The second part of the labours of the Commission consisted in attempting to determine the effect of shock as a cause of death during chloroform inhalation. In a paper published in the *Practitioner* I have attempted to distinguish between shock and syncope, my idea being that syncope is due to temporary stoppage of the heart's action and may be rapidly recovered from, while shock is due to paralysis of the abdominal vessels and is a very grave and persistent condition. Many attempts were made to produce syncope in the animals experimented upon by raising the head, by attempting to stimulate the vagus reflexly or even by direct irritation, but all these experiments seemed to show that stoppage of the heart's action through the vagus was not a dangerous condition. We also attempted to produce shock by a blow upon the intestine or by such an operation as avulsion of the toe nail—an operation which has frequently been followed in man by fatal results. In these attempts, however, we were unsuccessful.

REMARKS ON THE EFFECT OF CHLOROFORM ON THE RESPIRATORY CENTRE, THE VASOMOTOR CENTRE, AND THE HEART.

Made in the Section of Therapeutics at the Annual Meeting of the British Medical Association, held in Bournemouth, July, 1891.

By LEWIS E. SHORE, M.A., M.D.,
Demonstrator of Physiology University of Cambridge.

DR. LEWIS SHORE, after remarking on some of the points raised by Dr. Brunton's address, gave an account of certain experiments made by Dr. Gaskell and himself on the action of chloroform on the respiratory centre, the vasomotor centre, and on the heart. In these experiments the application of chloroform directly to the exposed *fourth ventricle of the medulla* in the rabbit always caused a rapid cessation of respiration, by quickly diminishing the extent and depth of the breathing without markedly influencing the rate. This effect was sometimes preceded by evidence of excitation of both the respiratory centre and the vasomotor centre at the moment of application. One or two drops so applied were sufficient to kill the animal. With the failure of respiration the blood pressure gradually fell, but was still considerable when the respiration stopped.

The injection of chloroform into the *internal carotid artery* of the rabbit caused a small long-maintained rise of blood pressure, due to a stimulation of the vasomotor centre. The respiration became slower and changed in character, the inspiratory phase being markedly increased. Two or three minims of chloroform were usually sufficient to produce these changes. Further injection of one or two minims brought about rapid failure of the respiration, usually, indeed, a sudden cessation, notwithstanding a very high blood pressure. Immediately the respiration stopped, the blood pressure began to fall. That this was associated with the maintenance of the respiratory act, and not due to a depression of the vasomotor centre by the direct action of the chloroform, is shown by the fact that it did not occur if artificial respiration was maintained. Chloroform readily acted on the respiratory centre, first slightly stimulating it, then paralysing it. It stimulated the vasomotor centre, successive injections driving the blood pressure higher and higher, but large doses ultimately paralysed it. The respiratory centre always completely failed long before any depression of the vasomotor centre occurred. Injection of chloroform into the *vertebral artery* gave similar results, a smaller amount being needed; even half a minim sometimes sufficed to stop the respiration. With the cessation of respiration the blood pressure at first fell, but that the vasomotor centre was not paralysed was proved by the fact that a rise of blood pressure occurred later on, due to the action on that centre of the asphyxial condition of the blood. In one case this asphyxial rise was as much as from 66 mm. of mercury to 102 mm.

Injection of chloroform into the *jugular vein* produced very

different effects. Its marked characteristic was a rapid fall of blood pressure with weakening heart beats; in one case, in a rabbit, 1 minim of chloroform injected into the jugular produced a fall of pressure from 104 mm. to 40 mm. in one minute, and another minim further reduced this to 26 mm. The respiration was at first not markedly changed, but after a few inspiratory gasps stopped rather suddenly one minute and fifteen seconds after the last injection; and although no pulse was evident in the carotid, the heart was found beating regularly but feebly three minutes later. The heart, although not absolutely arrested by the chloroform, was rendered inefficient to maintain an adequate circulation for the continuance of respiration. These experiments point to the conclusion that the fall of blood pressure produced by chloroform is due to failure of the heart's action rather than to paralysis of the vasomotor centre. It may, however, be questioned whether the action of chloroform, when injected into the vascular system, is the same as when it is inhaled in the ordinary way.

In order to decide this question the following experiment was devised: Two animals were taken, two dogs or two rabbits, and the arteries supplying the brain of one animal were gradually ligatured so that its brain was completely prevented from receiving blood from its own heart. The arteries, carotids or vertebrals, and in some cases both carotids and one vertebral, were then connected to the corresponding arteries of the other animal, and the brain thus supplied with blood, which returned by one pair of jugular veins cross-connected in a similar way. Care was taken that the brain was at no time without a supply of blood, the last artery being ligatured at the same moment as the cross circulation was established. Thus one animal, the *feeder*, was supplying its own brain by one carotid or one vertebral (and this always adequately sufficed) and also supplying the brain of the other animal, the *fed*. The blood pressures of both animals were taken from the femoral arteries. When chloroform was given in the ordinary way, by inhalation, to the feeder and the usual effects produced in that animal, namely, fall of blood pressure and slowing of respiration, chloroform-carrying blood was also being sent to the brain, and the brain only, of the fed animal, and there produced insensibility, a rise of blood pressure, and slowing of respiration. When the fed animal, on the other hand, inhaled chloroform, a marked fall of blood pressure was produced, and as the chloroform could not reach the brain, this could only be due to a direct action of chloroform on the heart. In the latter case the chloroform could be pushed till the blood pressure was nearly zero, and no heart beats were visible on the tracing, and the animal would continue for some time to breathe regularly, the respiratory centre, of course, deriving its blood supply from the other animal, the feeder. If the brain of the fed animal, on the other hand, was richly supplied with chloroform, by giving large doses to the feeder, the respiration could be brought into a very precarious condition without the slightest fall of blood pressure, the chloroform depressing the respiratory centre, but not the vasomotor. Complete stoppage of the respiration of the fed animal could not be produced before the feeder succumbed to the large quantity of chloroform given to it.

These experiments confirmed the results obtained by injection and showed that the fall of blood pressure observed in chloroform inhalation is due, primarily, to direct action on the heart, and not to a depression of the vasomotor centre.

A fall of blood pressure was not, however, inevitable; complete insensibility may be produced without any fall at all, and usually the fall is slight, and a dangerous depression is only produced when the chloroform is given after insensibility is produced. The respiration begins to fail before the fall of pressure is dangerous.

These experiments were in accordance with those of the Hyderabad Commission, inasmuch as they show that, when chloroform is administered without interfering with perfectly regular respiration, complete insensibility can be produced without obvious weakening of the heart's beat. Inefficiency of the heart is brought about by the rapid inhalation of chloroform in too concentrated a form. The experiments supported in two respects the practical teachings of the Hyderabad Commission, namely, that chloroform should be given gradually and with plenty of air, and that great care should be

taken not to push the chloroform when struggling or gasping respiration occurs.

SECTION OF THERAPEUTICS.

THURSDAY, JULY 30TH, 1891.

WILLIAM VICARY SNOW, M.D., President.

DISCUSSION ON ANÆSTHETICS.

DR. DUDLEY BUXTON, in introducing the discussion, said the subject might best be considered under the following heads:—*a.* Clinical facts, that is, those derived from a careful examination of patients placed under various anæsthetics. *b.* Pathological facts, that is, those furnished by necropsies of patients who had died whilst taking some anæsthetic. Inquiry had to be made into the causes of (1) death under an anæsthetic, and (2) dangers and difficulties under an anæsthetic. Before entering upon the question what circumstances played a part in jeopardising life under an anæsthetic, he wished to make two observations. In the first place it had been urged that the moments of danger during the administration of an anæsthetic were not the best for the calm and judicial examination of the phenomena. When, however, the whole attention of the anæsthetist was occupied with the matter in hand the seconds of danger were quite long enough for noting the facts required. In the second place, the dangers of anæsthetics were considerably magnified owing to the frequency with which the subject was discussed by medical men and the way in which all fatalities were recorded by the press. When carefully given by experienced men, however, fatalities were remarkably few considering the potency of the agents employed. Passing to clinical facts, it would be necessary first to consider the circumstances concerning the patient himself which might influence the question of anæsthetisation. Clinical records showed very clearly that it was not only the diseased but the apparently healthy who succumbed to anæsthetics. In these cases it had been alleged that fright was the real cause of the death, but against this hypothesis was the fact that children did not die so frequently in that way as adults. Death did not occur so often in persons broken down by disease as in the strong and vigorous. On the other hand, children and persons so ill as to be preoccupied with their sufferings were not so apprehensive of death from the anæsthetic. Deaths in the initial stage of chloroform narcosis were by no means rare, but he knew of no death occurring under any other anæsthetic in this initial stage of narcosis. It was important that a full list of such fatalities should be made, with their circumstances carefully detailed. With regard to race, it seemed likely that Orientals enjoyed greater immunity than Europeans or Americans. Dr. Reeve had suggested¹ that climate played an important part. The remarkable manner in which Orientals recovered from the most severe operations would apparently indicate an unusual resistance to shock. Moreover, they were unaware of the frequent occurrence of death under anæsthetics, and therefore psychical fear was absent; whilst the dread of death was not so great as among Europeans. Sex seemed to have little to do with the matter. In the Royal Medical and Chirurgical Society Committee's Report, 28 out of 109 patients were women, that is, about 25.6 per cent., while out of 106 fatalities under chloroform collected by Turnbull, 30 of the patients were women. It was probable that the risks were, as far as sex went, nearly equal. With regard to the alleged immunity of parturients, 3 of Turnbull's 29 selected cases of deaths in women occurred during parturition. The statement probably arose from the fact that chloroform practically became dangerous only when pushed to the extent of true anæsthesia. Again, in these cases, a vapour of extreme dilution was sufficient, while the time of induction of analgesia was very prolonged. With respect to age, persons of over 70, and children of three years and under, had died during the administration of chloroform. Of Turnbull's collected cases, 56 were under 21. Statistics of the various children's hospitals showed that the very young were not free from danger, so that the working rule which so very many had adopted "give chloroform to persons under 6 years and over 60" could not be applied without due caution. With regard to "temperament," there was no

evidence that the nervous and timid ran greater risk than robust strong-minded individuals. Several instances were on record in which persons had expressed a strong presentiment of impending death before taking chloroform, and had succumbed under its influence; but, on the other hand, he had himself known many persons with the same presentiment go through the operation most satisfactorily. The question how various departures from health might influence the safety of persons submitted to anæsthetisation had next to be considered.

Organic Disease of the Structures comprising the Nervous System.—He had anæsthetised in cases of cerebral tumour, when sclerosis and softening had existed; in persons who had died within a few weeks from cerebral apoplexy; in hemiplegics, and when more or less serious disease of the spinal cord was present; in persons actually insane, or who had been insane, or who shortly afterwards became so, and often in epileptics. His notes showed no particular features characterising these cases. In operations upon the brain itself he employed chloroform in combination with morphine, but beyond profound cardiac depression in some cases he had nothing to relate. Chloroform in this instance was used to obtain as much cerebral anæmia as possible. Wood held that ether was contraindicated in persons with cerebral tumours. It was certainly highly important to curtail as much as possible the stage of excitement in such persons, and therefore when ether was given he (Dr. Buxton) preferred anticipating its use with that of nitrous oxide.

Organic Disease of the Circulatory Organs.—The heart undoubtedly in human beings played a most important part in the question of the danger arising from anæsthetics. Of 50 cases of death under chloroform collected by Dr. Snow, 39 were imputed to "cardiac syncope," 3 to "probably cardiac syncope," 1 to "probably asphyxia," and in 4 the symptoms were not observed. Of these cases, 35 were subjected to necropsy, and 16 showed "some alteration of the heart, accompanied in a few instances by disease of other organs." Of these, 2 cases showed thinning of the right ventricle, 3 had valvular disease, and 9 showed varying degrees of fatty degeneration of the heart. Of Turnbull's 160 cases, necropsies were recorded in 44; of these, 20 showed fatty degeneration, 1 case valvular disease, 1 endocarditis with granular disease of the heart's substance, 1 dilatation, and 2 hypertrophy of the heart. Among more recent cases very many had been reported as evincing more or less fatty degeneration of the muscular fibre of the heart. The frequency of the occurrence of this condition in connection with deaths under chloroform would seem to establish a causal rather than a coincidental association. It was known that with all forms of degeneration affecting the heart muscle there was a loss of elasticity, and the researches of McWilliam had shown that the inhalation of chloroform led to an acute dilatation of the heart,² so that when these two facts were considered together it was easy to understand why chloroform should be so fatal in cases of fatty degeneration of the heart. In such people the acute dilatation induced by the chloroform would take place, and owing to the loss of resiliency of the heart muscle, the contraction which should follow the dilatation could not take place. There was incontestable clinical as well as experimental evidence that primary heart failure was the commonest form of trouble in chloroform poisoning. The experiments of the English Chloroform Committee, those of the Glasgow Committee, the careful work of Professor Wood and Dr. Hare, of Philadelphia; as well as the research of Dr. McWilliam, undertaken for the British Medical Association, had distinctly demonstrated the existence of primary syncope. The work of the Hyderabad Commission, as far as it went, was excellent, and it was only to be regretted that its so-called conclusions were permitted to be framed in such a way as to mislead those not sufficiently familiar with the matter to assume that it had settled, once and for all, the question whether chloroform caused primary heart failure. The Commission failed to observe it in their experiments, and this only was the Commission entitled to state. It however went beyond this, and stated emphatically that primary heart failure never occurred either in the lower animals or in man, and practically told the profession that deaths from chloroform need never occur save through care-

¹ Holmes's *Syst. Surgery*. American edition.

² BRITISH MEDICAL JOURNAL, ii, 1890, p. 831.

lessness or when the Commission's directions were not carried out. In so saying the Commission assumed a grave responsibility which had lulled many persons into a feeling of dangerous security when employing chloroform, and had led to a reckless use of the agent in a way open to the most severe criticism. He (the speaker) thought it the duty of the Section to state most distinctly that the clinical evidence before them contradicted the findings of the Hyderabad Commission, and showed its conclusions to be at variance with common experience. Clinical evidence also bore out the pathological evidence given above in two ways, first in those cases with which most careful chloroformists were familiar when heart failure stopping short of paralysis occurred during an operation. He had met with such cases many times with chloroform, three times with nitrous oxide, never with ether. The pulse flagged, usually intermitting at first, then growing jerky and ceasing while the rhythm of respiration remained unimpaired, and the amount of air entering the lungs was unaffected; inversion and, if needed, artificial respiration had in his experience always restored the cardiac action, but such occurrences forced upon one the certainty that were the chloroformist's attention not on the alert and his fingers upon the pulse, a fatality might have taken place. Chisholm had published similar instances and Dr. Reeve, of Layton, Ohio, had described several instructive cases of this character. Skilled chloroformists and others had also related cases to him (the speaker) which make him confident that there were very many of wide chloroform experience who would bear him out in the contention which he ventured to formulate as his second conclusion, namely, that clinical experience went to show that there was distinct evidence of cardiac failure occurring during chloroform administration. Much, however, might be urged in support of the contention that these cases were the result of lessening the dose of chloroform, and thus leading to a partial resumption of consciousness and its accompanying phenomena of weakened pulse, etc., or of the contrary extreme, an unguarded increase of chloroform leading to overdosage. Neither of these explanations completely covered the ground. Clinical experience showed, further, that mere valvular disease of the heart—except in so far as that state offered evidence of change of structure of the myocardium—did not materially affect the prognosis in chloroform administration. Touching those sudden inexplicable deaths under chloroform which took place in the initial stage of the administration various explanations had been offered: it had been called a "chloroform idiosyncrasy," and paralysis of the heart by a reflex inhibition. Moray and others had recommended atropine in order to render the vagi incapable of inhibiting the heart. This the Hyderabad Commission pronounced to be dangerous, as they considered the slowing of the heart to be protective, as lessening the rate of circulation and so diminishing the actual quantity of chloroform conveyed to the respiratory centres. Again, it had been asserted that the paralysis was a true reflex stopping of the heart directly resulting from fear. This statement was not supported by clinical evidence. Functional heart perturbation and "irritable heart" were in his experience very dangerous. Such persons took any anæsthetic badly, more especially chloroform; possibly their powers of eliminating the drug were interfered with, and so accumulation was more apt to occur. His own experience was that in such cases chloroform attacked the heart, ether the respiration. With regard to ether, he had been unable to discover any evidence from the records of necropsies performed of any heart lesions associated in a causal or other relation with deaths from ether.

Organic Diseases of the Lungs.—*Post-mortem* examinations made upon persons dying under chloroform gave no evidence of lung disease which could be associated with the cause of death. In two or three cases the lungs were spoken of as "congested," but this condition seemed to have been always accompanied by some heart lesion, and was probably the result rather than the cause of the poisoning with chloroform. There had, however, been several sudden deaths under chloroform in operations for empyema. The symptoms recorded had been those of heart failure and no asphyxia, and they probably arose from additional strain being put upon a heart

already severely hampered by displacement, or from a sudden alteration of intrathoracic pressure occasioned by the escape of the contained fluid. He had seen several cases of alarming syncope under such circumstances. Similar syncopal attacks supervened upon tapping or removing large abdominal tumours. The peril of these cases under chloroform, and the difficulty, inconvenience, and distress of giving them ether by the mouth had induced him to employ rectal etherisation for them, and the plan had proved in many cases to be valuable. Ether killed by failure of respiration, and here one would expect to find *post-mortem* evidence of pulmonary disease in ether deaths. The presence of bronchial catarrh, of emphysema, and chronic bronchitis had been recorded, and in cases where death had been attributed to ether and yet had not taken place for many hours after the inhalation of the anæsthetic acute bronchitis had been assigned as the cause of the fatality. Many of the recorded deaths, although not the result of actual want of skill, had yet probably arisen from the use of an imperfect method of administration, and were really due to the enormous and unnecessary quantity of ether employed. This faulty method was responsible for two grave dangers to persons with rigid chests, diseased vessels, emphysematous lungs, and the associated heart enlargement, namely, prolonged period of struggling, and ether toxæmia from accumulation of undue quantities of ether in the circulation. The chest conditions which in practice gave rise to trouble under ether were extreme bronchial irritability, marked emphysema, pulmonary oedema, chronic bronchitis, and phthisis, in which the vomica contained quantities of pus. True asthma might also give bad results with ether, and hence he ordinarily used a mixture in such cases unless the general condition of the patient seemed to render it undesirable to employ even the small quantity of chloroform contained in such mixtures. *Diseases of the kidneys* did not affect the prognosis under chloroform, nor was there sufficient evidence that ether, when given properly, caused nephritis or induced suppression of urine in cases in which the kidneys were diseased. Very large quantities might perhaps produce such an effect. His experience with a pretty extensive series of nephrectomies, nephrotomies, and other operations on the kidneys in which he had employed ether induced him to attach less importance to the alleged dangers of that anæsthetic in such cases. He was not aware of any *post-mortem* evidence which could be held to support the adverse view to ether in renal surgery. Other visceral diseases need not be further referred to. Of *blood conditions* various forms of anæmia played an important part in prognosis when chloroform or any other anæsthetic was given. Whether elimination was interfered with, or whether the visceral and nervous systems, being poorly nourished, were peculiarly liable to poisoning by anæsthetics, it was impossible to say; but it was certain that some of the most anxious cases with which they had to deal were those of patients suffering from marked anæmia. In diabetes, again, he had seen the combination of the operation and the anæsthetic prove most disastrous. Disease of the vessels was often a *crux* to the anæsthetist, who, aware that vascular excitement would follow the use of ether, feared chloroform lest the state of the heart associated with the vascular degeneracy might render that agent dangerous. He had used ether in many cases, chloroform in some, and a mixture in others; but as he had never seen any untoward symptoms, his clinical evidence was *nil*. With regard to the circumstances connected with the operation which might influence the prognosis, one had to take into account posture, nature of the operation, its duration, and the concomitant shock. Any posture except the supine one, with the head fully extended, was more or less dangerous—more so in chloroform than in ether, as want of elimination of the former was more serious, and the drug being less volatile did not so easily escape. The conditions requisite for the due elimination of chloroform were unimpeded exchange of air, and this could only be obtained when the lungs were filling and emptying fully and the air passages were straightened out, the glottis freely opened, and the tongue prevented from pulling back. Lying on the side certainly impeded respiration. Heart failure and syncope might follow this position, especially when pleural effusion was present or the heart was interfered with by old adhesions or by abdominal distension, effusion, or tumour. There was an especial danger of placing a person

to be anæsthetised in a sitting posture, as he was pretty sure to slip down into a hunched up position, which interfered in a marked degree with all the vital processes. The symptoms arising from malposition of the patient; these were summed up in gradual failure of respiration and weakening of the pulse. The nature of the operation affected very largely the question of shock, as shock depressed the vitality of the patient; if the anæsthetic told in the same direction, the danger was manifestly increased. It was from this point of view that the administrator preferred not to give chloroform, selecting ether for such cases. There were also dangers arising as "after-effects" of the anæsthetic—for example, prolonged sickness, bronchitis, extreme and progressive cardiac depression. It was, therefore, of the first importance that the least quantity compatible with thorough anæsthetisation should be employed, and for the shortest time. His own experience led him to believe that anæsthetics did not abrogate shock; he would instance operations about the optic nerve, castration, operations in the rectum about the generative tracts, as examples in which even deep anæsthesia might exist without suppressing evidence of reflexes excited by severance or dragging upon nerves. He believed that similar evidence existed as to operations in which branches of the fifth pair of nerves were involved. Further evidence was needed upon the point. With regard to the method of administration, great advances had been made during the past decade which revealed some conclusions which had formerly been arrived at. The verdict of the Royal Medical and Chirurgical Society that the chief objection to ether was the length of time required to produce anæsthesia by its use could not be accepted nowadays, since from one to two minutes was the time now required. Again, in the employment of chloroform there was no uniformity, and a point of importance to be worked out was how far the method used in the induction of anæsthesia was responsible for the result. Unfortunately the reports of fatal cases seldom gave the method employed, an omission which he trusted would in the near future be corrected. Dr. Dudley Buxton, concluded by urging practitioners to keep careful records, not only of any fatalities, but also of all cases in which dangers and difficulties under anæsthetics had arisen.—Mr. PRIDGIN TEALE wished to plead for the clinical side of the study of anæsthetics. He reminded them that in his Address in Surgery, two years ago, he had spoken out very strongly on this question. Since then numerous deaths had been recorded in the medical journals, exclusive of cases which had taken place in America—three deaths from ether and thirty-three from chloroform—that of course did not represent the ratio of deaths as between ether and chloroform, because these deaths were mainly hospital deaths, and he did not think that ether was given in so small a proportion of cases as that would imply in the hospitals of the kingdom. What, however, were these deaths from ether? One of them occurred in a case of chronic suppuration of the thigh, the second in a severe amputation, and the third was in a case of fractured pelvis with extravasation of urine, the patient having been in an exceedingly bad condition to begin with. If they looked through the list of deaths occurring during chloroform administration, what did they find? Out of the thirty-three, seventeen deaths occurred in comparatively minor operations. They included extraction of teeth, amputation of thumb, dislocation, lupus, operation on the eye, amputation of the finger, fractured patella, dislocation of the shoulder, examination of obscure case, passive motion in fractured ankle, plastic operation on the face, and so on—presumably the bulk of the patients being in good health at the time of the administration. Did such deaths occur from ether in people in good health? Not one. These statistics did not include the Scotch deaths—for they had deaths from chloroform in Scotland as well as in England—and he had heard of several deaths in England which had not found their way into the press. He thought it was a terrible death roll from chloroform, and a serious matter for the consideration of the profession. Dr. Buxton referred to another very important point in speaking of those who nearly died from its effects. During the six or eight years before taking up ether, he had in private practice six patients whom for some minutes he had believed to be dead. One was a case of squint, and two occurred in operations on the rectum—minor

operations. Did he get these "narrow shaves" with ether? No, he did not. Regarding ether-giving, he had to say that he thought many of the deaths were due to the defective mode of administering the agent. They ought not to have these deaths from asphyxia and from bronchitis. They could be, and ought to be, guarded against. Why did these accidents occur with ether? Because there was no proper teaching of ether administration. The more intelligence and practice, the more safe was its administration. It was possible to give ether without distressing the patients. He had had ether himself, and was amazed to discover how slight was the amount of distress. They could not expect ether to be administered in the best way if young assistants just beginning practice were allowed to "flake" into it without any teaching. Again, if patients were in winter taken out of a warm bed, put on a cold operating table, and allowed to become chilled before the drug was administered, these patients could not be said to be in a very good condition for receiving ether. Its administration was an art to be learned, and could be acquired by all except those who had not the power of concentrating their attention on what they were doing and those who were so deficient in sensitiveness as not to know when the patient was failing. As to the time, he quite agreed with the previous speaker that it took but a short time to get a patient under ether; many only required one minute and a-half. He had tried to teach his students how it should be given by referring them to the curve of harmonic progression, as illustrated by the construction of the harp. They should take the first half minute to accustoming the patient to the mouthpiece and to getting over the fear of the patient—simply to get the patient quieted down and to breathe into the bag. Then by the next half minute the patient became so numbed by the ether that he began to feel that it was not irritating to the respiratory organs. As soon as this occurred it should be given again and the patient should be kept under the drug, as little as possible being used. He had known ovariectomy cases lasting for half an hour to be carried through with about half an ounce of ether. As far as he knew, only one instrument was worth using. Though they had learnt ether-giving from America, he thought the proper mode of administering it had been developed in this country. Ormsby's bag was not equal to Clover's small machine; he had seen nothing to equal that. There was a tendency to make the bag too small, and that he thought was a falling off from a better method. He felt very strongly that ether ought to be the anæsthetic taken up by hospitals and schools, and that the men ought to be turned out from these institutions able to give ether, and then they would have at hand an agent which was perfectly safe and which had an enormous advantage over chloroform, in that, after a patient had got well under ether, they could frequently go on operating without renewing the anæsthetic. The patient began to come round before the sensitiveness to pain returned.—Mr. GEORGE EASTES said that of the three agents producing general anæsthesia now in common use—nitrous oxide, chloroform, and ether, or mixtures of the same—the first need not long detain them: its safety was well attested, but its very rapid action unfitted it for use in general surgery. Possibly the anæsthetic of the future would be a mixture of nitrous oxide and oxygen, for which it was claimed that its use might be continued for hours without risk. Unfortunately, a special apparatus was required for the use of the combined gases. During the last twenty years ether had come to be regarded as safer than chloroform, but since the publication of the report of the last Hyderabad Commission the advocates of chloroform had again been more frequently heard. But, whilst this new crusade in its favour had been going on, there had apparently been still more deaths from chloroform than were formerly recorded. For example, in the first half of this year fourteen cases of the kind amongst all classes of the population had been noticed in the *BRITISH MEDICAL JOURNAL*, no fewer than eleven of which occurred in hospitals. For eleven years he himself had used chloroform alone, but having unfortunately witnessed five deaths from it between 1864 and 1875, though in only one of them had he been the administrator, he had since the latter year constantly employed ether for adults—happily without cause for serious anxiety during any operation—and had only used chloroform

for them when ether seemed to be contraindicated. With regard to the Report of the Hyderabad Commission, time permitted him to offer only two obvious criticisms. Dr. Brunton founded his opinions respecting the safety of chloroform entirely on his experiments on monkeys and other lower animals. Animals, however, were not human beings, and deductions drawn from the one set of cases could not be rigidly transferred to the other set without considerable reserve. Surgeon-Major Lawrie seemed to base his advocacy of chloroform chiefly on the fact that, although he had administered it to human beings many thousands of times, he had never had a death. Certainly his statistics were far and away the most favourable with respect to chloroform or ether with which he (Mr. Eastes) was acquainted. Dr. Lawrie's practice, however, had been in India, and it must be remembered that, with few exceptions, patients in that country were not of our race. They had a dietary vastly different from that in these islands, and lived constantly in a temperature far above that usually experienced here. It was possible that from these or similar causes chloroform might be less dangerous there than here. So far as the temperature of the air was concerned, he could adduce some corroborative evidence from the case of patients submitted to etherisation. When this was effected in summer he had noticed less coughing and less interference with respiration than in winter. They had to accommodate their practice to their environment, and, although chloroform claimed no victims in India, they must not forget that the death-roll from that cause in England remained very high. He could scarcely believe that the mode of administration was the sole cause of this difference in results. The views of Surgeon-Major Lawrie had been so widely published, and their roseate promises of easily-attained absolute safety, on the single condition of "watching the respiration only," had so enchanted the readers that it might be imagined that the majority of chloroformists were endeavouring to follow implicitly the Hyderabad instructions. Especially it might be thought that this was the case in hospitals, and yet the majority of reported deaths from chloroform still occurred in these institutions. Since, therefore, deaths from chloroform in England seemed to be even more numerous than before, he was driven to the conclusion that in this country chloroform of itself was relatively an unsafe agent. And further, since the best presumable statistics showed that in equal numbers of administrations deaths from chloroform were quite five times more numerous than the deaths from ether, could it be a matter for wonderment that the advice should be given again and again that ether ought to be employed here rather than chloroform for ordinary purposes of anaesthesia? He said "here" advisedly, since some difficulty was experienced in keeping and administering ether in tropical regions, though during the Egyptian campaign—its temperature being kept low by artificial means—it was thus used with complete success in the base hospital at Ismailia. The Hyderabad Commission reported, and Dr. Brunton had repeated the statement, that chloroform and ether acted alike, but that the former was the stronger, less of it being required to produce anaesthesia. Why not, then, employ the weaker agent, seeing that it induced anaesthesia equally well, whilst being less fraught with danger? His (the speaker's) whole contention was this: Give ether, if possible, and reserve chloroform for cases unsuited to the other, such as those of infants or very young children, persons affected with chronic bronchitis, or other affections of the respiratory organs; for operations on the mouth or larynx, or for brain surgery. Passing to methods of administration, Mr. Eastes said that unquestionably the best yet devised was that of Mr. Clover, or a modification of the same. Nitrous oxide gas was first used, and, when the larynx had become insensible, was replaced by an etherised atmosphere which was thenceforward employed until the end of the operation. There was usually not the least struggle, the patient breathed as calmly as if going to sleep, no pallor of the face was produced; the pulse was generally improved by the first few whiffs of ether vapour, and if felt was found to remain steadily good during the operation. He had kept many a patient insensible with this instrument for 90 minutes; once during 2 hours, in the case of a gentleman, aged about 75, whose thigh was amputated by Mr. Durham; and on another occasion during 2½ hours for Mr. Bryant, while a huge ovarian tumour that

was generally adherent, and the uterus containing an immense fibroid, were both removed. In both these latter cases the patient held out splendidly, and the pulse gave no sign at all of failure. It was in such cases where the patient was enfeebled from long-standing disease, that the advantages of ether seemed to be most manifest. The apparatus, however, was too cumbersome and expensive for practitioners generally; but these objections should not weigh in the case of public institutions. The next best inhalers for administering ether were probably Clover's small apparatus, or that of Ormsby; and, lastly, the sponge in a leather cone. With all these instruments it was advisable to begin with the vapour well diluted, and gradually increase its concentration as the patient "went off." But practitioners who had always used chloroform and nothing else might demur to making the change. In such cases the A.C.E. mixture was most useful. The ancient dictum that chloroform depressed whilst ether excited the heart's action was apparently not borne out by physiological experiment upon animals, but it seemed to form an excellent working hypothesis for clinical purposes, at any rate when these drugs were employed in the usual manner for ordinary anaesthesia. Now half of the A.C.E. mixture being ether it prevented cardiac depression, and the limit of safety was not easily reached. This agent was best administered in the open fashion on flannel, stretched over wire, on to which it was dropped from a bottle in the manner in which chloroform was generally used, though a little more of it was required to produce and maintain anaesthesia than was necessary with chloroform alone. The objections usually made to A.C.E. were that it was weaker than chloroform or ether, and that time was lost in rendering the patient insensible. This objection, however, was scarcely worth consideration when the few moments' delay might mean the safety of a human life. The second objection to the A.C.E. mixture was that its elements evaporated with varying degrees of rapidity, so that the patient at one time breathed chiefly an etherised atmosphere, and then one in which chloroform predominated. This, however, was a theoretical objection not noticeable in practice. Those who made it had not generally used the mixture, as he knew from having pointedly asked them the question. To those who continued to use chloroform he would say, "Study the rules for its administration published by Surgeon-Major Lawrie, and conform to them implicitly." No one else with the like vast experience of chloroform had equalled him in respect of his success. Whatever anaesthetic might be chosen, the administrator should give his mind absolutely to the condition of the patient—should watch him and him alone, and only attend to the operation or the surgeon's procedures in so far as they bore on the anaesthetic. To the neglect of this rule some of the deaths he had witnessed had been due.—Dr. CHILDS (Weymouth) said the discussion to which he had listened had completely justified the Committee in bringing it before that Section. Prompted by this feeling, he was anxious that a committee should be formed to investigate this difficult subject from a clinical standpoint, dealing with questions bearing on the relative safety of ether and chloroform, the methods of their administration, and further, with a matter of great importance which had been touched upon in the discussion respecting those who were apparently in great danger of death from either ether or chloroform. He moved: "That a committee be formed to investigate the clinical evidence with regard to anaesthetics, especially the relative safety of the various anaesthetics, and the best methods of administering them." In addition to Dr. Snow (the President of the Section), they should be very glad to have the names of Dr. Lauder Brunton, Mr. Pridgin Teale, Dr. Dudley Buxton, and Mr. Eastes as members of the committee.—Dr. RICHARDSON (Torquay) seconded the motion, and proposed to add the name of Dr. Childs to the committee.—Dr. COUPLAND, in supporting the motion, said that this was, of course, a matter which concerned surgeons rather than physicians, but there was a class of cases in which often very serious symptoms arose during the administration of chloroform in which physicians were interested—he referred to cases of empyema and others requiring operations upon the lungs. He had had the misfortune about twelve months ago to lose a patient in whom there was a pulmonary cavity, which the surgeon was in the act of opening; and although, as the event showed

afterwards, the patient could not have lived very long, death took place under the anæsthetic. He hoped the Committee would issue some rules for guidance in such cases, as he had often seen considerable difficulty occur in them.—Dr. LAUDER BRUNTON thought that, as the investigations of this Committee were to be directed chiefly to clinical work, it might perhaps be better carried out by men unfettered by any connection with experiments on animals. Perhaps it would be better if the Committee were to consist of men who were accustomed to clinical work, and who were going to investigate the subject from the clinical side, and that they would call in as necessity arose any assistance they would like from those who had investigated the subject from the other side. This would apply not only to himself but to all other men who had investigated the subject experimentally. Another difficulty which stood in the way of his acting on this Committee was, as was well known, and as of course the members of the section were aware, that it was as the representative of a medical journal that he had gone out to Hyderabad to undertake the investigation, and he did not feel himself quite at liberty to do anything in the matter without the sanction of the editors of that paper; he therefore could not form a member of the Committee without previous consultation with them. Some people had the idea that he was president of the Hyderabad Commission, but that was a mistake; Surgeon-Major Lawrie had ably occupied that position.—The PRESIDENT hoped the reasons given by Dr. Brunton for not becoming a member of the Committee would be removed, and that Dr. Brunton might yet be able to act with them.—The motion was then put to the meeting and carried unanimously.—Dr. COPEMAN, Research Scholar of the Association, resuming the discussion, said he wished to refer to a point in relation to anæsthetics as given to animals, of which he had a very large acquaintance, and which, perhaps, would have some bearing on the administration of chloroform to human beings. He referred more particularly to the kind of chloroform used. Methylated chloroform had been in use at the hospital in which he was educated because it was much cheaper, and it was supposed not to be inferior to the pure chloroform. The animals on which he had experimented were chiefly monkeys, and it was found that when chloroform was used which was bought by the experimenters themselves, and which was pure, the anæsthesia was brought about in a perfectly successful manner. On one occasion they lost three monkeys in succession, and it was afterwards discovered that on that particular occasion they had been supplied with methylated chloroform. When they used methylated chloroform it not infrequently happened that the animal was suddenly found to be dead, although a moment previously it had appeared to be breathing quite normally. When this state of things occurred artificial respiration was for the most part quite useless for restoring animation even though the heart might still be found to be acting feebly on opening the chest wall. The deaths all seemed to come about from a cessation of respiration which was absolutely sudden.—Mr. HARSANT stated that the two main questions were the relative safety of chloroform and ether and the mode in which chloroform killed. Statistics ought to settle the first question, and he adduced instances to show how much these statistics differed. At the Bristol Royal Infirmary during the last 17 years chloroform was administered 5,902 times, with 3 deaths, and ether 704 times, with 1 death. This proportion might be above the average for chloroform but would not do at all for ether. Over and over again he had seen patients in very serious danger from chloroform, and his opinion was that ether was much safer. Death in human subjects almost certainly occurred from the heart in some cases.—Dr. NEVE (Cashmir) spoke from personal experience of over 4,000 cases in the Cashmir Mission Hospital, and he referred to the statistics of that hospital to show that no death from chloroform had ever occurred in it. Five or six cases had occurred which had presented considerable difficulty, but not during the administration of the drug, and in those cases he had considered it to be due to the mode of administration. He had followed the rules laid down by Syme and Surgeon-Major Lawrie, namely, large doses of chloroform with plenty of air. They pushed it to the full extreme and watched the respiration carefully. A surgeon was about to give chloroform to a patient with a very weak heart, and he was consulted as to what was to be done. He administered the chloro-

reform, the operation was begun, and proceeded some time in safety, and then he was called upon to assist in the operation, and within two minutes the patient was dead. The person to whose care the chloroform was handed over had given no more chloroform whatever, and the patient had died from shock: the result of insufficient chloroform. In the hospital they never watched the pulse under any circumstances, but always the respiration. Other instances of as favourable results had occurred in Edinburgh and Glasgow, and it would not do to tell him that these were merely Indian results. They were the results obtained by those who followed Syme's principles of administration.—Dr. HORSFALL had given chloroform ever since 1863, to man and animals, in every possible case and all sorts of diseases of the heart and other organs, and though he certainly had had some anxious moments, he had never seen a death from chloroform. One point should be noticed, however, and that was the quality of the chloroform. Methylated chloroform was certainly very inferior, and he believed it to be dangerous. Givers of ether had stated that there was no distress following its administration, but he had the clinical opinion of his patients to the converse. They dreaded it. The increase in the number of deaths from chloroform at the present was the result of ether giving. It was quite dreadful to watch anæsthetists administering chloroform as if they were giving ether. If these deaths did not occur it was proof of the safety of the agent and evidence against the mode of its administration by the practitioner. They could not give rules for the administration of chloroform except this: to remember that they were giving, not chloroform, but chloroform mixed with air. They should watch the respiration. They need not mind the pulse unless something arose to call attention to it; they should watch for complications, and give the mixture of air and chloroform according to the condition of the patient for the time being.—Dr. TYSON pointed out that in considering this subject, they had to remember the country practitioners who had to give an anæsthetic only about six times in a year. Death under chloroform was sudden, whereas deaths from ether often occurred two or three days after its administration, and to the country practitioner that made a great deal of difference. The friends were, so to speak, "eased off."—Dr. RENTON (Glasgow) said that Scotland had always been looked upon as the home of chloroform. He had been thoroughly trained in its use from the time that Mr. Syme had instructed him to use it on the towel. Looking back over the experience of some years, he was struck with the anxiety of the operator during the time the anæsthesia was going on. Following the address of Mr. Teale, he went to Leeds, and was shown by that surgeon the method of ether administration which he recommended, and for the last two years he (Dr. Renton) had almost uniformly used ether, and during that time he had not had the least trouble with any of his patients. He thought it would be an advantage if the inhaler was simplified. He felt very strongly that students should be more efficiently trained in the mode of administering the various anæsthetics. Chloroform was more easily applied than ether, but the safety of the patient should be the first consideration.—The Hon. Dr. G. LE FEVRE (Australia) stated that he had been engaged very largely in administering anæsthetics in Melbourne. He had tried many methods, and now generally adopted the mixed method. He had given chloroform very largely, but not with as good results as he could wish. At one time methylene was in favour, and he gave that in almost every case; but after a while it was noticed that its effect seemed to pass off too quickly, and they were obliged to combine its use with chloroform or the A.C.E. mixture; and now, although they were very anxious to give ether an extended trial, they had to adopt the method of giving a little chloroform so as to assist the ether. He had tried various inhalers, but he had not found them at all satisfactory. He administered ether with a leather cone and a sponge. He thought the administrator should watch the operator to the extent of knowing what he was about to do. He agreed with the last speaker that it was a great evil to teach that the pulse could be neglected altogether. It was quite in one's power to watch both, and by that method the best results would be achieved.—Dr. LAUDER BRUNTON said one point had come out very clearly in the discussion, namely, the very great difference

of opinion that prevailed amongst practical men with regard to ether and chloroform. And the point was that the differences seemed to have a geographical limit. It was found that a number of men in this country and in the northern States of America preferred ether, while those in tropical or sub-tropical climates preferred chloroform. This seemed to point to a difference of effect according to the state of the temperature, and, although in Hyderabad they had investigated this subject, they were not able to decide the question, owing to the limits of the temperature. Another thing which had been brought out very clearly was the wisdom of the rules for the administration of chloroform laid down by Syme. Syme did not believe in watching the respiration only; he attended to the pulse as well. One of the great causes of immunity from death in Edinburgh was that the best chloroform was always used and they always gave plenty of it. Dr. Copeman's experiments bore this out very strongly. In London he did not think the same care was shown in selecting the chloroform as in Scotland. Regarding Syme's statement that they were always to give plenty of chloroform, he said this certainly prevented shock during the operation. Mr. Teale had shown that a number of the deaths which had occurred were in minor operations. It was just in these cases—avulsion of the toenail or in extraction of a tooth—in which it was thought unnecessary to give the patient a lot of chloroform, that death occurred. He believed that death from shock played a very important part in this subject. He agreed with the statement that experiments upon animals could not at once be transferred to man. They could not even transfer their experiments on man—say even on 1,000 men—to men in general, because they might have 4,000 cases without a death, and in the very next death might occur, on account of the abnormal conditions in certain men which caused them to die when ordinary men would not. He believed the fatty heart to be a very important matter, although in their experiments at Hyderabad they had not met with the results which they expected. Men with fatty hearts were in danger of dying even without chloroform, say in a crowded meeting—a man so afflicted spoke on some subject, and dropped down dead. They had, therefore, to distinguish very sharply between deaths *from* the anæsthetic and death *during* the anæsthetic. There was a large number of facts which required careful collation. When men were to be found with so different and so strong opinions on this subject, it was possible that there was truth on both sides. It was for them to endeavour to find out what that was in each case, and combine the two.—Dr. DUDLEY BUXTON, in reply, said that, speaking of the administration of chloroform, he was an out-and-out follower of Syme. At the same time, he believed that chloroform killed by means of the heart. Some thought that ether must make the patient uncomfortable and miserable. If ether was properly given, discomfort would never arise. The most comfortable method was to commence the inhalation with nitrous oxide gas, and then follow with the ether. If given in that way, there was absolutely no struggling, nobody would be required to assist, and the patient would be anæsthetised in from one minute to 1½ minute. Another method was by letting the patient inhale air only, until he became accustomed to the facepiece. The bag should be well inflated, the patient should breathe two or more respirations, and the ether reservoir should then be turned midway between the mark (0) and (1), and the patient should inhale that for four or five respirations, the administration rapidly passing on until the maximum point was reached. There was thus no struggling in a very large majority of cases, and no inconvenience. He endorsed most heartily the remarks made by Mr. Eastes. Regarding his advocacy of the A. C. E. mixture, it had been forced upon his attention again and again that they did not give enough air in giving that mixture. If it was not diluted, the respirations gradually became shallower, and then suddenly the patient became black in the face, and strenuous measures had to be adopted to restore him. Some troublesome cases of resection of the rib and empyema turned out badly, and these had led him to adopt the novel method of giving ether by the rectum in these cases. He agreed that many deaths from chloroform were due to an impure drug. No apparatus was of use with chloroform or ether unless the anæsthetic was given with brains. Administrators should not pin their faith

on any inhaler, but should watch carefully the result of the drug.

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

OPERATION FOR CLEFT GREAT TOE NAIL.

ONE case of the above came under my care. It was troublesome to the patient if he walked far. There was a slight tubercle at the root at the line of junction of the two parts of the nail. I put him under chloroform and fired him round the root of the nail with a thermo-cautery, and cut the nail short. The result was very satisfactory. After ten days the patient found no more inconvenience in wearing a boot than formerly, and as the old nail grew forward the new one followed without a cleft. I have seen one such case fail after extraction of the nail. The slight after-inconvenience caused by firing I consider recommends it as compared with extraction; whereas the results of firing I consider at least as good as those of extraction. Firing is the operation done by the veterinary for a cleft in the homologous organ of the horse, in which animal the operation is very successful.

From the development of the organ it is easily understood why firing thus should be effective.

HENRY SMITH, M.D.,
Bengal Medical Service.

MIMIC LABOUR.

It may be interesting in connection with Dr. Leith Napier's very valuable paper in the *BRITISH MEDICAL JOURNAL* of November 7th, to give some brief detail of a curious case of spurious pregnancy and mimic labour that occurred some three years ago in my practice. The patient was an intelligent, respectable woman, aged 34 years, and had been married about 5 years without conceiving. At the time when I saw her first, she considered herself pregnant, not having menstruated for four months, and she then engaged me to attend her in her confinement.

Some four months afterwards I was sent for late at night to attend the patient, who was said to be "very bad in labour." On arrival I found her suffering very much from rhythmical pains, and to judge from their violence it looked as if all would be over in a short time. On making an examination, the cervix at once struck me as having all the conditions of the non-pregnant state. Not having seen anything similar before, but suspicious of its nature, the opinion was expressed that the case would not come off that night. On arrival early the following morning, it was ascertained that the pains continued without intermission during the previous night. The patient was then put under chloroform. On bimanual examination the uterus was found normal. When the patient was told that she was not pregnant, the pains ceased immediately, and did not return: she was up and about soon afterwards as if nothing had occurred. Amenorrhœa existed for nine months. This woman conceived three months afterwards, and was delivered of a healthy child.

Liverpool.

T. GERALD GARRY, M.D. M.A.O.

PERICARDIAL EFFUSION IN AN INFANT.

At the meeting of the Pathological Society on November 3rd, Dr. Rolleston showed the heart and pericardium of a tuberculous infant with considerable effusion. This has induced me to place on record the following case:—

The patient was a child, 5 months old, whose birth had been artificially hastened at the eighth month on account of the mother having a severe attack of puerperal convulsions with temporary albuminuria.

The mother made a good recovery under the chloroform and chloral hydrate treatment, but did not suckle. The child, though small, was never ill until October 22nd, 1891, when it received a slight kick on the left temple whilst lying on the floor, another child 10 years old running in suddenly and not seeing the baby. No mark was ever visible beyond a little