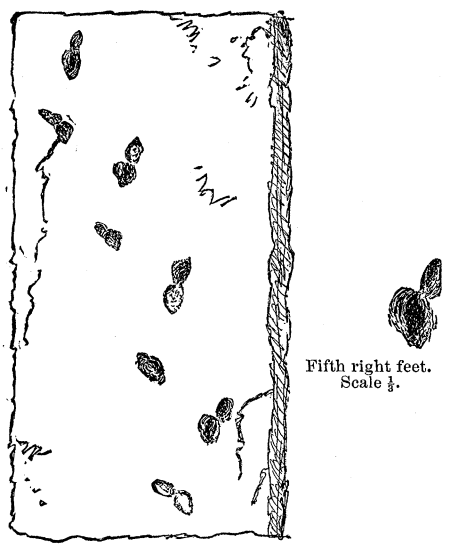
Slab No. 4 has nine pairs of hind-foot tracks, with the fore-feet sometimes coinciding, and elsewhere separated at considerable distances. They are in relief, that is, on the under side



Fifth right feet.
Scale ½.

SLAB NO. 3.

Average stride, 8¼ inches; width of trackway, 4½ inches.
Scale, 1-12.

of the layer, and resemble Nos. 2 and 3, but smaller; and the stride is two inches less.

Thorough search was made among the vast quantities of waste stone in the main quarries, and also in those of Stone Cañon adjoining, as well as in the streets of Denver, where these red quartzitic sandstones are largely used for flagging. The scarcity of the tracks is emphasized by the abundance of raindrop impressions. There were also many irregular stellate moulds, left by some crystallization, which a quarryman mistook for tracks.

H. W. PARKER.

SUCCESSFUL EXTRACTION OF A BULLET FROM THE BRAIN.

THE *New-York medical journal* of March 28 gives an account of an interesting surgical operation recently performed in New York, from which we condense the following statement:—

On the 24th of January, 1884, a healthy young man, Bruno Knorr, nineteen years old, was admitted into one of the wards at Bellevue hospital, suffering from a pistol-shot wound penetrating the brain through the centre of the forehead. The patient was semi-unconscious, and when aroused was irritable, and in answer to all questions simply grunted 'ja.' It was thus impossible to ascertain the circumstances of the occurrence of the injury. It has since, however, been learned from the patient, that, while lying upon his back, he shot himself with a pistol held in contact with his forehead. There was complete loss of motion without loss of sensation on the right side of the body, below the head. There was increased sensitiveness on the left side, which was very marked upon the left side of the scalp near the ear.

Preparatory to the operation, the patient's scalp was shaved. He was then etherized. A flap of gutta-percha tissue was fastened to his forehead to protect his eyes from the antiseptic solution used.

The bullet-hole in the skull, which was about half an inch in diameter, was then enlarged with a Ronguer forceps; but during the process a small clot was disturbed, which gave rise to arterial bleeding from beneath a depressed fragment of the skull whose sharp, convex edge had been driven into the brain. Upon the removal of this fragment the arterial hemorrhage was alarmingly profuse, and it became evident that the patient would speedily bleed to death unless it could be stopped.

After many unsuccessful attempts, Dr. Fluhrer succeeded in catching the artery with a Langenbeck's artery-forceps, and, while he held the instrument, an assistant attempted to tie the vessel. Unfortunately, during the process the delicate artery was torn, and it was found impossible to reach the remaining portion without removing another piece of the skull which covered it. In the mean time, the hemorrhage was so great as to threaten the patient's life. This was partially arrested by an assistant, who passed his finger through the opening in the skull, and compressed the artery against the brain, while Dr. Fluhrer removed a disk of bone sufficiently large to enable the artery to be reached with a Pean's forceps. With the aid of two pairs of dissecting-forceps, he succeeded in passing a silk ligature around the artery, and tying it. Upon the removal of the Pean's forceps, however, the pulsations of the artery and brain loosened and threw off the ligature, so that the bleeding became as profuse as before. The vessel from which the blood flowed was found to have been severed near its junction with a large artery, which Dr. Fluhrer now seized below the point of bifurcation. He saw clearly that the short branch could not be tied; and fearing that the slightest movement of the patient's head might tear the delicate vessel from the forceps, and cause an inevitably fatal hemorrhage, he transferred the artery to the grasp of the short and light clamp shown in fig. 1, which could lie in the wound with-

FIG. 1. — SMALL ARTERY CLAMP, ACTUAL SIZE.

out risk of detachment. No further attempt was made to ligature the artery, and the metallic clamp was left in the brain for many days. Two and a half hours had been spent in reaching this stage of the operation. Having arrested the hemorrhage, Dr.

Fluhrer proceeded with his attempt to follow the course of the ball with the probe. The patient's head was now placed in such a position that the presumed track of the ball was perpendicular to the horizon. A perfectly straight Nelaton's probe was then passed perpendicularly into the brain to a depth of about six inches, when a soft resistance was felt, which no effort was made to overcome. The depth to which the probe had passed supported the hypothesis that the bullet had gone completely through the brain, and had struck the opposite side of the skull. In order to ascertain the probable locality of the impact, the probe was left standing in the brain, and the point on the back of the head was noted at which the probe would emerge if projected through the brain. This was presumed to be the point of interior impact. An opening was then made in the skull at a point three-quarters of an inch lower down in the supposed plane of the path of the bullet, and the membrane covering the brain was carefully slit so as to admit the end of the index-finger. A resistance was felt in the brain at the depth of about half an inch, which was believed to be the bullet. Instead of exploring this resistance with a needle, it was decided to continue the opening in the skull upwards until the point of impact was reached, and then extract the bullet through the opening it had itself made. This was successfully accomplished.

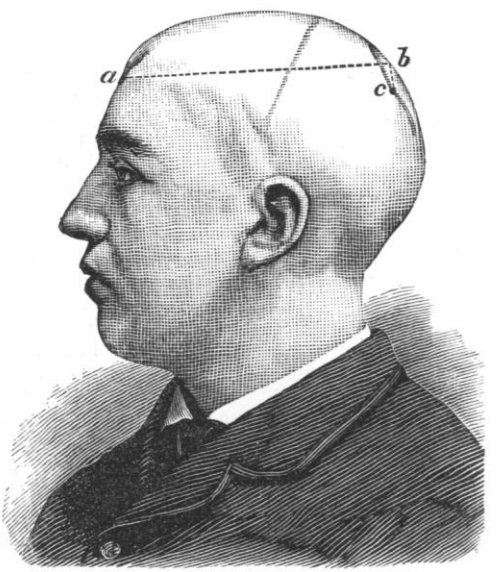


Fig. 2.

The patient's head was then placed in the same position as at first, and the probe was again introduced through the opening in the forehead, and, as before, it encountered a soft resistance at about the depth of six inches. Leaving the probe standing upright, the finger was carefully introduced into the brain from the opening at the back of the skull, and the discovery was made that the obstruction to the passage of the probe was due to the *dura mater* alone. This was remedied by slitting the membrane, and the end of the probe then appeared at the opening in the back of the head. A small-sized rubber tube was attached to this end, and drawn through the brain by the removal of the probe. The tube was left in the brain for drainage-purposes, and the patient's wounds were then dressed.

The operation, which had been conducted throughout with antiseptic precautions, was completed in about four hours from its commencement, the greater portion of the time having been spent in stopping the cerebral hemorrhage.

In addition to Dr. William F. Fluhrer, the following members of the house staff were present, and witnessed the operation: Drs. R. T. Morris, J. R. Conway, jun., W. W. French, J. H. Woodward, H. N. Williams, P. Oppenheimer, H. S. Wildman, H. Herman, H. Biggs, E. Hurd, C. F. Roberts, and W. G. Rutherford.

On May 22, 1884, Dr. Fluhrer exhibited Knorr at Bellevue hospital to a number of physicians. He was then, so far as could be judged, in perfect health. Apart from the scars upon the patient, the only abnormality discoverable was a limitation of the visual field for green and red, observed by Dr. W. F. Mittendorf. Inasmuch as this feature was common to both eyes, it is questionable whether it was caused by the injury.

The engraving, fig. 2, is from a photograph of the patient taken at that time. The light line marks the position of the fissure of Rolando. The bullet entered at the centre of the forehead, an inch and a quarter above the upper level of the eyebrows: it passed in a straight line through the brain, from *a* to *b*, and was deflected to *c*, where it lodged.

The patient left the hospital, where he had for a long time been retained simply for observation, on June 30, 1884, and in a month went back to work at his old employment in a butcher's shop. He remained at work during the exceptionally hot weather in the early part of September.

On Sept. 12, between twelve and one o'clock in the morning, Knorr received a heavy blow in the anterior scar from the elbow of the man with whom he was sleeping. Knorr states that he suffered intense pain in the head for half an hour, when it died away, and he fell asleep again. He awoke at about four o'clock, and noticed, with wonder, his right forearm beginning to flex upon the arm. He tried to hold it down with his left hand, but failed. Then his right leg was drawn up. Then his left upper and lower extremities respectively became affected in the same manner. He remembered being asked what was the matter, and that he could not speak, but screamed, and then lost consciousness. The convulsive movements were so energetic, that the patient was thrown from his bed upon the floor; nevertheless, he was able to return to work the same day.

On Oct. 1, while delivering a parcel at the house of a customer, he was seized with a slight rigidity, followed by a short convulsive movement of the

limbs, and a momentary loss of consciousness, but did not fall.

He has now had no recurrence of convulsions, or other epileptic symptoms whatever, for a period of nearly six months. When he began working after his discharge from the hospital, he noticed, in trying to keep in mind the orders for deliveries to customers, that his memory was not so good as before the injury. He now follows the same occupation, and performs the same duties in it, as before he was shot. He feels perfectly well, and, by the test mentioned above, is sure that his memory is constantly growing more retentive.

THE DEBATE ON VIVISECTION AT OXFORD.[1]

IN our last issue we gave a brief notice of the proceedings in an overflowing convocation at Oxford, which resulted in a majority of 412 votes to 244 in favor of the decree promulgated by the Hebdomadal council. This decree had only an indirect bearing upon the question of vivisection; but as it was made an occasion for a fresh, and, let us hope, a final, trial of strength between the scientific and anti-scientific forces of the university, it is desirable to furnish our readers with a somewhat more full account of what took place than we had time to print last week. Seeing that the debate had clearly been organized with no small amount of care on the side of the anti-vivisectionists, and that the ablest as well as the most authoritative speakers in Oxford who could support their cause were put forward, we may regard the arguments which were adduced as a fair example of the best that can be said against vivisection by cultured thought and cultured speech. We will therefore confine our remarks to what was said on this side of the question.

Regarded as a piece of oratory, the speech of Canon Liddon was, in our opinion, perfect; and the effect of what we may term an artistic eloquence was enhanced by the appearance and costume of the speaker, as well as by the appropriateness of his surroundings in the densely crowded Sheldonian theatre. But when we look from the manner to the matter of his speech, we are unable to bestow such unqualified praise, although we confess that even here we were agreeably surprised by the judicious moderation of its tone. His views, briefly stated, were, that so long as we hold it morally lawful to kill animals for food, or otherwise to use them for our own purposes, so long must we in consistency hold, that, under certain circumstances, it is morally lawful to inflict pain upon animals for the benefit of man. The special case of vivisection does not differ in principle from other cases where pain is thus inflicted; but it ought to be qualified by three conditions: it should be resorted to as rarely as possible, it should be guarded against the instinct of cruelty, and it should be so used as not to demoralize spectators. With all this, every physiologist would of course agree. The canon, however, proceeded to talk what, in the strictest meaning of the word, must be termed nonsense, when he affirmed that physiology might be 'divorced' from vivisection. That this statement has gained currency among the anti-vivisectionists does not alter its essentially unreasonable character. It is perfectly true that in many departments of physiological research vivisection is not required; but it is no less true that in many other departments vivisection is an unconditional necessity. This fact, one would think, admits of being rendered obvious to any impartial mind, howsoever ignorant of physiological science; for, if this science consists in the study of vital processes going on in the living organism, does it not obviously follow that some of them can only be studied while actually taking place? How, for example, would it be possible to gain any knowledge of the electrical and other changes which occur in a gland during the process of secretion, except by estimating these changes during the act of secretion? The gratuitous information which physiologists receive from technically ignorant sources, touching the nature and the value of their own methods, can only suggest the presumption of inexperienced youth when venturing to instruct a maternal grandparent in the practical aspects of oölogy.

It appears that Professor Burdon-Sanderson had pledged himself not to exhibit vivisections to his class for the purposes of teaching, and for this concession to the unreasoning prejudice of his opponents he received a warm expression of gratitude from Canon Liddon. Probably enough, under the circumstances in which he is placed, the concession is a prudent one; but that it merited the eulogium which was bestowed upon it by Canon Liddon on moral grounds, no man of common sense could very well suppose. Demonstrations on the living subject, if performed in a class-room at Oxford, would of course be always performed on animals under the influence of anaesthetics; and therefore the 'demoralizing' effects upon the minds of young men, which Canon Liddon takes to have been averted by Professor Sanderson's concession, can only be understood to consist in disregarding the mawkish sentimentality which cannot stand the sight of a painless dissection. This kind of 'morality' may be regarded as tolerable in a girl: in a man it is not tolerable, and deserves the same kind of pitying contempt as is accorded to personal cowardice, with which it is most nearly allied.

Canon Liddon, however, regretted that Professor Sanderson had not further pledged himself to restrict his experiments *for the purposes of research* to animals kept under the influence of anaesthetics during the operations, and killed before recovering from their anaesthesia. We have no doubt that Professor Sanderson might have complied with the first of these suggestions without any serious detriment to his future researches; for, as a matter of fact, the cases in which anaesthetics interfere with the progress of an experiment, are, comparatively speaking, very rare indeed,

[1] From *Nature* of March 19.