Hill's statement with regard to them is absolutely incorrect, and I will again consider it under the charge of incompetence.

As I have already pointed out more than once, Mr. Leonard Hill's accusation that many of the experiments performed by the Hyderabad Commission were so careless in execution that they could not for a moment be accepted by trained physiologists, applies in its present form to all their experiments, and must so apply until the experiments to which it actually does apply are specified so as to exclude those to which it does not apply. I asked him to specify the untrustworthy experiments, and with the exception of those which I shall deal with under the head of incompetence his "many" have dwindled into *one* solitary experiment which he utilises for a double purpose, employing it in his lecture as the basis of an accusation against me of ignorance of exact physiological methods and using it in his rejoinder as the basis of an accusation of carelessness; but, as I have already shown, this solitary experiment upon which Mr. Hill would found so much affords no basis whatever for either of his accusations.

Having thus examined the evidence by which Mr. Hill attempts to support his accusation of carelessness—an accusation which if proved would totally destroy the whole experimental work of the Hyderabad Commission—we find that it consists, first, in a fancy of Mr. Hill's that work is untrustworthy if it is done (1) in an out-of-the-way place, (2) with limited apparatus, and (3) in a short time, a fancy which fortunately for the world at large exists only in Mr. Hill's imagination, and does not correspond with facts; secondly, in a statement that the apparatus employed did not meet with Mr. Hill's approval; finally, we find that the "many" experiments which he denounced as untrustworthy have shrunk down into a solitary one, and even against this Mr. Hill's evidence of carelessness utterly breaks down. Such are the grounds on which Mr. Hill seeks to destroy the whole experimental work of the Hyderabad Commission.

I will now take up Mr. Hill's third accusation of ignorance of physiological methods. In his lecture he attempted to prove this charge by bringing forward the experiment of injecting chloroform into the jugular vein. In my reply I showed that this so-called proof was worthless, and that all the best textbooks on physiological methods recommended the method I used. In his rejoinder he finds it convenient to shift his ground, and say it was not the method but the manner of using it that was objectionable, and he now brings it forward as a proof not of ignorance but of carelessness, and under this heading I have already dealt with it. Another proof which he brings forward in his rejoinder in support of his accusation of carelessness, but which, as I have already shown, ought really to have come under the heading of ignorance of exact physiological methods is that "an absolutely inefficient method was used to record the energy of the heart. A heart when poisoned with chloroform is thrown into paralytic dilatation; it continues to beat, but is incapable of emptying its cavities. A needle thrust into the heart would exhibit the efforts of contraction, it tells us nothing of the efficiency of action of that organ, and yet this was the method employed by the Commission." This statement of Mr. Hill's is a most extraordinary one, for if he has read the report he must know that the Commission did not employ a needle in the heart in order to record its energy, but simply in order to ascertain whether it was contracting or not, for which purpose, as Mr. Hill himself acknowledges, it was amply sufficient.

I now come to Mr. Hill's last accusation—namely, that of incompetence. In his lecture he affirms that I, in experiments on the effect of altered position, paid no attention to the absolute necessity of placing the arterial cannula in the axis round which the animal was turned, and that by neglect of this simple precaution the experiments on the point were rendered utterly worthless. Although it is in another place that he applies the word "incompetent," yet if his accusation that I neglected this simple precaution were true, I should well deserve the epithet. But this statement is a pure product of Mr. Hill's imagination. It does not correspond to the facts of the case, and is therefore untrue. Nevertheless Mr. Hill considers that he was justified in uttering it, without taking the trouble to ascertain previously whether it were true or not because he did not find in the report a state-

ment that certain precautions were taken. The reason why no such statement appears in the report is that my long experience in physiological work has led me to look upon these precautions as so indispensable that I no more thought of mentioning them than I did of commencing my account of each day's work with the statement that the sun had risen, and consequently there was light enough to see our apparatus. For want of such a statement Mr. Hill may feel justified in rejecting all our experiments; and indeed, in order to be consistent, he ought to do so, for we have neither stated that the sun was up, nor that we employed artificial light when making our experiments, and consequently Mr. Hill has no assurance that we were not working in total darkness. But no amount of incredulity on Mr. Hill's part, nor of tenacity in holding to his fancies, will ever convert these fancies into facts, or change his statement from untruth into truth. It is curious to learn from the data with which Mr. Hill furnishes us how he came to make this unfounded statement. He is apparently unable to conceive of an axis without an axle, and so he postulates a swing board as a necessity for the experiment. His imagination, limited by the experience of the scanty supplies in a London laboratory, cannot picture to itself a supply of animals nearly of the same size, nor can he conceive that a floor may be temporarily heightened in the part required by means of blocks. Having thus laid down a canon to which experiments must necessarily conform, he condemns those which do not do so as being utterly valueless, in the same way as he condemned those which did not conform to his canon of carelessness. In neither case does it seem to have entered into Mr. Hill's mind that he could possibly be mistaken, and so he takes upon himself to act as the mouthpiece of trained physiologists, and, in this assumed capacity, to condemn our experiments without further inquiry.

I have now taken up Mr. Hill's accusations of prejudice, ignorance, carelessness, and incompetence, one by one, and have shown that all those accusations are absolutely groundless, and that the experiments of the second Hyderabad Commission are perfectly trustworthy, and may be accepted as such both by trained physiologists and by everyone else.

REFERENCES.

- 1 BRITISH MEDICAL JOURNAL, March 19th, 1898. 2 *Ibid.*, March 5th, 1898.
3 *Ibid.*, April 17th, 1897. 4 *Loc. cit.*

THE EFFECTS OF THE DUM-DUM BULLET FROM A SURGICAL POINT OF VIEW.

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PROFESSOR BRUNS is reported to have stated at the late meeting of the German Chirurgical Society, that the use of the dum-dum bullet in warfare is "brutally inhuman"; and the inferences to be drawn from certain questions lately put by members of the House of Commons to the Secretary of State for War are sure to conjure up before the minds of hysterical persons, who have no means of knowing the facts of the case, the notion that the English Government has selected for use in the English army a small-arm projectile which in the spirit, if not in the letter, contravenes the agreement come to at the Congress of St. Petersburg, in 1863, not to use explosive shells of less than 400 grammes in weight. As a matter of fact, there is no doubt that the effects of the dum-dum bullet have been exaggerated. This enhanced idea regarding the damage caused in human tissues by this missile is probably the result of reports from India, which were grounded on experiments made there by firing it through animals of greater resisting power than man, and on the natural prejudice in favour of the home-made article. Experiments on animals give only a general idea of the effects of a projectile; they supply no reliable evidence of the injuries it will produce in man or in other animals than those experimented on, inasmuch as these depend altogether, other things being equal, on the resistance offered by the tissues to its passage: the greater the resistance the greater will be the damage done by it.

All war may be said to be "inhuman"; but if the inhumanity of war is to be judged by the greater or less severity

of the wounds produced by the weapons and projectiles used in it, then war is more humane now, dum-dum bullet notwithstanding, than when it was when Sniders or even Martini-Henrys were employed. The object to be attained by leaving the point of the dum-dum bullet uncovered by the cupronickel envelope was to increase its stopping power on traversing soft parts only, in consequence of its breaking up without contact with bone; but this does not nearly always occur, and then the wounds it produces in soft parts are precisely similar to those of the service Lee-Metford or of the French Lebel bullets. When it does break up it causes a severely lacerated wound of the soft parts, but one not nearly so severe as those resulting from the ordinary small-bore or any of the older rifle bullets when they meet bone in their passage. The fractures of the shafts of long bones and of their cancellous ends resulting from the dum-dum bullet are comparable in every way with those produced by the service Lee-Metford, and are no more difficult of cure than the latter, notwithstanding that particles of the core and of the envelope are liable to remain in the tissues. The Snider bullet was probably the most destructive small-arm projectile ever used in an army, but the inhumanity of its employment in war was never suggested. When travelling at the same velocity it produced more extensive fractures of bones than any small-bore bullet, dum-dum or other; it comminuted the bone into larger fragments, and displaced these to a greater extent; the fissuring of the bone did not extend so far from the seat of fracture as it does in the case of the small-bore missile, but in the former case the periosteum was also greatly lacerated, while in the latter it, to a great extent, remains unbroken over the fissures, and preserves the larger fragments in their normal positions, this being, of course, favourable towards recovery. Besides increased accuracy of shooting, the only advantage a small-bore rifle possesses over the older weapons is that it preserves a higher rate of "remaining velocity" at all ranges than they do, and, as a result, will cause a greater number of severe injuries. But at equal velocities the Snider and Martini-Henry bullets produce greater damage to bony structures than do the Lee-Metford or dum-dum bullets, while the latter, if it deforms, causes a more lacerated wound of the soft parts.

I have made experiments with dum-dum bullets; I have seen our men who were hit with them on the Indian frontier, and I have received numerous letters from medical officers who saw and treated the injuries produced by them in the Tirah campaign, and I am convinced that an exaggerated idea of their effects exists. The experiments referred to proved that they often pass through the soft parts without changing their shape or breaking up; the fractures resulting from them in the wounded from India are no more severe—are, indeed, perhaps less so—than those caused by the Afridi Snider and Martini-Henry missiles; and the information obtained from some of the medical officers in the late expeditions in India goes to show that they often produce clean, punched-out holes in long bones, a class of injury favourable to recovery and seldom seen to result from Snider bullets.

That the dum-dum bullet, when it breaks up, produces a more lacerated track through soft parts is no doubt true; for this it was invented, because the "stopping power" of the Lee-Metford was found to be *nil* when bone was not implicated, and something had to be done to render the small-bore weapon effective against the rushes of Asiatic fanatics. But that the fractures of bones caused by it are more severe, or more lethal in their results, I very much doubt. The carcasses of the animals experimented on did not show it on dissection; the wounded men now at Netley afford no evidence of it, nor do the statements of some medical officers in India bear out this view.

It was with reference to fractures that Bruns raised this question of the "brutal inhumanity" of the dum-dum bullet; but if the suggestion that it produces no more damage to bony structures than the service Lee-Metford does be correct, then it follows that its use in warfare is no more "inhuman" than is the employment of any of the small-bore weapons with which the armies of all the civilised nations of the world are now armed, for they all produce injuries of about the same degree of severity; and with regard to this latter class of small arm Bruns himself has stated that "the new

arm of small calibre is not only the best, but it is also the most humane, in that it lessens the horrors of war as far as possible."

In conclusion, it may be well to point out that the articles of the Geneva Convention do not refer at all to the use of small-arm shells in warfare, but to quite different matters; it was, as already mentioned, at a Congress of the representatives of all the European Powers held at St. Petersburg in 1868, that a minimum weight of 400 grammes, or about 14 ozs., for explosive projectiles was agreed upon.

MEMORANDA: MEDICAL, SURGICAL, OBSTETRICAL, THERAPEUTICAL, PATHOLOGICAL, Etc.

THE SCHOTT TREATMENT OF CARDIAC DISEASE.
A REVIEW of certain cases of cardiac disease which have been treated at Nauheim, or by the Nauheim method, without benefit, leads me to venture on a discussion as to the *rationale* which governs that treatment.

It is now generally accepted that a portion of the change in the area of cardiac dulness and in the position of the apex beat is due to the altered relations of the lungs and diaphragm to the heart which result from the treatment. There is, however, a real reduction of the capacity of the heart in those cases which receive benefit.

I find that among the numerous explanations which have been advanced to account for the contraction of the organ there is one assumption in common—that there exists some specificity in the Nauheim waters residing in the salts contained therein. I venture to maintain that there is a law of hydrostatics involved which has been altogether disregarded.

The principle to which I allude is the complement to the principle of Archimedes, that "a body immersed in a liquid loses a portion of its weight equal to the weight of the liquid displaced." "Every body immersed in a liquid is subject to a resultant pressure equal to the weight of the liquid displaced." If a body float on the surface of a liquid, the pressure on the immersed portion of that body equals the weight of the body. If a human body be floated in a bath of water, the pressure exerted by the water on the skin and underlying structures equals the weight of the subject.

The result in the case of a living subject is the application of massage to the immersed portion of the body by hydraulic pressure. The effects may be enumerated as follows: (1) Compression of the vessels (arteries, veins, and lymphatics) in all tissues unprotected by the bony skeleton; resulting in greatly increased resistance to the heart's action in circulating the blood, with propulsion of the lymph and venous blood towards the cavities protected by the bony skeleton. (2) The reflex effect on the heart (retarding it) through the splanchnic nerves, dependent on increased pressure on the abdomen from without. (3) The ascent of the diaphragm in response to the increased abdominal tension, a consequent diminution of the long axes of the lungs, an increase in the short axes of the lungs, and a displacement of the heart upwards (resulting in alteration of the relations of the heart and lungs). (4) A reflex action of doubtful existence and degree from the cutaneous nerves. (5) The influence of the temperature of the water in which the body is immersed, varying with its degree.

I do not refer to the other portions of the Schott method; they are "exercises," and have no pretensions to being anything more.

We have evidently in the Schott treatment a new demonstration of the old truth that exercise is beneficial in some forms of cardiac disease, and it is highly doubtful if we have anything more. The balneological treatment is doubtless an ideal one for some cases; the exercise can be perfectly graduated, respiration is free, and the cardiac beat is well regulated from the splanchnic area—but it may be potent for evil as for good.

There is another lesson to be learnt from a study of the law of hydrostatics referred to, namely, that there are many cases