pended perpendicularly, *i. e.* with the head upwards, and the arteria innominata was cut across. As blood flowed through this opening, the right auricle ceased to contract, and at last collapsed. At this stage the body was laid horizontally, with the hind parts slightly raised. The right auricle was instantly refilled with blood from the inferior venous trunks, and recommenced to contract powerfully; the play of the left ventricle also recommenced; the pulmonic circuit was re-established; and the action of the left side of the heart was also restored, as the restarting of jets of blood from the divided innominata obviously proved. This experiment I have repeated several times, with the same results.

EXPERIMENT II. Another young cat was thoroughly narcotised as before, with the smoke of the lycoperdon giganteum, and the heart was exposed by removing a portion of the left thoracic wall; the right pleura was uninjured. The heart continued beating strongly and rhythmically after its exposure; and the breathing continued. A long needle, armed with a strong twine ligature, was now passed under the trachea, and the ends of the ligature having been brought under that tube, were tied very firmly at the back of the neck; in this way the large vessels in the neck were to a great extent compressed, without there being any pressure on the trachea. By a quick incision through the neck above the ligature, the whole head, and two or three of the cervical vertebrae, were removed from the trunk. The heart still continued to beat, but the respiratory movements failed. A tube was therefore fixed in the trachea, and artificial respiration set up. The body was now suspended with the neck upwards, and as blood was being lost by the vertebral vessels and carotids, the heart speedily began to empty itself, and in proportion the right auricle and ventricle collapsed, and ceased to play. The body was then laid in the horizontal position: the auricle almost immediately became fully refilled with blood from the inferior cava, and, together with the ventricle, recommenced to contract so vigorously, that the pulmonic circuit was obviously made, since the left auricle also refilled and began to act. By raising the body a second and even a third time into the erect position, the right cavities once more collapsed; to become refilled and to recontract, on restoring the trunk to the horizontal line. At last, when the system was so emptied of blood that the auricle remained shrunken and quiet, even when the body was suspended by the hind extremities, I succeeded in refilling it, and in setting it in motion for a brief period, by compressing the abdomen firmly with a grasp of the hand, thus forcing a little remaining blood onwards toward the heart.

EXPERIMENT III. A full grown cat was rendered insensible as before. The heart was exposed, and the body was suspended by the head. The pulmonary artery was divided, and the auricle and ventricle were allowed to empty themselves, and become shrunken and at rest. The inferior vena cava was then closed near to the heart by a pair of spring forceps, and the position of the body was changed from the erect to the recumbent position. No filling of the auricle, and no reaction took place. After waiting four minutes, I removed the forceps: instantly there was a rush of blood into the auricle, which as soon recovered its contractile power. The ventricle likewise responded in due order, and continued to pour out its blood by the pulmonary artery, until the venous system below the heart became emptied of its fluid contents, when both cavities gradually sank and rested for good.

EXPERIMENT IV. A cat was again the subject. The first steps of the operation were the same as in the experiment preceding. After the heart was exposed, and the body placed with the head upwards, I carefully separated the heart from every attachment with all the surrounding parts, except the inferior and superior venae cavae, and laid it on a card. The right cavities continued to contract, pouring out blood by the pulmonary artery, until they became completely collapsed and at rest. Several minutes were now allowed to elapse, when the body was laid hori-

zontally. As in all the preceding instances, the cavities received a free draught of blood from the inferior cava, resumed play, and continued in quick and rhythmical action for nearly ten minutes, until, in truth, they had exhausted all the venous blood that could flow into them from the lower half of the body.

I have but little to add in the way of comment on these experiments. They must be judged of as they stand. As experiments they are easy to perform: and I feel sure that any physiologist who may take the trouble to perform them carefully for himself, will not be deceived in the results. They prove to demonstration, as I conceive, the complete independence of the heart of any power, force, or influence derived directly from the brain; and they show that the recumbent position of the body in syncope is useful, not because the head *per se* is laid low, but simply because it changes the direction of the circulating currents, and leads to the re-supplying of the empty heart with its one and only necessary stimulus, blood. By removing the head from the trunk, the heart was of course cut off from all communion with the brain; and by severing the heart from all its attachments at its base, except the two cavæ, it was of necessity removed from every kind of connection with the whole nervous system. Yet the recontraction of the circulatory organ was just as complete when blood was again poured into it, as in the cases where its union with the cerebro-spinal axis was preserved. Could any experiments illustrate more forcibly the truth of the position I have taken?*

I have treated as yet only of those cases of syncope in which the failure of the heart's action lies in the mere abstraction of its stimulus. It is proper, however, to refer to the other classes of cases, where the central failure is connected either with an overburthened condition of the pulsatory organ, with debility of its muscular walls, or with valvular obstruction. In these cases, the recumbent position, though also affording more or less of relief to the symptoms, acts in a manner different from that which I have described as occurring during syncope from hæmorrhage. I shall describe this difference in my next part.

[To be continued.]

Mortlake, August 1854.

PERFORATION OF THE DUODENUM: SUDDEN DEATH: WITH REMARKS.

By JOHN SHEPHERD FLETCHER, Esq., Lecturer on Practical Anatomy at the Chatham Street School of Medicine, Manchester.

ON the 9th of June, 1849, at two P.M., I was requested to go instantly to see a man in an adjoining inn, whom I found dead on my arrival. On inquiry, I was informed that he entered the house about 12 o'clock, and was supplied with a glass of beer and porter mixed. He sat down and took up the newspaper; but soon complained of being unwell, and placed his hand over the epigastric region where he said he had pain. He sat there for some time (other persons being in the room), and about half-past one was noticed asleep, as the persons in the room thought; but as he continued so, and looked pale, they determined to awake him, when they found him cold and apparently lifeless. I was then sent for, and arrived in five minutes.

* In the experiments related, I used the smoke of the lycoperdon giganteum (common puff-ball) as an anæsthetic, in preference to chloroform; and I would recommend all experimentalists to do the same. First: because the lycoperdon is much less expensive than any other anæsthetic. Secondly: because, like Woorara, it exerts but little influence in paralysing the heart. Thirdly: because it is much more easily administered to animals of ordinary size, such as cats, dogs, and rabbits, than other similar. For the mode of using this substance, see my paper on the subject in the ASSOCIATION JOURNAL for June 3rd, 1853. The experiment of removing the encephalon was performed on the suggestion of Dr. Willis, to whom I am deeply indebted for much valuable aid in carrying out these and many other inquiries.

I found him in an erect sitting posture, quite dead and cold, except the chest. The left arm was quite livid; the face was flushed, and not expressive of pain. I learned from a person in the room that he had slept with him the night before, when he appeared well except for some slight pain in the bowels; that about 8 A.M. he had complained of much pain in the abdomen, and he (my informant) recommended him to get a little brandy, which he did. He had travelled the previous night from London to Manchester to enter upon the duties of a fresh situation to which he had gone in the morning, but complained of being unwell, and went away to the inn at which I found him in order to obtain a bed. He had taken some coffee as well as the brandy, ale, and porter.

EXAMINATION OF THE BODY FORTY-SIX HOURS AFTER DEATH. The body was rather emaciated; the face was apparently sunken; there were no external marks.

Abdomen. On opening the abdomen, the peritoneal sac was found to contain a quantity of darkish brown liquid without any peculiar odour, with a greasy appearance on the surface as if from slight mixture of oil; it gave a slight acid reaction with litmus. Suspecting perforation from the presence of this fluid, I examined the bowels and stomach carefully; and about half an inch below the pylorus, on the upper and outer side of the first portion of the duodenum, there was found a large oval shaped opening half an inch long and of nearly the same width. The peritoneum around this part was but slightly injected with blood; but on the under surface of the liver it was very much so, as well as that portion lining the abdominal walls generally. The peritoneal intestinal covering was but slightly reddened; there was no appearance of effused lymph on any portion of this membrane. The small and the large intestines contained but little faecal matter. The outer edge of the perforation seemed even and smooth; it was slightly rough at one side. On opening the duodenum, the inner margin of the opening was found quite smooth and even. The mucous membrane in some parts was more destroyed than the other coats, giving to the opening a slight funnel shape from within outwards. The edges around were thickened and hard. There was little or no surrounding inflammation; and the upper edge of the opening was not more than about a quarter of an inch from the pyloric valve which was quite healthy. The mucous membrane lining the lower portion of the duodenum was of a deepish red colour. All the other intestines were healthy. On opening the stomach, it was found almost empty. The mucous membrane lining the greater end, larger curvature, and cardiac extremity, particularly the latter, were of a deepish red hue and much injected; except for this the rugæ were natural. No ulceration was found in any part. The coats were of usual density and strength. The mucous membrane of the mouth and upper part of the œsophagus was pale; the lower part of latter was congested. The liver was very large, and filled with fatty substance. The spleen was normal. The gall-bladder was tolerably full. The bladder was empty. The kidneys were slightly diseased from granular deposit.

Chest. The pleural cavities contained a small quantity of serum. The lungs were emphysematous. The pericardium contained half an ounce of pale serum. The heart was soft and flabby; a small quantity of dark blood was found in the right cavities; the left cavities were empty. The only trace of disease was a slight deposit on the mitral valves, not sufficient to create much if any obstruction to their healthy functions.

Head. There was slight opacity of the arachnoid and congestion of the veins of the dura mater. About two drachms of fluid were contained in each lateral ventricle. In all other respects the brain was healthy. On analysis, the fluid found in the peritoneal sac was found to be slightly acid, and to contain an excess of chlorides.

REMARKS. This case offers an illustration of a variety of perforating ulcer of the digestive canal, which is not of very frequent occurrence, and which is much less frequent in

the duodenum than in the stomach. The absence of a correct previous history is to be regretted in this case; although it is probable that no very urgent symptoms had existed; indeed, it is not unfrequently the case that these ulcers proceed to a considerable extent without giving rise to other symptoms than those of gastrodynia; and this would be more likely to be the case with an ulcer in the duodenum than in the coats of the stomach. When the fluid in the peritoneal sac was found to give such an acid reaction, poisoning by some acid was suspected; but a subsequent examination showed that the acid present was not in sufficient quantity, and that the fluid also contained the chlorides in excess, probably from food taken some short time previous to death. The idea of poisoning was also opposed by the situation of the perforation, which generally, in irritant poisoning, takes place in the coats of the stomach; but the character of the opening itself was such as to point to ulceration as its cause. "It was oval in shape; its edges were smooth; the coats were destroyed from within, giving the opening a funnel shape from within outwards." These are characters which belong to perforating ulceration not connected with poisoning, and assist, although not sufficient in themselves, to distinguish between that which is due to poison and that which results from disease.

How long this man had been out of health is matter of doubt; but, from the general appearance of his body, and from his companion's statement, I am led to believe that he had complained but little, and that his symptoms had not been such as we should expect did we not know that ulceration, even in the coats of the stomach, of this kind, may proceed to perforation, as in this case, without causing any great amount of suffering. From the inflamed state of that portion of the peritoneum lining the under surface of the liver, and which would be in close contact with the seat of disease in the duodenum, it is probable that for a time this viscus, with its covering, had assisted to keep closed the opening, although no effused lymph was found, which may seem strange; but the history of these cases shows that its absence is not very unusual—due, no doubt, to the character of the inflammation, which is of the lowest kind, resembling somewhat gangrene where there is an absence of that healthy preservative action leading to the effusion of lymph. That his health could not have been good is shown by the fatty liver and slightly granulated kidneys; and, from these circumstances, it is probable that his habits had not been very regular.

The very sudden death is another point worthy of special notice, as it but rarely happens that cases of perforation terminate so suddenly as in this case. The only explanation I can offer why it should have done so here is the contiguity of the disease to the great nervous centres of the sympathetic system, through which the shock has been such as to suspend life. The state of the blood in the cavities of the heart lends probability to this view, as being that which I have found to exist after sudden death resulting from shock to or disease of the nervous centres, and, in my opinion, serves to further illustrate the views on sudden death advanced some years ago by Dr. Francis (*Guy's Hospital Reports*, 1845), and which my experience has tended to verify. The left cavities being empty, and the right containing a quantity of blood, proves to me that the heart had continued to act after the function of the lungs had ceased; the circulation in them being arrested, the right side of the heart could not empty itself. This arrest of the breathing power before the cessation of the pulse in sudden death, is believed by Dr. Francis to point out as its cause injury to the nervous centres; whilst, in sudden death from disease of the heart, breathing continues after the heart has ceased to beat. These I consider as important facts, worthy of remembrance by all in cases of sudden death; my experience having served to convince me of their truth.

6 Lever Street, Manchester, August 1854.