visiting Buxton in winter, spring, and autumn than in the hot months of summer, and this applies to the most varied sorts of complaints. During a long experience I have noticed that the cases visiting Buxton do worse in hot seasons than in cool, even though the former be dry and the latter very wet." Even in his first edition the author advocated the establishment of a sanatorium for climatic treatment at Buxton, and we hope to see his suggestion in regard to a sanatorium for poor consumptives carried out.

The Clinical Diagnosis of Lameness in the Horse. By W. E. A. WYMAN, V.S., Professor of Veterinary Sciences at Clemson A. and M. College. (New York: William R. Jenkins. 1898. Roy. 8vo. Pp. 170. 32 Illustrations.)—This "little effort," the author states, "is a summary embodying the teachings of Professor Möller, of Berlin, arranged in a practical manner." His first chapter deals with the detection of the lame leg, the second in a general way with detection of the seat of lameness, while the last discusses in detail the diagnosis of lameness arising from various affections of the several regions of the limbs, etc. The arrangement is rational and systematic, and the writer's ideas are clearly expressed in text and illustrations. It is somewhat remarkable that so little should have been specially written on a subject which gives rise to so much controversy, and which is so important to those having the care of horses. In works on veterinary surgery lameness as an indication of abnormality of parts receives much consideration, but Dr. Wyman's book is the first we have met with dealing exclusively with its detection. Probably the paucity of literature on the point is due to recognition of the fact that proficiency in the detection of lameness and its seat cannot be gained from reading alone, but demands long and patient exercise of the powers of observation in presence of the patient. Though there may be little which is original in this work, much may be gained by the reader whose observation is guided by the methods herein set forth.

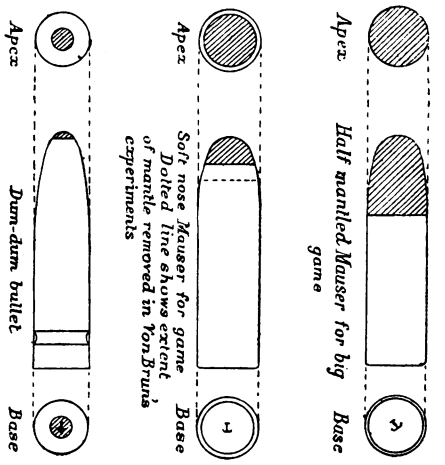
THE WOUNDS PRODUCED BY MODERN SMALL-BORE BULLETS.

THE DUM-DUM BULLET AND THE SOFT-NOSED MAUSER.

"INHUMAN" OR "INHUMANE."

IT will be remembered that considerable feeling was aroused in the spring of this year by an address delivered by Professor von Bruns to the Congress of German Surgeons which met at Berlin in April. It was very generally assumed, not by any means only in this country, that his address contained what was practically a charge of inhumanity against Great Britain. The questions discussed by Professor von Bruns have thus been somewhat prejudiced by what was, in fact, an unhappy rendering of the title of the address. To this address, which was a preliminary communication, Professor von Bruns had given the title On Inhumane Military Projectiles, and this was in some quarters translated as dealing with *inhuman* projectiles. As the Dum-dum bullets employed in the recent campaigns on the frontiers of Afghanistan are the only lead-pointed small-arm bullets that have been extensively tested in actual warfare, the error was unquestionably one to be regretted. It is to be hoped, however, that the question raised by von Bruns, which is of wide importance to all nations, and especially to our own, will be considered and discussed in a temperate and unprejudiced fashion, such as it eminently deserves.

Professor von Bruns has now published a volume,[1] for a copy of which we are indebted to him, which deals, as its title shows, with the effects produced by the modern lead-cored, nickel or steel-covered bullets, when they have been more or less deprived at their point of the outer hard covering or mantle in which they were until recently entirely encased for use in all the modern European small-bore military rifles, such as the English Lee-Metford, the German Mauser, the French Lebel, etc. This hard mantle was adopted to enable them to take the grooves when propelled, by the powerful modern explosives, through the rapidly twisted rifling of the barrel, and to withstand the enormous friction and pressure.



The Dum-dum bullet and Mauser bullets with mantles partly removed. The shaded portions show where the mantle is absent and the leaden core exposed.

Rightly to comprehend the question which von Bruns raises, some preliminary remarks are indispensable. It has long been well known to military surgeons and sportsmen who have studied the action of bullets that there are two principal ways in which their energy can be expended when they strike a man or an animal. If the projectile be a hard one, as when its leaden core is enclosed in a hard mantle, or when it is provided with a steel tip, or when it is of lead hardened by alloying it with tin, etc., its energy is mostly expended in penetrating deeply, while the bullet alters little in shape. Such projectiles are often used against hard-skinned animals, such as elephant, rhinoceros, and hippopotamus, or against those which are dangerous from their bold and reckless charges, such as buffalo. Such bullets have the property of penetrating deeply into vital parts through thick and hard skin and bones. But if, on the other hand, they strike a soft non-vital part they may pass completely through, and a large proportion of their energy thus be lost, so that they have little perceptible effect on the animal, and this is particularly found to be the case if their diameter be not great.

If, on the contrary, the bullet be of soft lead, the resistance it encounters, and the heat generated on impact, cause the bullet to alter its shape, and become broader, or even mushroom-shaped at the cost of its length; the deeper it goes the more deformed it becomes; and it inflicts thus a larger wound, increasing in size with its depth, This alteration of shape has been termed the "setting up" of the bullet. With such projectiles the energy is expended in making a large and disabling wound, and the bullets possess more "stopping power" than the hard ones.

EXPLOSIVE AND EXPANDING BULLETS.

Formerly this tendency of the bullet to deform used to be increased by explosives being placed in a cavity n the front of the bullet, so as to detonate upon impact. But "explosive bullets" have long been abandoned by sportsmen, as the same effect is found to be better produced by merely leaving a small empty air chamber in the apex, which rends and widens the projectile on its striking, causing it to be classed as an "expanding bullet." Expanding bullets do not traverse the animal completely, but remain within its body, expending all their energy in disabling it, even when none of the hard parts are struck. They are used against deer, antelope, lion, tiger, and other soft-skinned animals, which, when so struck, are unlikely to move far or fast, or to charge at, or escape from, the sportsman.

All these soft, explosive, or expanding bullets have the dis-

[1] *Ueber die Wirkung der Bleispitzengeschosse ("Dum-Dum" Geschosse).* Von Professor Dr. v. Bruns, Generalarzt à la suite des K. Württ. Sanitätskorps. [On the Effects of Lead-pointed Projectiles (Dum-dum Bullets). By Professor von Bruns, Surgeon-General in the Würtemberg Army Medical Service.] Tübingen, 1898, Laupp'sche Buchlandlung. The volume contains 24 pages, 13 photolithographs, 5 skiagraphs, and 1 woodcut.

advantage that they do not penetrate deeply, and are easily stopped by a large and firm bone or by other resistance, so that they are little used against hard-skinned animals. Man is a soft-skinned and easily disabled animal, and civilised nations have agreed, by the St. Petersburg Convention of 1868, to renounce in war the use of explosive bullets for small arms. But regarding expanding bullets no such agreement exists, or indeed could exist, as all military leaden small-arm projectiles used in 1868, were more or less expanding.

RECENT CHANGES IN SMALL-ARM BULLETS.

Since the date of the Convention of 1868, the small arms of the European Powers have undergone considerable changes, which are mainly the following:

First, by lessening the diameter of the bullet and propelling it by a greater explosive force, the velocity of the bullet has been greatly increased, and since the velocity has much to do with the energy a bullet expends on striking, these bullets at the ordinary distances of warfare possess a greatly increased energy on impact. We have seen that energy can be expended either in penetration or in making a large "stopping" wound, according as the projectile is hard or soft, and hence since,

Secondly, bullets are now encased in a hard mantle of nickel or nickel steel to prevent their losing their shape in passing through the rapid twists of the rifling of the barrel at their present high velocity—our projectiles have gained enormously in penetration (they will traverse three men or more in a row), but exhibit a corresponding loss of their power of producing disabling wounds if they fail to reach a vital part or strike an important bone.

Thirdly, bullets now kill or wound at much greater distances than formerly, that is, their range is increased. They will, for instance, kill even at two miles' distance. But as at these long ranges they have lost most of their initial velocity, they there produce no phenomena on impact that we were not already familiar with in the older weapons, and their increased range is not of special interest to us in connection with the present subject.

Scarcely was the ink of the St. Petersburg Convention dry when questions arose presaging the present difficulty. In the Franco-German war of 1870-71, the newly-introduced Chassepot rifle employed by the French propelled its projectiles with such velocity, that at near ranges, when they struck upon a compact bone, the soft lead composing them frequently flew into fragments, and produced effects resembling an explosion. Kocher, of Berne,[2] experimentally showed that the apparent explosions were due to two causes: first, the bullets, heated and softened by their striking a compact bone with enormous energy, flew into fragments of all sizes, even to minute dust, and tore a large hole; and, secondly, if they struck a cavity filled with fluid or semi-fluid matter, such as bladder, skull, or bone enclosing a medullary cavity, the contents of the cavity were driven by hydraulic force in all directions equally, and the bony or other enclosure was rent into fragments by its own contents after the manner of a shell. Kocher's experiments showed that the apparent explosions were not due to any explosive materials, and the impeachment of the French military bullets went no further.

THE MANTLED LEADEN BULLET.

At the present moment nearly all European troops are armed with small-bore weapons firing the mantled leaden bullet of very high velocity. The cartridge, shell, explosive, and bullet are on the whole very similar among all these nations, although differences exist which should make us a little cautious in concluding that their effects will be absolutely identical.

On these weapons first appearing, they were soon tested by sportsmen against large game, and it was at once seen that the want of setting up or expansion of their bullets on impact was in many respects against them, as the animals were only slightly disabled by wounds involving only the soft parts, or unless some important vital organ or important bone were seriously injured. It was attempted to remedy this defect, first by slitting the mantle so that it might permit the leaden core to expand on impact, and next by leaving the apex of the leaden core uncovered, which answered the same purpose better, as the incomplete mantle rent in all directions on striking. Such bullets, called "soft-nosed," are now in use for killing elephants and hard-skinned as well as soft-skinned big game, and are said to excel all former projectiles, both in their penetration and in their disabling power.

Experience was gathered more slowly by military surgeons regarding the effects of the new projectiles upon man. From Chili, Greece, the North-Western frontier of India, and, lastly, from the Soudan, information was obtained showing that in mere flesh wounds the injuries produced by the modern bullets were remarkably slight—so slight that a brave and determined enemy was not stopped or disabled in his onset, even if his wound were necessarily mortal in time. So much was this found to be the case when the modern English magazine rifle was employed against brave and fanatical tribes, that the leaden core was in the late Chitral and North-Western frontier of Indian wars, intentionally exposed, and the character of the bullet altered, by the soldiers rubbing a portion of the mantle off the apex; and, finally, this alteration was adopted by the authorities and carried out in the Dum-dum arsenal near Calcutta. Hence the projectiles so supplied, with their core partly exposed, received the now familiar name of Dum-dum bullets. And the bullets so prepared were found to expand on impact, and thoroughly to disable a wounded enemy.

VARIATIONS IN ITS EFFECTS.

It has then to be remembered, in considering the various experiments and conclusions detailed in von Bruns's paper, that the behaviour of small-arm bullets upon impact varies greatly according to circumstances, and tends especially to exhibit the following peculiarities:

1. *Penetrating Bullets.*—Hard and mantled bullets tend to penetrate to great depths without becoming deformed.
2. *Setting-up Bullets.* — Soft leaden bullets of moderate velocity and energy tend to become shorter and broader and even mushroom-shaped at the tip upon impact, which has been termed the "setting-up" of the bullet.
3. *Expanding Bullets.*— Soft leaden bullets with an air chamber at the apex tend to expand to a greater degree than No. 2 when they strike.
4. *Disintegrating Bullets.*—Soft leaden bullets or mantled bullets with leaden tips, when their velocity and energy are great, tend to fly in pieces or disintegrate on impact. This is to be distinguished from the following.
5. *Explosive Bullets.*—Bullets provided with substances that detonate on impact, enclosed in their apex or elsewhere, are the explosive bullets properly so-called.

We can now appreciate the experiments of von Bruns with lead-pointed bullets upon man, published in the work which is the subject of the present review.

VON BRUNS'S EXPERIMENTS.

Von Bruns's experiments were made with the German Mauser bullets, some of which were altered by removing part of the mantle at the apex so as to imitate as nearly as possible what the Dum-dum bullets were supposed by him to be. But it is important to observe that von Bruns has evidently never seen or experimented with the genuine Dum-dum bullet. The results of his experiments were very striking. Using cadaver material and demonstrating the effects by the actual preparations, photographs, and skiagraphs, he showed that at ranges up to 200 metres the leaden-pointed mantled projectiles which he used produced "wounds more severe than any hitherto known gunshot wounds." They had a huge aperture of entrance and a still larger exit wound; the flesh and skin at both were torn into tongues and strips, often like the slashes of a mediæval costume, and the soft parts generally were ragged and pulverised, as if they had been blown from the mouth of a gun. Skiagraphs showed that the bones also were reduced to hundreds of minute fragments, and, although the bullet itself always passed through and escaped, the wound was bestrewn with minute fragments of its metals, from the size of a split pea to that of a pin-point. In every case, even when the soft parts alone were involved, amputation would have been the only possible resource. These results von Bruns terms "explosive action," and he points out that it is present in wounds of the soft as well as of the hard parts. He adds that in acquiring this destroying power the bullets lose in

[2] *Schusswunden*, Leipzig, 1880.

penetration, and hence at long ranges are inferior in this quality to the completely mantled bullet. At 400 metres the "explosive" effects were produced, though in a less degree. Beyond 500 metres these effects ceased to be commonly observed.

PROPOSED PROHIBITION OF LEADEN-TIPPED MANTLED BULLETS.

Von Bruns, as the result of these experiments and observations, proposes that all such lead-pointed bullets shall be pronounced inadmissible in warfare between civilised nations.

There can be no doubt that von Bruns, in the paper before us, has amply proved that the bullets with which he experimented produce dreadful wounds at short ranges, and surgeons are indebted to him for having drawn such marked attention to them. The writer has repeated his experiments with the same Mauser bullets as von Bruns employed, with results which confirm those which he obtained.

There is also no doubt that von Bruns, in treating the subject, has stated his facts and conclusions in a proper and temperate manner, and has used no terms that should offend English susceptibilities in regard to the Dum-dum bullets. Neither in his *vivâ voce* address to the Congress of German surgeons, nor in the report of it since printed and marked "original" in the *Centralblatt für Chirurgie*, July 2nd, 1898, *Beilage*, page 38, nor yet in the pamphlet now before us, has has there been any evidence of harsh or hasty speaking, or of an inclination to make, to the disadvantage of anyone, more of the facts than they deserve. And the facts, as von Bruns in his writings, photographs, and skiagraphs so graphically depicts them, are such that we cannot perceive anything very unreasonable in his having come to the conclusion that "the German military authorities should take steps to obtain, by international agreement, such a modification of the St. Petersburgh Convention that only such small-bore leaden bullets be employed in war as are wholly steel mantled, or at least mantled at their tip."

THE DEFECTS OF VON BRUNS'S EXPERIMENTS.

We say it is perfectly reasonable in von Bruns to sustain this thesis. But that it would be wise unreservedly to adopt his conclusions is not so evident. There are several matters that first require consideration, and these may now be stated.

1. In the first place, von Bruns's experiments were not made with Dum-dum bullets at all, but with soft-nosed Mauser bullets, such as are manufactured for German sportsmen for use with the Mauser rifle in shooting big game. As we write there lie before us Dum-dum bullets obtained from the War Office, soft-nosed Mauser bullets such as that shown by von Bruns at Berlin in April, and the *facsimile* of the Mauser bullet drawn in the pamphlet under review. All of these Mauser bullets were procured by the writer last April in Berlin, when von Bruns's communication was first read, and with one or other of them von Bruns's experiments were made. When they are laid alongside the Dum-dum bullet (see diagram) any one accustomed to deal with such questions would certainly decline to admit that experiments with the former necessarily justified conclusions regarding the latter. The Mauser bullet is a more perfect cylinder (that is, tapers less in the front half), its diameter is greater, so are its weight and initial velocity (though slightly); and, lastly, von Bruns's bullets show 5 mm. of lead exposed, while the Dum-dum bullet shows but one, if so much. Looked at from the front, von Bruns's bullets appear all lead, while in the Dum-dum bullet about one-third of the diameter only is uncovered by the mantle. Hence it is clear that von Bruns's experiments were made with projectiles too unlike the Dum-dum to justify us in at once accepting his conclusions as being true of it. They may be probable, but they are not proved.

2. In the second place, retention of the complete mantle would not, in many cases, do away with the disintegration of the bullets on impact at short ranges and their consequent pseudo-explosive effects. This was shown in 1870-71 by the Chassepot bullets, and was due to their great velocity, or rather energy, on impact. So long as it is permissible in war to use weapons which, like all our most modern small arms, discharge projectiles of such high velocity and great energy on impact, anything that will rend the mantle, such as striking a buckle, button, or the like, or a dense compact bone, as well as their impinging upon a cavity filled with fluid or semi-fluid material, will produce a disintegration, or, as von Bruns calls it, an explosion. Such things occurred even with the old weapons. The writer saw in the Sixties a coastguardsman who had shot himself with an Enfield carbine by placing the muzzle against the left angle of his lower jaw. On striking this hard bone with full muzzle velocity the bullet burst into hundreds of fragments which, mixed with pieces of bone, blew brain and skull to the ceiling above in a mingled spray of flesh, bone, and lead. Only by using weapons of less muzzle velocity than our modern small arms can we avoid the frequent occurrence of disintegration of bullets at short ranges.

3. In the third place, the term "explosive" applied by von Bruns to these disintegrating bullets is misleading and open to objection. We have demonstrated that some term such as "disintegration," which we have here applied to the phenomena that have been studied, first by Kocher and now by von Bruns, is required to distinguish them from those of true explosion; and we must therefore dissent from von Bruns's statement that "by the enormous increase of their initial velocity, leaden projectiles themselves become explosive bullets" (Pamphlet, p. 22).

4. Fourthly, von Bruns in none of his papers has any control experiments, photographs, or skiagraphs to enable a comparison to be made between the effects of the lead-pointed projectiles and the fully-mantled bullets. He writes as if the latter were fully known, and to this exception may be taken. In any case, in a scientific treatise aiming at arriving at such far-reaching conclusions, it would have been fitting to furnish such a means of comparison.

5. And, lastly, as we have shown that von Bruns in his experiments neither possessed nor employed the Dum-dum bullets, we consider him inaccurate, beyond what is permissible in such a question, in assuming that they would have given results identical with those of his big-game Mauser bullets. It was at least premature to class them together in the title of his paper as "leaden-pointed projectiles (Dum-dum bullets)," and we believe his doing so is not likely to promote his object of having all such projectiles excluded by international agreement from use in civilised warfare.

ALEX. OGSTON.

ARCHÆOLOGICA MEDICA.

XLV.—WILLIAM CHESELDEN, ANATOMIST AND SURGEON.

WILLIAM CHESELDEN must be looked upon as the father of modern English surgery, for he belongs as much to the old school as to the new. Born on October 19th, 1688, the son of George Cheselden, then living at the extreme end of Somerby, a village in the County of Leicester close to the great British encampment of Burrow Hill, Cheselden seems to have been descended from a wealthy family of graziers who contributed several members to the medical profession. William Cheselden received a good classical education and was apprenticed to Mr. Wilkes, a surgeon of repute in Leicester. In 1703 he was studying anatomy as the house-pupil of William Cowper,[1] but he appears to have left him when he was only 15 years old, for on December 7th, 1703, he was bound apprentice for seven years to James Ferne, the Surgeon to St. Thomas's Hospital. On December 5th, 1710, he was admitted to the freedom and livery of the Barber-Surgeons Company, and on January 29th following he had a full certificate to practise as a surgeon. He seems to have begun at once to lecture on anatomy, for in 1711 he issued a printed syllabus, which shows that his course consisted of 35 lectures and that it was repeated four times a year. The popularity of his lectures and the way in which they interfered with the routine courses delivered at the Barber-Surgeons Hall are attested by the minute still extant in the books of the Barber-Surgeons' Company, which runs: "At a Court of Assistants of the Company of Barbers and Surgeons held on March 25th, 1714; our Master acquainting the Court that Mr. William Cheselden, a member of this Company, did frequently procure the dead bodies of malefactors from the place of execution and dissect the same at his own house, as well during the Company's public lectures as at other times without the leave of the Governors and contrary to the Com-

[1] See Arch. Med. XLI, BRITISH MEDICAL JOURNAL, i, 1898, p. 160.