speed up the care of the wounded, Percy's contribution being the organization of a corps of stretcher-bearers who, during the battle rather than after it, removed the wounded to field-hospitals where immediate treatment could be given. This was, of course, in line with the Napoleonic policy of accelerating all the activities of his armies, which moved with what seemed to his contemporaries to be incredible speed. (S. C. H.)

foreign bodies possible. A long, narrow bullet-forceps which could be taken apart, one blade of which was shaped into a spoon, was particularly recommended. The other arm carried a bullet-borer covered by a ring which screwed in place so that the one instrument combined forceps, spoon, and borer. The first chapter of the second part, dealing with the proper time and the importance of amputation, is excellent. The dissertation of Bilguer: *De membrorum amputatione rarissime administranda, aut quasi abrogande,* was translated into French by Tissot, and found many spirited supporters, although the matter had already been dealt with thoroughly by Le Dran, Boucher, Gervaise, and Faure. The reasons for and against operation were debated, and the arguments supported by personal experience. With complete recognition of the necessity of limiting amputation, this conservative point of view is kept within proper limits. The next century was to develop a new approach by means of exarticulation. Percy's book is well written and easily read.

August Gottlob Richter* (1742-1812), a figure of the first magnitude among German army physicians, and the pride of German surgery, gave a clear classification of the principles of bullet wounds in his "Fundamentals of Wound Therapy" (1792). The influence of Richter in this field is not as great as is that of many others, but it is worthy of mention. It is of special importance since the weight of his opinion finally demolished the idea of "air wounds", a matter which had been attacked already by Le Vacher. Richter states: "It is very probable that the injuries called 'air wounds' are directly

* Richter studied and taught in the town of Göttingen from 1760 to 1812, a period when it was establishing those standards of scholarship and teaching for which it early became noted among the German universities. After graduation he spent a year and a half in France, Holland, and England; in the last, under Pott at St. Bartholomew's in London, receiving an impetus which was manifest in his subsequent career. Like Pott, Richter was particularly interested in hernia (Richter's hernia) and cataract. In 1766, at the age of 24, he became a professor at Göttingen and instituted the modern teaching of surgery with patients in Germany; first in Vogel's Ambulatorum and then, in 1780, with 15 hospital beds. Writing in a scholarly style, he blended the practical knowledge of the wound surgeon with the scientific knowledge of his day. Especially noteworthy was his seven-volume Surgery which displaced that of Heister, and his editing of the Bibliotheca Chirurgica (1771-1796), the first "Zeitschrift" of Surgery. C. M. Langenbeck (1776-1851), one of the great surgeons of the early nineteenth century, was a pupil of Richter and his successor at Göttingen. He in turn taught B. Langenbeck (1810-1887), founder of the modern school of surgery in Berlin. The latter was the foremost surgeon of Germany in his day, and was, indeed, the preceptor of Billroth himself. (S. C. H.)

caused by the bullet itself. The extreme degree of crushing without breaking the skin or penetrating the limb may be explained by the projectile striking the tissue tangentially." This opinion was almost universally accepted thereafter, although the existence of air wounds seems to receive common acceptance among the laity to this day. Richter accentuates the difference between wounds of entry and of exit, and considers an incision to the periosteum absolutely necessary in supposedly crushed wounds of bone. He does not seem to have been imbued with the fear of amputation, since he says: "The first duty of a surgeon in treating a bullet wound is to make certain that it is not more advisable to amputate immediately rather than to attempt to heal the wound. The operation should not be done at all if it cannot be carried out immediately after the injury." He makes it clear that only the peculiarities of the individual case can decide the question of amputation. In spite of free incision, as carried out at that period, deep suppuration frequently developed, and Richter had a great fear of the resorption of pus in bullet wounds, since it was almost always associated with a fatal outcome and could not be controlled by late amputation.

English surgery had reached an excellent position through Wiseman, Cooper, Cheselden, Monro, Sharp, Bromfield, and Pott. Later, with John Hunter, Abernethy, Astley Cooper, Guthrie, Brodie, Liston, and Syme, it had the highest standards in Europe, a position it may, in many respects, still claim. The union of anatomical and surgical instruction made French surgery of the eighteenth century great, furthered military surgery in England, and brought it into the prominence in Germany which it has at present. Luckily, surgery escaped the influence of the system which led internal medicine astray at the end of the last and the beginning of the present century.

John Hunter* (1728-1792) should be considered the principal founder of modern English and German surgery; he was an out

* It is scarcely necessary to dwell upon the life and attainments of John Hunter, for with the passing years his fame becomes ever more lustrous. As Buckle said, "He was one of those extremely rare characters who . . . remodel the fabric of knowledge. They revolutionize our modes of thought; they stir up the intellect to insurrection; they are the rebels and demagogues of science." American surgeons are in direct line of descent from him through Physick and Post, while the nineteenth century school of English surgery, culminating in Lister, received its impetus from him. Garrison states most truthfully that "Hunter found surgery a mechanical art and left it an experimental science." (S. C. H.)

and out genius, of whom Baillie said, with justice: "There is no subject which he had considered to which he has not added new light." His statements about bullet wounds, a subject to which Hunter turned his attention during three years of war in Belle Isle and Portugal (1761-1763), are very brief and yet most important. The principles there emphasized are presented with such clearness and precision that they promptly became a new basis for treatment.

He unjustly states that everything previously written about bullet wounds was superficial. "The leaders who were interested in this branch of surgery seem to have developed no underlying principles and to have been concerned entirely with practise." This is certainly false, and must be excused on the grounds of Hunter's excessive originality.*

The following observation of his is striking: "Many cases may be observed in which the bullet has struck at a low velocity, where sometimes the wound of entrance, but most often the wound last in contact with the bullet, has healed by first intention." The remark about the effect of the speed of the projectile and the resistance encountered is especially interesting, though not entirely original. His explanation of the earlier healing of wounds of exit as compared with wounds of entrance is certainly not correct; he really meant that wounds inflicted by a projectile traveling at high speed heal more slowly than do those caused by bullets of lower velocity. He contradicts himself when he states that bullet wounds become more like incised wounds as the range of fire decreases.

Hunter shows how false it would be to believe that incision would change the crushed bullet path fundamentally, and with the most logical reasons he opposed the misuse of poorly planned incisions. "I believe that the widening of wounds as a general rule is to be condemned in cases where bullet wounds are not dressed with the greatest care. Widening is an act which is diametrically opposed to a fundamental principle applied to all other wounds." He states that surgical intervention is necessary in the following cases: *1* in the

* Hunter's accusation was in a considerable measure correct for he had in mind the discovery of principles, which, however, eluded even his hot chase. The cause of "wound fever" and "pyemia", for instance, still remained in covert for two generations after him. Hunter here shows that contempt for the past and confidence in his own powers, expressed so sharply in his well-known retort to Jesse Foot: "Jesse Foot accuses me of not understanding the dead languages; but I could teach him that on the dead body which he never knew in any language dead or living." (S. C. H.)

presence of severe hemorrhage, where an artery must be ligated; *2* in head wounds, where there is reason to consider the possibility of fracture; *3* when bony fragments require removal; *4* when the wound contains a foreign body which cannot be removed without incision, and delay is more dangerous than operation; *5* when organs such as intestine or lung are outside the body cavity and cannot be replaced without incision; *6* when a vital organ is pressed upon and its function disturbed.

These fundamental principles still exist, although dilatation of cranial wounds has been stated to be unnecessary, or even harmful (Stromeyer). It is difficult to judge from Hunter at what period amputation should be undertaken, or whether it should be performed at all, as he feels that a more expectant treatment would have a better result. It appears to have been a common custom to amputate on the battle-field, but there is no doubt that when the operation is carried out in suppuration after the first severe period of inflammation is over, it offers a better prognosis, a fact which applies particularly to the lower extremities. Hunter, however, says little about this point.

Venesection was recommended in general for full-blooded patients, as was the internal administration of bark, if especially severe suppuration was present.

Amputation in the Eighteenth Century

At the end of the seventeenth century many surgeons looked upon amputation with dread, and executed the operation only under the most pressing circumstances. This usually meant progressive gangrene of an extremity, a type of case upon which surgery could be done quite regardless of consequences. As surgical technic improved, the indications for amputation broadened. The greater refinement of firearms increased the necessity for amputating crushed extremities on the battle-field at a period when the facilities for transporting the wounded were extremely poor, the roads bad, and material for the splinting of limbs scanty. The indications for amputation in civil practice broadened to include caries of bones and joints, necrosis, and aneurysm. Previous sections have already indicated how a reaction against amputation set in at about the middle of this century, and a dispute over the advisability of operation arose, which only subsided at the beginning of the nineteenth century when

resection was accepted by civil practitioners. As far as military surgery was concerned, the question of the advisability of primary or secondary operation was a matter of vital interest. Since it will be necessary to discuss this matter in more detail later, we will only insert here a few remarks about the marked progress in technic during the seventeenth century.

FIG. XV. AMPUTATION SCENE FROM "THE ELEMENTS OF SURGERY" BY MIHLES IN 1746. THIS SURGERY WAS ESSENTIALLY A COMPEND FROM HEISTER, TO WHOM DUE CREDIT WAS GIVEN. NOTE THE FORMATION OF FLAPS AND THE INEFFECTIVE APPLICATION OF THE TOURNIQUET.

By the end of this period, flap amputation according to Sabouris, Verduin, and Lowdham, was well understood, although the circular incision made by a single stroke or by repeated strokes had been known for some time. A universal acquaintance with the facts of the circulation of the blood, as well as the introduction of the tourniquet by Morel and Petit, had caused ligation to be recognized as a safe method of hemostasis. Although the procedure originally involved acupressure and ligation en masse, it was quickly improved by introducing ligation of isolated arteries, an operation strongly recommended by Bromfield. A short time later the double flap amputation of Ravaton was developed. This was executed by a primary circular incision, followed by flap formation and stab wounds. The technic had been described by Ravaton himself in his book, and was dismissed as impractical, but it was given great prominence later by the work of Vermale.

There was a tendency to allow greater latitude in the choice of amputation sites, because mechanical progress had made it possible to replace an amputated limb with an effective artificial device instead

of the simple wooden leg previously available. Amputation at the calf and above the malleoli came into usage, since surgeons were well aware that the danger to the patient varied with the level at which the operation was performed. The further development of the flap technic made exarticulation simpler, since it was a procedure which could only be carried out with difficulty by means of a circular incision. Eventually, exarticulation came to be considered less dangerous than was amputation in continuity. Le Dran executed the first operation of this type, at the shoulder joint; a procedure made possible only by ligation of the axillary artery. Exarticulation of the hip, suggested long before by Ravaton and others, was successfully performed by H. Thomson and by Sabatier. Exarticulation at the knee joint, favored by many (Richter, among others), appears not to have been universally accepted.*

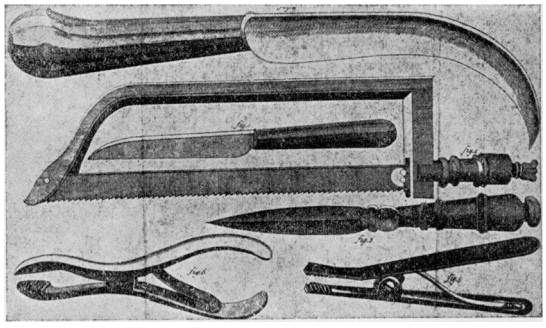

FIG. XVI. THE SICKLE-SHAPED KNIFE AND THE CRUDE ARTERY FORCEPS. (FROM MIHLES.)

The funnel incision of Alanson was soon recognized as impractical. Richter considers it in detail, and was the one to cause the bent, sickle-shaped amputation knife to fall into disuse by clearly demonstrating that it was unsuitable.

Trepanation in the Eighteenth Century

Although the indications for trepanation were already quite broad at the end of the seventeenth century, they were to expand to a shocking extent in the period to follow. This operation was not the exception in cranial wounds, but was the rule, it receiving the

* Not all the possible methods of amputation were exhausted, for in the nineteenth century, through Moreau, Park, and White, interest was again aroused and fresh contributions were made. (S. C. H.)

approval of the foremost authorities of the world. Le Dran outlined the indications in force at the time as follows: *1* trepanation is in itself a relatively harmless procedure, and the patient should recover if fatal complications do not set in; *2* any crushed wound of the skull requires trepanation, because meningeal suppuration necessarily follows—a condition which can heal only if the skull is opened; *3* an extensive skull fracture, with exposure of the dura, is less dangerous than is a fissure; *4* any fracture of the skull requires exposure of the dura by elevation, by the breaking away of bone, or by trepanation.

It is easy to see that this sort of practise is based on the fundamental idea that any meningeal inflammation must of necessity be associated with extensive suppuration and the formation of a pus-filled cavity. Healing was supposed to be impossible unless such a cavity was drained. It was also held that extravasated blood became transformed into pus, a view denied by Pott without perceptibly influencing practise. Ravaton holds forth at length on the frequency of unwarranted trepanation, and he says: "I have seen surgeons so obstinate in seeking for a place of accumulation that after having applied six crowns without finding anything, they would have, I believe, removed the rest of the bones of the skull if death had not taken the patient away from them." Yet he confessed that an exact outline of the principles of the operation was lacking. Heister, also, was very doubtful about the value of trepanation, and states that he had seen few cases recover. Atkins and van Wyck were also opposed to the procedure, and the latter states that the operation could quite properly be omitted in cases where there was simple extravasation of blood (Sprengel). All these warnings were in vain in the face of the most weighty authorities. Pott,* whose work on cranial wounds is classical in other respects, advises trepanation almost as extensively as does Le Dran, at the same time confessing that many cranial wounds heal without operation—a fact which he considers pure coincidence.

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* Percival Pott (1714-1788), a pupil of Cheselden and the leading English surgeon of his day, wrote in 1768, "Observations on the Nature and Consequences of those Injuries to which the Head is Liable from External Violence." This is now less well-known than are his essays on "Fractures and Dislocations" with the description of "Pott's Fracture" and "Pott's Disease of the Spine", but it was for many years authoritative on the subject of head injuries. With its many case-histories, it still remains an important historical document. (S. C. H.)

In Germany, Schmucker, Theden,* and Bilguer were especially loud in their praise of the operation, as was Richter, who was accustomed to execute it rather late, as opposed to Pott, who operated as soon as possible after the wound. Although the symptoms of concussion and of inflammation of the brain were well known, cases were trephined as a prophylactic measure to prevent the development of inflammation. Most of these authorities used strenuous antiphlogistic measures, including venesection, in the treatment of cranial wounds. Pott, Ravaton, and Bilguer recommended bleeding especially, and it may be that the unfavorable results of trepanation at present are due to the fact that we live in an age opposed to venesection. The nineteenth century may settle this question. The indications for trepanation should not be considered established until comparative statistics of the results of treating cranial wounds with and without operative intervention are available in greater numbers.**

The progress made during the eighteenth century in the treatment of gunshot wounds may be summarized as follows: Operative dilation of the bullet path was advocated by Le Dran, Bilguer, and others; it was limited somewhat by Ravaton and especially by Hunter. Le Dran pointed out the difference between wounds of exit and of entrance. The more major amputations on proper indications were carried out by Bilguer. The indications for primary and secondary amputations were elucidated by Faure and by Hunter. Le Dran, Pott, and Bilguer gave the broadest indications for trepanation. The existence of air wounds was denied by Le Vacher and Richter, while, due to the efforts of Schmidt and Hunter, more attention was paid to the direction and force of the blow and the resistance offered by the various parts of the body. Instruments for bullet extraction became more and more simple, only small bullet-forceps, spoons, and borers being employed (Percy). The sequelae of severe gunshot fractures and amputations were well recognized, but had not been classified into characteristic disease groups.

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* Schmucker and Theden, less well-known than Bilguer, probably because they wrote less, each held the rank of Surgeon General in the armies of Frederick the Great. (s. c. h.)

** The understanding of the rôle of infection solved in part, but in an unexpected manner, this problem of Billroth. And yet, some confusion still remained until the World War. Indeed, even today there remain two camps, the one believing in more radical and immediate procedures, the other in a conservative attitude. On the whole the latter is the more commonly followed and seems the more correct. (s. c. h.)

III

War Surgery in the Nineteenth Century

(Dufouart, Lombard, Larrey, Guthrie, Thomson, Hennen, C. M. Langenbeck, C. F. v. Graefe, Dupuytren, Baudens)

The nearer we come to recent times with this sketch through which we are portraying the history of war surgery, the more difficult it becomes. The foreground of a picture reveals more of the individuality of the painter; each minute detail has such significance that it is difficult to give it sufficient emphasis. A historical survey may well be compared with a landscape of a mountainous country; in the distance is a chain of ancient peaks, sharply and characteristically shaped; in the middle distance there are mountainous forms, blended together yet clear and precise; the nearer we come to the foreground the clearer appear the rocks and hillocks, until we see those on which we stand most clearly delineated. It is hard to select the level at which to cut off the picture, in order that the whole be not distorted by portraying too much or too little, and it is difficult to apply the exact coloring so as to obtain a full tone without satiation. We shall endeavor, with such skill as we may, to bring the task to an end.

The writings of this century become more and more comprehensive and the different points of view more numerous, since progress in learning and change in methods of warfare were rapid. Sprengel stated that no period can be compared with the eighteenth century in the progress of religion, respect for human rights, knowledge, and learning,—matters which are most important in practical life. What will be said about the nineteenth century, the age of steam, machinery, the telegraph, and the revolution in government and education!

If we subject the progress of military medicine to scrutiny, a more detailed classification appears necessary. It seems reasonable to adopt the method used by most military surgeons in their writings; that is, to discuss gunshot wounds in general, and then to consider injuries of the different parts of the body in greater detail. It is first necessary to give a short review of the material available.

The text of Dufouart, *Analyse des blessures d'armes à feu et de leur traitement*, Paris, 1801, and that of Lombard, *Clinique chirurgicale des plaies faites par armes à feu*, Strassburg, 1804, are closely

connected with the end of the previous century, and contain little of a revolutionary nature, although they appeared in a time of revolution.

A new era was begun by the works of D. J. Larrey*, the constant companion of Napoleon I. The results of this surgeon's observations are set down in his *Mémoires de chirurgie militaire et campagnes*, Paris, 1812-1817 (German translation: Leipzig, 1813 and 1824), and later in a different form in the *Clinique chirurgicale* (German translation: Berlin, 1831). In the first, the individual campaigns are described in chronological order, and a wealth of interesting material is presented, not alone concerning military surgery, but also about all the sickness and suffering of a large army. It is impossible to gain a better general view of the life of an army surgeon than by reading this remarkable contribution. The campaigns in Egypt and Russia are the most fascinating. A certain breadth of view in the presentation of material not really surgical might be considered an objection by one reader and an advantage by another. For one who does not consider his time too valuable, the perusal of Larrey's *Mémoires* should prove most interesting, but if a more general and rapid review of more material is desired his *Clinique Chirurgicale* should be read. The latter is written with the clarity, brevity, and precision of the previous century, and forms a pleasant contrast to the modern breadth and circumstantiality of French literature. Larrey was the instigator of striking modifications in the medical organization of the French army, changes required by the extreme mobility of the Napoleonic troops. Before his time, the wounded, scarcely attended at all, were transported a considerable distance to the surgeons who followed behind the army, and were then evacuated to hospitals. Larrey was dissatisfied with

* Dominique Jean Larrey (1766-1842), one of the greatest military surgeons of all times, served in the revolutionary and Napoleonic armies from the first republican campaign on the Rhine to Waterloo. He organized the medical services so that the surgeon was brought to the wounded rather than the wounded to the surgeon. The "flying ambulance" was really the "mobile hospital" of today, and like it functioned at the fringe of the zone under fire. Not only was Larrey a great organizer and administrator, but he was also a great surgeon. He believed in amputating at once, rather than in waiting for infection or gangrene, and his practise was as modern as it could be without a knowledge of infection. His *Mémoires de Médicine Militaire* are the nineteenth century equivalent of Paré's "Voyages Made Into Divers Places"; indeed, here a Paré somewhat less the *gascon* and somewhat more sophisticated seems again to walk the battle-fields of France. (S. C. H.)

the results of treatment after transportation of this kind and felt that many unnecessary deaths occurred. By having a number of suitably equipped surgeons follow the advance guard, he arranged to treat the fallen directly on the battle-field and to execute any necessary operations immediately. From these dressing stations the wounded were taken to temporary hospitals, from which they were evacuated to permanent hospitals as quickly as possible, in order to

FIG. XVII. THE MOBILE DETACHMENT FOR THE CARE OF THE WOUNDED ON THE FIELD OF BATTLE. (FROM LARREY'S MÉMOIRES.)

preserve the mobility of the former. This arrangement of Larrey's was accomplished gradually, and only with the help of Napoleon's energy, but it proved so valuable that it was soon introduced into nearly all armies. The surgeons who shared the dangers of the men fighting on the battle-field gained immensely in prestige, and the effect of early treatment appeared marvelous when compared with the results obtained by the older methods.

The English works of the Napoleonic period, while less brilliantly presented, are richer in content, and in many respects resemble Germanic contributions. The more significant of these are the following: G. S. Guthrie*, "Treatise on Gunshot Wounds

* Guthrie's commentaries on war surgery still remain the most weighty and comprehensive of those written in English. The very brief but illustrative case-histories, each bearing upon some fundamental problem carry with them the atmosphere of the Peninsular campaigns. Nevertheless, there is little of the Charles O'Malley about Guthrie, rather a profound seriousness, as a result of which he comes far from underestimating his own importance and that of his profession as an army surgeon. "On termination of the war in 1814, I expressed at first my regret that we had not had another battle in the South of France, to enable me to decide two or three points in surgery which were doubtful." Napoleon obliged him with Waterloo. In his last years he inspected the services in the Crimea, welcoming the opportunity for further experience, but not agreeing with Florence Nightingale (who did not

of the Extremities Requiring Amputation" (German translation; G. Spangenberg, 1821); John Hennen*, "Remarks Concerning Several Important Subjects In War Surgery" (German translation by W. Sprengel, Halle, 1820); and J. Thomson,** "Observations from the British Military Hospitals in Belgium After the Battle of Waterloo, with Remarks Concerning Amputation", 1816, (German translation, 1820).

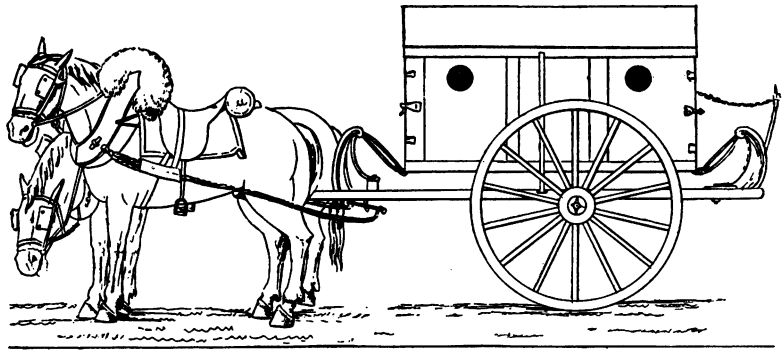

FIG. XVIII. THE LIGHT CARRIAGE FOR THE RAPID TRANSPORTATION OF THE WOUNDED FROM THE BATTLE-FIELD. (FROM LARREY'S MÉMOIRES.)

Of these books, the first two are about the best on the subject. Thomson's observations only included part of the after-treatment, since he played no active part in the campaigns himself and only visited the hospitals in Brussels and Antwerp after the battle of

welcome a battle as a means of clearing up a few disputed points in surgery) as to the inadequacy of the care of the wounded. (S. C. H.)

* John Hennen (1779-1828) was one of those Irishmen, not rare, who seek a career in the King's pay. Born in the County Mayo, and schooled in Limerick, he spent a gay if not studious period at Edinburgh. In 1800 he joined the 40th regiment as an assistant surgeon and served through the Peninsular War and the final campaign against Napoleon in Flanders in 1814. He met a fitting death combatting a yellow-fever epidemic at Gibraltar in 1828, and is commemorated by a monument there. Billroth's comparison of the writings of Thomson and Hennen shows an interesting correlation with their lives. (S. C. H.)

** John Thomson (1765-1846) was a Scotchman by birth and education, studying his profession at Glasgow and at Edinburgh in the University and the Royal Infirmary. For a brief year he fell under John Hunter's influence at Leicester Square, returning to Edinburgh as Professor of Military Surgery, a subject that always seemed to fascinate him although he had but little experience therein. He lectured for seven years, resigning under the criticism of John Bell. In 1832, when the chair of Pathology was founded, largely at his instigation, he was the first to fill it. Always a studious surgeon he was considered "in his time the most learned physician in Scotland". (S. C. H.)

Waterloo. In spite of much that is interesting in this book, to compare it with the works of Guthrie and Hennen is like comparing a good lithograph with an oil painting.

Guthrie collected his experiences in the Spanish campaigns of 1812 and 1813, where he served in the English army under Wellington. His book includes only the most important features of military surgery, and completes the work of Hennen, which was apparently the principal reference used by Stromeyer in working out his "Maxims of Military Surgery".

Hennen had the post of Deputy Inspector of Military Hospitals in the war in Spain, and also in the Belgian campaign against Napoleon. His work is the most fundamental and reliable in English military surgery, as each page is living and realistic. Rare understanding, unusual clarity of conception, enormous knowledge, and wide experience—all the most English of qualities—are united in this book. This surgeon, as well as the other English heroes of science,—Pott, Hunter, and Astley Cooper—is characterized by a great love of truth, understanding, judgment, reliable knowledge, and sure confidence. I cannot recommend the book too highly, and believe sincerely that no surgeon should enter upon a campaign without having read it.

The knowledge added to military surgery by the war of independence in Germany is not great when compared to the books just mentioned. C. M. Langenbeck, the famous anatomist and surgeon of Göttingen, did not publish anything about his activities in Antwerp, where he acted as army surgeon in the hospitals established there after the battle of Waterloo. His treatment of gunshot wounds can be found scattered throughout various chapters in his great work, "Nosology and Therapy of Surgical Diseases". C. F. von Graefe*, general staff surgeon of the Prussian army, has left behind only a brief dissertation on amputation, and a few notes added to the German translation of Dupuytren's lectures. Langenbeck and von Graefe were, above all, outstanding as teachers, and anyone who has been a pupil of the elder Langenbeck will remember that he was considered, *vivo voce*, the most excellent teacher on the

* Carl Ferdinand von Graefe (1787-1840), Professor of Surgery at the University of Berlin, served in the War of Liberation, 1813-1815. He is best known for his contributions to plastic surgery, of which he is the founder in the modern period, and the von Graefe forceps is the first of the modern hemostatic instruments. Albrecht von Graefe, the father of ophthalmic surgery, was his son. (S. C. H.)

medical faculty, and although he laid little emphasis on learning for its own sake, it is richly represented in his publications.

The July revolution of 1830 in Paris, in which Dupuytren* treated most of the 1,200 wounded, caused that surgeon to write his "Lectures on Wounds Caused by Weapons of War". They were collected by his pupils, Kalisch and C. F. von Graefe, translated into German, and supplied with suitable foot-notes. I could not become intensely interested in the book, although it is possible that the original, which was not available to me, may be read more easily and pleasantly.

Finally, we must speak of the book of Baudens,** one of the most genial and arrogant of Frenchmen, entitled "*Clinique des plaies d'armes à feu.* This contains a description of his experiences in the French campaign in Algiers, and for one who can orient himself quickly in a large book, it should be of the greatest interest, since much of the material is new and valuable. It is not necessary, however, to take too seriously, all that he has to say.*** In the book of Hennen, however, one should not skip a single page.

General Conceptions of Gunshot Wounds

The idea that bullet wounds should be classified as crushing injuries involving loss of substance remained in force. Dupuytren

* Guillaume Dupuytren (1777-1835) was the leading French surgeon of his generation. His energy and industry were beyond all compare, and he therefore rose from obscurity to fame, and presently to wealth. He succeeded Sabatier as professor of operative surgery, and was for years the head surgeon of the Hôtel-Dieu. He is remembered for his interest in surgical pathology (Dupuytren's contracture, and the Musée Dupuytren) and his contributions to clinical surgery. Unfortunately, his attitude toward his colleagues was one of contempt and enmity, so that he was more admired than beloved. To Percy he was "the first of surgeons and the least of men". (S. C. H.)

** Jean Baptiste Luciens Baudens (1804-1857), a native of the Pas de Calais, studied his profession in Paris. In 1830 he passed with the colonial forces of France into Algiers where he taught and practised surgery for nine years. He won such a reputation by his achievements there that on his return to France he was made a member of the council of the service of "Santé des Armées", and chief surgeon at the Val de Grâce. He served with distinction in the Crimean War, but died the following year. His writings apparently partake of the flamboyancy of the period of Napoleon the Third, whose campaign in Italy was, at the time of Billroth's writing, stirring up the animosity of the Germans. (S. C. H.)

*** In this book of Baudens on war surgery, the author claimed to be the discoverer of the use of the ice-pack in contused wounds, the first to practise resection of joints in the field, and he assumed the credit for the introduction of chloroform ("this beautiful discovery of Flourens!") in operations in war surgery.

contributed more exact studies of the effect of projectiles, as modified by their speed and the resistance encountered. He attempted to support his claim that the greater the distance from which the shot is fired, the larger the wound of exit would be as compared with the wound of entrance. He states that the wounds of exit in soft parts more closely resemble torn than crushed injuries. Baudens supposed that the bullet acts as a sort of chisel, forcing the soft tissue apart without causing an actual loss of substance. Hennen gives many examples of the queer course taken by bullets, particularly in the neck and thorax. An instrument of Percy's called a *tribulcon* was almost universally used for extracting bullets. Some employed a small forceps as well. Whenever possible, Baudens attempted to remove bullets from deep wounds by means of a counter-opening.

Opinions about the most suitable treatment for simple gunshot wounds varied considerably. All agreed on the principle of primary incision, but some placed greater emphasis on this point than did others. Dupuytren was particularly interested in early débridement of the wound. The fact that suppuration often required later incision was universally recognized. Baudens was the only one who cut all uneven tags of tissue away from the fresh wound margin with knife and scissors, and claimed that the procedure favored rapid healing.*

Another important point, apparently well understood, was that the first properly applied dressing should remain undisturbed for three days. Larrey went even further in this respect, and left his primary dressings untouched until the tenth day, or even later.

The dressings themselves were varied. After most men had been converted to only mildly irritating or non-irritating applications, Larrey reverted to stimulating dressing materials, such as had been employed in the Middle Ages. Opposed to the use of emol-

* The idea was not new with Baudens. In his *Mémoires* Larrey says "Desault taught us that in order to change the nature of wounds from a complicated to a simple state . . . it was necessary to remove the bruised edges with a sharp knife and then to unite the wound with a suture; and that this method is practicable only in wounds of the face, and in solutions of continuity of the soft parietes of the mouth. In my campaigns in Germany and Egypt I have profitted by the practical lesson of this man of genius, who appears to have here made one of the most important discoveries in surgery." This was indeed true, but it was necessary for Sir Henry Gray to discover again in the World War that which Desault in 1790, and Larrey in 1812, had advocated, the débridement and primary suture of gunshot wounds. (S. C. H.)

lients, he covered the wounds with compresses soaked in wine of camphor, red wine, or salt water, and then bandaged the entire limb. Most of the English employed dry lint. Except for a few remarks by Percy, Guthrie was the first to employ cold applications, a treatment also used by Langenbeck, who advised pulling a ligature through suppurating bullet paths of a fistulous nature. Dupuytren used simple dressings, and advised the use of chlorine water in cases where the wound was "atonic". When inflammation was present near the wound, he recommended leeches, a treatment opposed by all others as too irritant. Baudens simply dampened the dressings with cold water and kept them moist and cool by this means. He strongly advised firm bandaging of extremities.

In general, most surgeons inclined to the use of antiphlogistic measures to a degree almost unbelievable at the present time. Almost all the wounded were bled at least once, and those with bone wounds often suffered a repetition of the procedure. Baudens states that the first bleeding should precede the appearance of fever wherever possible. Most patients were kept on a severe dietary régime and were sharply purged. Larrey says that it was safe to allow only the Russians ample food and the use of brandy. Hennen speaks very emphatically about this matter: "Few people endure severe purging and repeated bleeding as well as soldiers."

Hennen makes a number of valuable suggestions about the location and erection of hospitals, as well as about various improved methods of ventilation. It is impossible to give this matter too much attention, since upon it the well-being of many hundreds of wounded is directly dependent.

Accidental Illnesses

All the authors I have mentioned wrote excellent descriptions of wound tetanus, and gave various circumstances as the cause. All admitted that no type of therapy was of value. Dufouart believed that tetanus was less the result of nerve wounds than of the drying of tendons when they were not properly involved in suppuration. Larrey supposed chilling to be the cause of the condition, since it was particularly likely to appear coincidentally with sharp changes in temperature. He admitted that it might be brought about by including nerves in a ligature, and advised careful examination of the wound in any case. Larrey held amputation to be the best method of treatment, but considered deep incision, cauterization with

the red-hot iron, and blister formation useful also. Opium was considered the most effective of the internal medicaments. Hennen expressed himself in no uncertain terms about the worthlessness of antitetanus therapy, and called it a glaring defect in therapeutics. Baudens saw very few cases of tetanus in Algiers, but those that did come under his observation were very acute cases with an almost invariably fatal outcome.

Although Quesnay's excellent work on the different varieties of gangrene had been widely read by the middle of the eighteenth century, apparently hospital gangrene was only quite recently recognized as a peculiar epidemic and contagious disease of wounds. Larrey described this terrible condition very well, and, strangely enough, supposed that its cause was the improper and too frequent dressing of wounds. His description included only the so-called pulpy form. He observed that hospital gangrene rarely involved the vessel wall, even though it developed in the immediate vicinity. He considered that the hot iron was the best caustic and the most rapid in its action. Hennen frequently encountered the rapidly progressive, ulcerative type of hospital gangrene in a well-situated hospital at Bilbao. He supposed that it was due to the fact that a large number of wounded were laid on straw on the ground. Not only did many die from this condition, but fresh scars broke down repeatedly with the development in a surprisingly short time of extensive gangrene. Hennen considered any external treatment useless; although he had heard the use of the hot iron recommended by the French, he could not bring himself to its use. The English surgeons even to the present day hesitate to use the actual cautery. He thought his best results followed dressing with Fowler's solution, and felt that turpentine was the most effective in halting parenchymatous hemorrhage, but he considered emetics, purgatives, and bark useless. He had seen bad results follow early venesection and the internal administration of camphor. It is stated that only a trace of hospital gangrene appeared in the hospitals of Brussels, and that of a very mild sort. Prompt isolation of such cases gave no opportunity for the gangrene to spread. Dupuytren described only the pulpy form, and recommended the daily application of spirits of turpentine and powdered bark to the wound, and if this treatment proved of no avail, he advised the use of silver nitrate, acids, caustic soda, and saltpeter with mercury.

The malignant wound fever was associated with accumulation of

pus, and considered to be the result of resorption of such exudate. This opinion became more and more wide-spread, although the same mechanism was never offered as an explanation of metastatic abscess formation. Dufouart regarded such disseminated abscesses as a favorable condition, and supposed that their expulsion by purulent sputum was to be desired. He rightly observed that any surgical attack should be abandoned from the period when suppuration develops in the wound, and was of the opinion that incision should be made only in cases of the gravest necessity. Amputation was considered a doubtful expedient in cases with suppuration fever. In discussing head wounds, Larrey speaks of liver abscess, a condition previously described by Morgagni. Richerand believed that the condition was brought about by contusion of the liver, but Larrey denied this on the ground that lung and liver abscesses often followed gunshot wounds, especially when joints were involved, and he expressed the opinion that the cause of abscess formation was a sympathetic stimulus to inflammation, transferred or derived from the wound. This, he felt, was favored by a predisposition of certain organs to inflammation, and suggested the possibility that metastatic abscess formation might be the result of infectious particles carried to internal organs by the blood-stream. Guthrie stated that he had never observed such suppuration after primary amputation, but toward the end of the campaign his attention was called to inflammation of pleura and lungs, associated with wounds of extremities. He stated that up to this time he had not recognized internal abscess formation as a cause of death after secondary amputation. He was aware of purulent phlebitis following amputation, but was inclined to consider it a result rather than the cause of wound fever, apparently after giving the matter a great deal of thought. Hennen considered inflammation of vessels and metastatic abscess formation in joints, organs, and body cavities to be the principal cause of death after amputation. He claimed that forced ventilation of hospitals was the only attack on these postoperative conditions.

C. M. Langenbeck believed that internal suppuration was best treated by local drainage and by amputation. He expressed himself in the following original fashion: "The nature of the condition should be investigated before an exchange is offered. An opening is made on each side of the thorax, since blood flows to the thorax in preference to any other organ, and a similar opening above the spot where the amputation is to be carried out. Incision is as effective as

is a lightning-conductor. I never omit this procedure, and hitherto it has always done good. In the same type of case and under the same conditions, no affections of the thoracic contents developed. To those who only admit 'post hoc' and not 'propter hoc', I can only say 'concedo'." Dupuytren assumed a sort of phlogistic and purulent diathesis favorable to the development of distant suppuration and visceral abscess formation. This diathesis he considered similar to the tendency to scrofula, tuberculosis, and carcinoma. Chilling, errors in diet, and mental disturbance were alleged to be the cause of a sudden change in circulation involving an increased intravascular pressure, inducing their effect after amputation of large amounts of tissue. In other cases phlebitis was offered as an explanation by Dance, Blandin, and Cruveilhier. This is certainly not always the cause, since all the symptoms of pus absorption are often seen in cases where no inflammatory lesions of vessels can be found at autopsy, and the illness may even appear in the absence of wounds. Dupuytren considered any case lost when the ominous symptoms of malignant wound fever appeared. Therapy was of no value, he held, and a mild antiphlogistic treatment was the most reasonable, although he had never seen any good result from it. He remarked very pointedly: "The surgeon stands by as a pure observer, and at most can prognose the melancholy course of a disease which he can not ward off, heal, or limit."

Cranial Gunshot Wounds

The beginning of this century saw great changes in the treatment of gunshot wounds of the cranium, since a sharp reaction to the broad indications for trepanation had taken place, indications which had been considered unalterable up to this time. Desault* did a great service in his opposition to the misuse of this operation, and other army surgeons soon fell into line. Larrey, for example, considered trepanation necessary, *1* when a piece of the fractured skull had been

* Pierre Joseph Desault (1744-1795) was trained in the College of Surgery and the great hospitals of Paris; or rather he trained himself, for almost at once his skill and knowledge in surgical anatomy surpassed that of his presumed teachers. Like John Hunter in England, in France he thought of anatomy in terms of function and of disease as pathologic anatomy. The great school of French surgery of the nineteenth century rests upon Desault and Bichat, who fired the train leading to Laënnec. Louis, as well as the other great French physicians of the same period, acknowledged his indebtedness to Desault whose doctrines he expounded. (S. C. H.)

driven inward far enough to injure dura and brain, and could not be elevated by any other means; *2* if a foreign body had become impacted between the broken pieces; *3* when the surgeon was convinced that a great extravasation of blood was present. Under these circumstances, the operation could be done only shortly after the injury or in the stage of complete suppuration, since the presence of inflammation was supposed to increase the risk. Larrey was able to extract bullets by making a counter-opening in certain rare cases, where the projectile had been felt with an elastic sound; one case recovered. He considered the operation either useless or directly harmful in all other cases, holding such a wound to be hopeless from the start. Hennen was the first to point out the value of cold applications in the treatment of cranial injuries, and he strongly recommended repeated venesection, as well as antimony, purgative salts, blue pills, absolute rest, and relaxation. As far as trepanation is concerned, he refers to the principles enunciated by Pott and Abernethy (these, as it happens, do not agree at all).

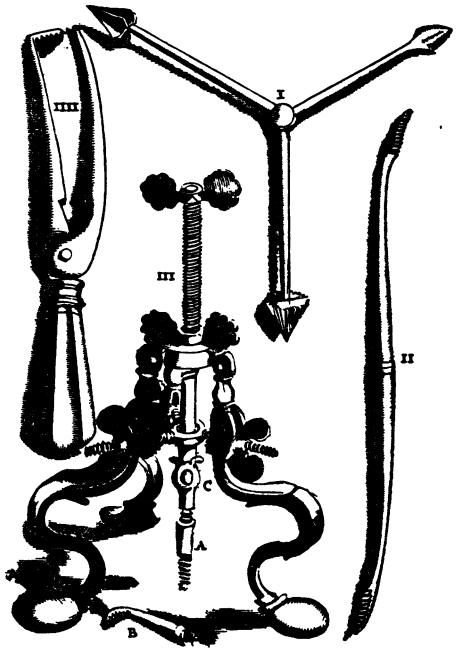

FIG. XIX. THE "TIREFOND" USED FOR THE ELEVATION OF THE DEPRESSED FRACTURE. (FROM SCULTETUS: ARMAMENTARII CHIRURGICI.)

C. M. Langenbeck advised against too early incision in cases of simple crushed head wounds, and discarded the "tirefond" for lifting depressed pieces of skull, favoring the use of the elevator alone for this purpose.

Von Graefe points out that trepanation itself involves the making of a very serious wound, and warns against its too frequent use.

While Dease, Abernethy, Astley Cooper, and John Bell opposed the free use of trepanation in England, Velpeau and Loville became enthusiastic supporters of the operation in France. Baudens criticized the attitude of Velpeau in this matter, and considered unsupportable

the indications given by that author. He did not trepan when the bullet was impacted in the skull, preferring to cut away the bone around the projectile with a knife and a rasp until it could be extracted.

Bullet Wounds of Chest and Abdomen

Few phases of military surgery have been subject to such slight differences of opinion as that of bullet wounds of the chest and abdomen. All writers agreed that non-perforating wounds of ribs, or fractures of the pelvis are not serious, and that the bullet should not be followed too freely in exploring perforating wounds not associated with injury to the intestine. They were fairly unanimous in stating that in wounds of internal organs the matter should be left to nature, except for antiphlogistic treatment. It is obvious that our prognosis for such cases should not be influenced by cures reported under the most unfavorable circumstances, although such statements do give us a ray of hope.

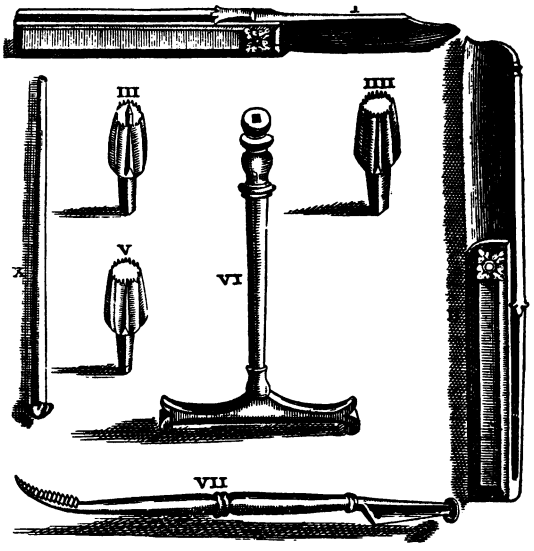

FIG. XX. THE MODERN TREPHINE WITH ANCILLARY INSTRUMENTS. (FROM SCULTETUS: ARMAMENTARII CHIRURGICI.)

It should be mentioned that Larrey was the first to enunciate the principle that immediate union in cases of penetrating wounds of the thorax was the best way to avoid emphysema, hemorrhage, and all other unfavorable complications. Before his time, surgeons had gone to great pains to keep such wounds open, often employing small tubes especially constructed for the purpose.

Gunshot Wounds of Extremities, with a Consideration of the Procedure of Amputation

At this period, prompt ligation was considered the best means of attack on arterial hemorrhage complicating gunshot wounds of

extremities, and nearly all writers warned against too much reliance on the principle that bullet wounds never bled to the point of danger. Without question, many died from hemorrhage on the battle-field, following wounds of large arteries, though some lives were certainly saved by timely ligation. Guthrie advised ligating both ends of the wounded vessel, especially in injuries where the entire extremity had been crushed, even though there was no arterial hemorrhage at the moment. He stated that bleeding often set in when the patient was transported at a time when suitable surgical assistance was not available. Hennen recommended cutting the ends of ligatures short when large vessels were ligated in continuity, on the grounds that healing by first intention would be favored. The small loop around the vessel would discharge harmlessly later by the formation of an abscess, and the danger of secondary hemorrhage was not so great. This procedure had many adherents in England, but was never universally accepted in Germany, and has now been discarded, although under certain circumstances it is surely worthy of consideration.

Most army surgeons were of one mind concerning the types of cases which definitely required amputation. According to Thomson, amputation should always be done under the following circumstances: *1* if a limb had been shot away; *2* if cannon-balls had caused a considerable degree of damage to bones or joints; *3* if large amounts of soft tissue had been avulsed, with consequent injury to nerves and vessels; *4* if a bone had been fractured by a flattened bullet without breaking the skin, but associated with destruction of soft tissue; *5* if a musket bullet had penetrated a main artery and broken the bone at the same time; *6* if a musket bullet had passed through a joint, destroyed the articular surface, and severed tendons.

All experienced men agreed that such general directions could be only approximate, and each case must be judged on its merits. Especial attention was given to the location of the wound, as to whether it involved a lower or an upper extremity, since arm wounds always have a better prognosis than do cases where the leg is involved. Nearly all agreed that any gunshot wound of the thigh was an indication for immediate amputation, and it was considered dangerous to institute expectant treatment of gunshot fracture of the lower leg, although justified when similar wounds of the upper arm were concerned.

Larrey and Baudens brought about an unusual development of exarticulation of the thigh and upper arm; the various exarticulations of the foot were less frequent, since wounds of that member were not so common. Baudens referred to a large number of joint injuries which ran a favorable course without operation, and healed with partial or complete ankylosis. He specified that wounds healed particularly well when exposed to the sun in Africa. The method of amputation which he described as his discovery, calling it a *methode mixte*, and stating that he had attained particularly favorable results with it, differs in no way from the double flap operation of Ravaton, although his method of execution is somewhat different.

The most favorable time for amputation had been a point of lively controversy during the previous century. It became particularly prominent when the Paris Academy offered a prize, in 1745, for the best dissertation on the subject. An article by Faure, in favor of late amputation, was successful, and this fact proves that the point of view defended by the paper was accepted by the most prominent authorities. There was little opposition until the time of Larrey, who threw the weight of his wide experience into the scales in favor of early, or so-called primary, amputation. The reason for so much uncertainty in this matter was, as is so often the case in learned discussions, that the question was never properly propounded. Le Conte divided the cases into those in which amputation could be postponed and those where it could be done immediately without danger. Boucher made a more satisfactory division, as follows: *1* the period directly after the injury, when the patient is still in a stupor; *2* the period during which the patient had recovered from this condition; *3* the period of severe inflammation; *4* the period of demarcated suppuration. Larrey pointed out that the patient should be allowed to recover from the first shock of the wound before the operation was undertaken, and stated that the time required for this recovery varied with the wound and the constitution of the patient. He stated that when the wounded man had recovered, the required operation should be done as quickly as possible. This is the so-called primary amputation. The period of severe, progressive inflammation was held to be the most unfavorable, and operations were done at this time only under the most pressing circumstances. The most suitable time was given as about three weeks after the injury, but unfortunately patients who really required amputation seldom

survived to the stage at which secondary operation had the best chance of success.

Guthrie and Hennen expressed the same opinion, apparently quite independently of Larrey, since they allowed him full priority. C. M. Langenbeck, v. Graefe, Dupuytren, and Baudens held fast to the same principles. Guthrie presented a striking collection of statistics which were decidedly in favor of primary amputation, since the results were better than those of secondary operation, excluding those cases which did not survive to the suitable period for the later procedure.

This point of view is quite as applicable to the operation of resection, and is now well-recognized. Extension of joint resection, better methods of fixing complicated fractures, improved equipment for transportation, and hospitals—the inevitable progress of the healing art—cause us to hope that perhaps in the future it will be possible to save the lives of the unlucky sacrifices of war by means of more certain and less strenuous methods. Nevertheless, we should not stray too far from the fundamental principles of those men who have left to us their wide-spread observations derived from the toil and misery of the long war at the beginning of this century, and whose work has been stamped by history as masterly and accurate.

The Most Recent Literature on Military Surgery

(Proceedings of the National Academy Regarding Gunshot Wounds,—Ross, Esmarch, H. Schwartz, Stromeyer, Beck, Simon, Baudens, Scrive, Lohmeyer, Löffler.)

We have extended the territory of history farther than is the custom of historians, and should break off at this point. It is not our intention to criticize the newer books on gunshot wounds, as this could only be done by means of personal experience. To abstract the books is also far from our design, and the reader may believe that we will spare him tiresome repetition, since the purpose of this paper is to stimulate reading. Since what has gone before has been a sort of incomplete review of the literature concerning gunshot wounds, as well as an outline of the historical development of the different opinions regarding these conditions, we will continue the same plan in reference to the more recent times and briefly indicate what the reader may expect to find in the different articles.

The February revolution in Paris, of the year 1848, furnished a number of wounded, which served not only as the subjects of clinical lectures, but also caused a discussion of gunshot wounds in the Académie Nationale de Médecine. The various reports were published for the most part in the Gazette des Hôpitaux, and later collected and translated into German by Dr. Wierrir. There are few books more suitable for the instruction of the young physician. The names of the contributors, Roux, Velpeau, Baudens, Blandin, Malgaigne, Jobert, etc., give proof enough that many valuable suggestions were made aside from the vast amount of commonplace material. Blandin gave a more accurate description of wounds of entrance and exit than had existed up to that time. Malgaigne shone once more in the statistical field, and in harsh, though pointed, criticism.

The wars of 1848-1850 in Schleswig-Holstein had a great influence on German military surgery. They, as well as the revolutions in Italy and South Germany, produced not only a number of excellent young surgeons, but also some very good—a few excellent—books on gunshot wounds. In contrast to other nations which gained little or nothing of a scientific nature from their recent wars, this fact is a refreshing proof of the scientific training of the German physicians, and certainly should be regarded as the result of our constantly improving university equipment.

The "Maxims of Military Surgery" of Stromeyer is in the hands of almost all physicians, and all consider the book one of the most valuable texts on German surgery. Since I read Dieffenbach's* Surgery, no book has appealed to me and left such an enduring impression behind as has this work of Stromeyer.

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* Johann Friedrich Dieffenbach (1792-1847) succeeded von Graefe as Professor of Surgery at Berlin, and was surgeon at the Charité for many years. He was followed by B. Langenbeck, Billroth's teacher. Dieffenbach was a pioneer in the plastic and orthopedic phases of surgery, and wrote the great operative surgery of his time to which Billroth refers.

Georg Friedrich Louis Stromeyer (1804-1876) was the most outstanding military surgeon of the nineteenth century, largely because of his "Maxims of War Surgery". This, in contrast to its title, is a rather bulky volume, crammed with sound scholarship and the practical surgery of traumatic lesions, as well as the diseases common in armies. He was also one of the founders of orthopedic surgery, his influence being felt abroad. He successively held professorships of surgery in Erlangen, Munich, Freiberg and Kiel, and in Billroth's day was one of Germany's more illustrious surgeons. (S. C. H.)

The little book of Friedrich Esmarch,* "Concerning Resection After Gunshot Wounds" should be considered a pillar of conservative military surgery. The younger generations of surgeons are already thoroughly imbued with the principles enunciated by B. Langenbeck and Stromeyer, which are set forth in Esmarch's book. I recommend the study of the after-treatment of resection cases as set forth there. According to my opinion, this matter is more important than is the operation itself, for it concerns not only the subsequent usefulness of the extremity, but also the life of the patient.

The "Lectures on Gunshot Wounds Collected in the Campaigns of 1848, 1849, and 1850", by Dr. Harold Schwartz contain a great wealth of accurate observation and give many practical rules without theoretical digressions. The entire question of gunshot wounds is thoroughly discussed, although little attention is paid to conditions which have not come under the direct observation of the author.

The modestly written little memoir of G. Ross, "Military Surgery in the First Schleswig Campaign", is similar in form to the memoirs of Larrey. The observations on the resection of long bones in continuity are important.

"Concerning Gunshot Wounds with Observations on the Wounded, Cared for in the Military Hospital at Darmstadt in the Summer of 1849", by Gustav Simon, is distinguished by its original view-point and by the clarity and pungency with which it is written; the subject is handled with freshness so that the treatise presents the theoretical aspects in a pleasing manner; also the more recent developments as presented in many minor contributions are taken up and it is therefore unusually stimulating.

A book outstanding as a review of the literature and in its observations is "Gunshot Wounds" by B. Beck, a student of Stromeyer, who obtained his experience chiefly in the campaigns in Italy and Baden. Especially well done is the introduction in which he paints a life-like picture of the military duties in the field.

From the bloody war in the Crimea, in addition to a few very

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* Friedrich von Esmarch (1823-1908) was of the same generation as Billroth, and one of his frequent correspondents. He was a great military surgeon by right of experience, serving through the three major campaigns of the Bismarck period. A pupil of Stromeyer and B. Langenbeck, he occupied with distinction the chair of surgery at Kiel for many years, and carried his knowledge of war surgery over into the treatment of the traumata of civil life. (S. C. H.)

insignificant articles in the Journals, two thick military books have been published, but they contain little on war surgery. The one "Medical and Surgical Account of the Campaign in the East" by G. Scrive, medical inspector of the "Service de Santé" of the armies, portrays in an illuminating manner the functioning of the sanitary and technical arrangements which were characteristic of this campaign; but it contains little of general surgical interest. The other, "The War in the Crimea", by Baudens concerns itself for the most part with various means by which one attempted to overcome those invisible foes, typhus, cholera, ague, and hospital gangrene. That Baudens, a surgeon, did not deal more especially with straight surgery is in part because he first joined the army after the fall of Sebastopol, and in part by reason of the increased significance in modern times of the general sanitary control in the camp and hospital. With this the medical functions in the field became of increasing importance and the beneficial influence of this in the Crimean War was recognized, so that both of these books lay great weight upon this matter. If it is important that military surgeons in high command should read these works in order that they more correctly realize their responsibilities, it is also very desirable that the war department officials and those concerned in the administration of the armies should also read them. One may find there a not unimportant part of the mystery by which the French army was maintained in a vigorous condition for battle.

Quite recently has appeared two editions of Lohmeyer's book "Gunshot Wounds and their Treatment, Briefly Presented". It is written in the style of a "Handbuch" and does not please me; it contains many things that one knows to be incorrect; it is one of those sterile books which it is to be regretted ever attain a second edition.

Quite of another nature is the short book of F. Löffler, "Fundamental Precepts for the Treatment of Gunshot Wounds of War. First edition; From the Battlefield" (Berlin 1859). One can judge from the title what the author will make of it; the urgent desire of himself and his colleagues to make known during the campaign itself, certain fundamental principles of treatment, has given occasion for this sketch.

It would not become me to describe in more exact outline the broader duties of military surgery without having had first-hand

experience in the entire medical activities of a campaign. Any surgically inclined reader may acquire sufficient information from any of the better recent works on surgery. Any man who is to act as a medical man in the field is in duty bound to learn beforehand what is expected of him. The books of Hennen, Guthrie, Larrey, and Stromeyer are therefore strongly recommended to all surgeons.

Only the man who is familiar with the art and science of the past is competent to aid in its progress in the future.